



SYSTEM ANALYSIS AND DESIGN

**B.Com II Semester
(Computer Science)**

As Per Syllabus of Vijayanagara Sri Krishnadevaraya University, Bellary

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**A Complete Reference Material for
B.Com II Semester, Computer Science**

SYLLABUS

PAPER 2.6 SYSTEM ANALYSIS AND DESIGN (B.Com II Semester - Computer Science)

Unit I – Information and Management :

Data, Information, Types of Information, Management Structure, Management and Information Requirements, Qualities of Information, Example of Information Systems.

Unit II – Information System Analysis :

Role, Task and Attributes of System Analyst, Tools used by the System Analyst, Information Gathering, System Requirement Specification.

Unit III – Feasibility and Data Flow :

Feasibility Analysis, Data Flow Diagrams, Process Specifications and Decision Tables, Logical Database Design, Data Input Methods, Designing Output.

Unit IV – Implementation of Information System :

Implementing most changeable systems, Implementation Tasks, Implementation Strategies, System Testing, Quality Control, User Training.

Unit V – Tally :

Introduction, System Overview, Foundation, Start-up, Accounts Information, Voucher, Balance Sheet, Ratio Analysis, Display, Printing and Reports.

Practicals :

Practicals : 2 hours per week

Practical Assignments on Tally :

Practical assignments on Tally involving accounts information, voucher creation, creation of balance sheet, ratio analysis, report generation.

Recommended Books :

1. Rajaraman V, Analysis and Design of Information System, PHI (2000)
2. Elias M.Awad, System Analysis and Design, 2nd Edition, Galgotia Publication.
3. Ashok Kumar Sharma, Analysis, Design and Implementation of Information Systems, Vikas Publishing House (2000)
4. K.K.Nadhani, Accounting with Tally, BPB Publications, 1st Edition (1999)

CHAPTER – 1 : INFORMATION AND MANAGEMENT

Everyone in his or her day to day work gathers and processes data. For example, when a housewife buys milk every morning, she writes in a notebook the number of litres she bought. At the end of the month she adds the data (litres of milk bought per day) in the notebook and multiplies it by the price per litre. The result is the information she uses to pay the milkman. The data on milk purchased each day may be processed in other ways too to obtain different information. For example, if the total milk bought in a month is divided by the number of members in the family, it gives information on average milk consumption per head. If the total monthly expense on milk is divided by the monthly income of the family, it gives information on proportion of income spent on milk. The main point is that data and information are not the same.

Data is the raw material that can be processed for any computing machine e.g., employee, student marks, numbers, images, video, sound etc.,

Data can be defined as a representation of facts, concepts or instructions in a formalized manner, which should be suitable for communication, interpretation or processing by human or electronic machine.

Data is a collection of raw facts & figures. It is without any proper meaning. Data may be collection of words, numbers, symbols, graphics, videos or sound.

Information is the data that has been converted into more useful or intelligible form. Example : Report Card Sheet.

Information is a processed data that helps human beings in their decision making process.

Information is processed data which is used to trigger certain actions or gain better understanding of what the data implies.

Information is a collection of organized data that has meaning. Information may further be processed & manipulated to form knowledge.

Information is needed to :

1. To gain knowledge about the surroundings, and whatever is happening in the society & universe.
2. To keep the system up-to-date.
3. To know about the rules & regulations and bye laws of society or government as ignorance is no bliss.
4. To arrive at a particular decision for planning current & prospective actions.

Difference between Data and Information :

Data	Information
1. Data is raw fact.	1. Information is the processed form of data.
2. Data is not significant to a business.	2. Information is significant to a business.
3. Data are atomic level piece of information.	3. Information is a collection of data.
4. Data does not help in decision making.	4. Information helps in decision making.
5. Product Name, Students Name, Employee Name etc.,	5. Report Card Sheet, Balance Sheet, Profit & Loss Account etc.,

Types of Information :

- 1) **Strategic Information:** This is the information needed for long range planning and directing the course the business should take. The store owner may like, for example, to decide whether to expand his business by stocking new varieties of items in his store, whether to work on a small profit margin to expand sales, whether to open a new branch etc. Such information cannot be obtained by mere clerical processing of data. He has to obtain information on trends, effect of reduction in price of some items, impact of advertising etc. This type of information is less structure. Further, the volume of important information in strategic planning is small and is difficult to obtain. It is often obtained by processing huge amount of archival data stored over a long period.
- 2) **Tactical Information:** This type of information is needed to take short range decisions to run the business efficiently. For instance, the information on fast and slow moving items may be used to take the tactical decision to stock more of the former and give discount on the latter. Information on the payments of bills by customers may be used to decide appropriate credit limits to be given to customers. Tactical information requires specifically designed processing of data. Most of it is obtainable easily from day-to-day collection of routine data unlike strategic information. Further, the volume of tactical data is more than strategic data.
- 3) **Operational Information:** This type of information is needed for day-to-day operations of a business organization. For instance, the list of items out of stock on a particular day would be used to trigger the action of ordering them. List of customers unpaid bills beyond due date would be used to send reminders. Operational information is usually easy to obtain by straightforward clerical processing of data. Further, the volume of such information is much more than tactical information.
- 4) **Statutory Information:** Information and reports which are required by law to be sent to government authorities are normally clearly specified and require straightforward processing of data.

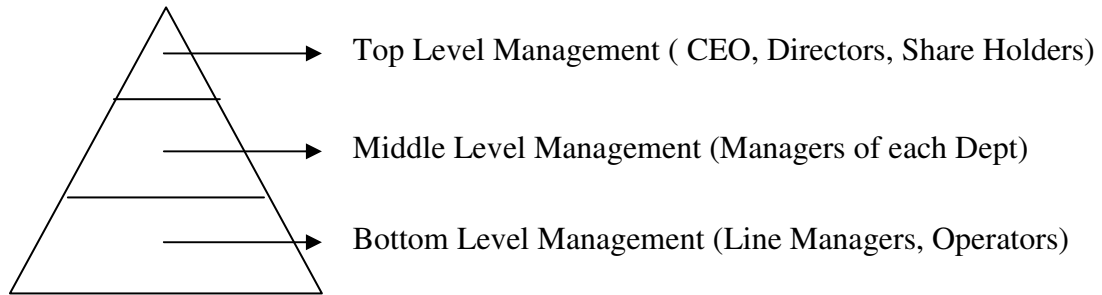
Why do we need a Computer Based Information System :

- The size of organizations is becoming larger. This is particularly true in India due to increase in population and rapid rate of industrial development.
- Computer based processing enables the same data to be processed in many ways, based on needs, thereby allowing managers to look at the performance of an organization from different angles.
- As the volume of data has increased and the variety of information and their timeliness is now of great importance, computer based information processing has now become essential for efficiently managing organizations.
- Organizations are now distributed with many branches spread all over the country and abroad.
- Markets are becoming competitive. To maintain favorable balance of payments in a country, organizations have to be internationally competitive.
- The general socio-economic environment demands more up-to-date and accurate information. Human society is changing faster than ever before. Governmental regulations have become complex. Organizations have to interact with many groups, financial institutions, etc., which did not exist before.

The entire above developments demand decision making, based on up to date, well analyzed and presented information rather than thumb rules and hunches of an earlier era. This can be done only by using computer based information systems.

MANAGEMENT STRUCTURE

The manager of each function is known as a middle level manager. Middle level managers report to the Chief Executive who is overall in charge of the organization. The middle level managers will, in turn, have many assistants who are responsible for specific day-to-day operations. They are known as line managers. The management structure is thus a pyramid as shown below.



In this pyramid the Chief Executive, being overall in charge of policy, will require strategic information. The middle level managers require tactical information to perform their function and the line managers being responsible for day-to-day operations would require operational information. Thus we see that as a manager rises higher in the hierarchy he receives summarized information which is also less structured. More complex analysis of basic data is required as we go up in the hierarchy.



MANAGEMENT AND INFORMATION REQUIREMENTS

The management of an organization would involve many different functions. The functions would depend on the types of organization. Many functions are, however, common most organizations. For effective management of each function, specific strategic, tactical and operational information are needed.

Human Resource Management

The major goal of human resource management is to make best use of the available human resources in the organization. To attain this goal, the information necessary at various levels of management is as follows

- (i) Strategic Information :
 - Long range human resource requirements at different levels
 - Policies on wages and incentive such as stock options and bonus
 - Policies on human resource development and training
 - Policies on personnel welfare and facilities
 - Policies on outsourcing non core functions.
- (ii) Tactical Information :
 - Performance appraisal
 - Demographic make-up of personnel and its impact on retirement
 - Production incentives and relation to productivity
 - Morale of personnel
 - Absentee reduction
 - Leave and overtime policies
 - Personnel deployment policies
- (iii) Operational Information :
 - Routine assessment
 - Skills inventory
 - Loans/advances and recoveries
 - Attendance record
 - Overtime assignment

Production Management

The goals of production (manufacturing) management is to optimally deploy human resources, machines and materials to maximize production of goods by the organization. To attain this goal the following types of information would be needed.

- (i) Strategic Information :
 - Yearly and monthly production quotas and alternate schedules
 - Policies on machine replacement, augmentation and modernization
 - Information on the introduction of new production technologies, acquisition and mergers
 - Identifying best product mix
 - Policy on quality assurance
- (ii) Tactical Information :
 - Identifying and controlling areas of high cost such as work in progress inventories
 - Identifying critical bottlenecks in production
 - Identifying alternate production schedules based on tools, machines, material and personnel availability

- Performance measures of machines (breakdown histories, cost of repair and failure) to decide on replacement
- Quality control measures
- (iii) Operational
 - Monitoring up to date production information by examining assemblies, detecting likely shortages and giving early warning
 - Scheduling better production dynamically
 - Preventive maintenance schedules of machines
 - Monitoring tools, machines, and human resource availability
 - Ensuring quality at each step in production

Material Management :

The main goal of material management (supply chain management) is to have readily available materials needed by the organization and to keep optimal levels of stock of items. To achieve this goal the following types of information would be needed.

- (i) Strategic Information :
 - Developing vendors for critical items
 - Determining optimal levels of inventory
 - Determining proportion of material to be ordered from different vendors
 - Reducing varieties of inventory
- (ii) Tactical Information :
 - Developing vendor performance measures
 - Determining the impact on material cost, availability and procurement with design changes and new product introduction
 - Determining optimal reorder levels and reorder quantity
 - Controlling high value inventory
- (iii) Operational Information :
 - Goods received, rejected and issued
 - List of excess and deficient items received
 - List of items rejected
 - Critical items received
 - Backlog of supplies
 - Stores in transit and in inspection
 - Value of inventory in hand and periodic stock taking
 - Order processing
 - Enquire stock position

Finance Management

The main goal of finance management is to ensure financial viability of the organization, enforce financial discipline and plan and monitor the budget. The various levels of information required to meet these goals are as follows :

- (i) Strategic Information :
 - Methods of financing
 - Pricing policies
 - Tax planning
- (ii) Tactical Information :
 - Variance between budget and expenses
 - Large outstanding payments / receipts
 - Credit and payment status
 - Cost increases and pricing
 - Impact of taxation on pricing
- (iii) Operational Information :
 - Periodic financial reports
 - Budget status to all functional managers
 - Tax returns
 - Share registration and transfers
 - Profit and loss account
 - Accounts payable
 - Accounts receivable
 - Payroll, provident fund accounts
 - Calculation of direct costs-overheads-standard cost
 - Cash management
 - General ledger

Marketing Management

The goal of this function is to maximize sales and ensures customer satisfaction. To attain this goal the various types of information needed are :

- (i) Strategic Information :
 - Search for new markets and marketing strategies
 - Analysis of competitors strategy
 - Technology and demographic forecasts and product changes
- (ii) Tactical Information :
 - Advertising techniques and analysis of their impact
 - Customer preference and satisfaction surveys
 - Sales force deployment and targets
 - Exploring alternate marketing channels. Timing of special sales campaigns
 - Customer relationship management
- (iii) Operational Information :
 - Sales analysis by regions, customer class, sales persons
 - Sales target versus achievement
 - Market share and trends
 - Seasonal variations
 - Effect of model changes

- Performance of sales outlets
- Costs of sales campaigns and benefit
- Call centre support
- Maintenance of home page on the world wide web
- Order entry

Research, Design and Development Management

The goal of this function is to continuously improve existing products and develop new products and processes. To attain this goal following types of information are needed.

(i) Strategic Information :

- Which products are to be developed?
- What types of improvements are required?
- What long range research is most promising?
- What technical collaboration would be appropriate?
- What areas would require new human resource inputs?

(ii) Tactical Information :

- Setting intermediate goals for projects and assess progress
- Checking availability of equipment and appropriate selection
- Determining proportion of resources to be allocated to various parts of a project
- Deployment of personnel to projects based on talent and performance
- Information on similar and related research projects undertaken by other groups.

(iii) Operational Information :

- Progress against goals
- Budgeted expenses versus actual
- Status of outstanding orders for equipment and components.

QUALITY OF INFORMATION :

The secret behind the success of an organization depends on the quality of information that is acquired. The three main qualities of information are,

1) Accuracy :

The information acquired should be hundred percent correct. It should be clear and to the point, So that it conveys exact information to the recipient and don't indulge him in lots of confusion in the information received. It is always preferred to analyze the information and present or forward the information in graphical form rather than in a set of table and numbers. Graphical representation helps the receiver to understand the information clearly and further analyze the information quickly and take correct decisions as per the situation without wasting time. This helps in reducing the waste of time in first understanding the information than analyzing the situation and later taking a decision. One should always remember that slight inaccurate information will cause a great damage. Therefore accuracy is the most important factor. Information must be free from material errors.

2) Timeliness :

Timeliness means getting information on time or within a speculated time. Time once passed out and information received after a required time is of no use, as to however important, accurate or relevant that information could be. Therefore one has to called accurate information on time so that it could be fruitfully used for further growth and progress.

The age of information is critical factor in determining its usefulness. Information must not be older than the time period of the action it supports.

3) Relevance :

Relevance means particular information useful to only a particular person. Before collecting any information one has to clearly know whether that information would be of some use to that particular person/organization. In case if it is of no use then there lies no meaning in wasting precious time and energy in collecting particular information. Therefore one has to clearly know the needs and wants of that particular person/organization, or else the most accurate and timely information also results to be of no use.

The contents of a report or document must serve a purpose. This could be to support manager's decision or clerk's task. Reports must contain relevant information. Reports containing irrelevancies waste resources and may lead to take incorrect decisions or actions.

4) Completeness:

No piece of information essential to a decision or task should be missing. Report should provide all necessary calculations and present its message clearly and unambiguously.

5) Summarization :

Information should be aggregated in accordance with the user's needs. Lower level managers need information in highly detailed. As information flows upward through the organization to top management, it becomes more summarized.

6) Reliability :

It is connected to the representation and the accuracy of what is being described. The reliability is also affected, if the data is not collected from right source.

7) Validity :

The validity of the information relates to the purpose of the information. In other words, it is answer to the question – does the information meet the purpose of decision making for which it is being collected? The validity is also depends on how the information is used. For example, to check the reasons for deterioration in the quality of product, one must collect all the possible causes which may affect the quality.

8) Consistency :

The information is termed as inconsistent if it is derived from a data which does not have a consistent pattern of period. The information must relate to a consistent pattern of period. The information must relate to a consistent base or pattern.

9) Age :

If the information is old, it may not be of use in the present context and it does not meet any characteristics of the information i.e., update of knowledge, the element of surprise and reduction of uncertainty, and the representation.

10) Impartiality :

An information should be impartial i.e., without any distorted view of the situation. The partiality creeps in, if the data is collected with a preconceived view, a prejudice and a predetermined objective or a certain motive.

Example of Information System :

The functions of central administration of a University :

Administrative Offices	Functions
Students' section	Students' admission records Administering admission tests Students' academic records Students' registration information Placement
Accounts section	University budget Payroll General ledger of receipts/payments Scholarships Collection of tuition and other fees
Purchase section	Order processing Vendor selection Stock register maintenance Issues to stores Receipts from vendors
Stores section	Inventory management Processing requests for items from departments
Hostel office	Mess management Hostel purchases/stores Room assignment Residents data
Medical centre	Medical records Medicine purchase/stores Scheduling doctors and appointments
Works department	Building construction Building maintenance Maintenance of electrical installation and water supply Maintenance of roads, gardens
Human resource	Personal records (leave, tenure) Assessment of employees Recruitment Staff discipline
Miscellaneous	Mailing Telephones Transport

The functions of various departments of a Manufacturing organizations :

Departments	Functions
Production	Production planning and control Maintenance management Bill of materials processing
Marketing	Advertising Customer records/follow up Sales analysis
Finance	Billing, payments Payroll Costing Share accounting Budget and finance planning Tax planning Resource mobilization
Human Resource	Recruitment Records Training Deployment of labour Assessment / promotions
Stores (Materials management)	Stock ledger keeping, inventory control Issues / reorder Receipts Enquiry processing
Information Systems	System software Application software Hardware infrastructure Database administration Home page maintenance
Maintenance	Physical facilities Communication facilities Electricity and water supply
Research and Development	Production improvement Product development Product testing Product design

CHAPTER – 2 : INFORMATION SYSTEM ANALYSIS

Who is System Analyst ?

A systems analyst is a person who uses analysis and design techniques to solve business problems using information technology. Systems analysts may serve as change agents who identify the organizational improvements needed, design systems to implement those changes, and train and motivate others to use the systems.

A systems analyst is a person who conducts a study, identifies activities and objectives and determines a procedure to achieve the objectives. Designing and implementing systems to suit organizational needs are the functions of the systems analyst. He plays a major role in seeing business benefit from computer technology. The analyst is a person with unique skills. He uses these skills to coordinate the efforts of different type of persons in an organization to achieve business goals.

THE ROLE AND TASKS OF A SYSTEM ANALYST

A system analyst's primary responsibility is to identify information needs of an organization and obtain a logical design of an information system which will meet these needs. Such an information system will be a combination of manual and computer-based procedures to process a collection of data such that the processed data are useful to the managers of the organization in taking decisions. The major role and tasks of system analyst are as follows:

1. Defining Requirements :

The most important and difficult task of an analyst is to understand the users' requirements. It involves interviewing users and finding out what information they use in the current systems and how they use it. They are then asked what information they lack, which if provided, will allow them to meet a set of quantified goals. The analyst has to then determine how such information can be generated.

2. Prioritizing Requirements by Consensus :

In any organization there are many users. Each user has some special information needs. It may not be possible to satisfy needs of every one due to limited computing capacity, time, constraints, availability of programmers, etc. Even if computer capacity is available, it would be necessary to take up some of the tasks first and others later. Thus there is a need to set priorities among the requirements of various users. This is best achieved by having a common meeting with all the users and arriving at a consensus. This responsibility of the system analyst requires good interpersonal relations and diplomacy. He must be able to convince all the users about the soundness of the group decision and obtain their cooperation.

3. Gathering data, facts and opinions of users :

Having determined the information needs and their priority, the systems analyst must develop the system with the active and willing cooperation of all the users. The users must be made aware of what information they will get, how it will be derived, and how they can make use of it. The analyst designing the system must make use of the users' long experience and expertise. With the users' help he must gather the necessary data. While developing a system the analyst must continually consult the users and get their views. He must be the users' students in learning various facts about the organization, and their teacher in telling them how best to use the computer-based system.

4. Analysis and Evaluation :

The system analyst analyzes the working of the current information system in the organization and finds out to what extent they meet users' needs. He then sifts through the facts and opinions gathered by him and find the best characteristics of a new or modified system which will meet the users' stated information needs. The key to good analysts is to reject redundant data and focus on important data. Various graphical means of data analysis are useful in this task.

5. Solving Problems :

Very often a problem such as the following is presented to a systems analyst: "We find that we are not able to quickly meet the demands for spare parts to repair our trucks sold to customers all over the country. We do not know how much spare parts we must stock at various branch workshops so that we have the parts when and where required without incurring high cost of storing many unused parts. What is the best system which will solve this problem?"

An analyst must study the problem in depth and suggest alternate solutions to the management. The relative difficulties in implementing each of the alternatives and benefits of each must be determined so that a manager can pick what he considers as the best solution.

6. Drawing up Specification :

A key job of an analyst is to obtain the functional specification of the system to be designed in a form which can be understood by users. The specification must be non-technical so that users and managers understand it. The analyst must win the acceptance of all levels of users of the system such as clerks, middle level managers and top managers. The specification must be precise and detailed so that it can be used by system implementers. It must also take into account expansion envisaged in the near future.

7. Designing Systems :

Once the specifications are accepted, the analyst designs the system. The design must be understandable to the system implementer. The design must be modular to accommodate changes easily. The analyst must know the latest design tools to assist him in his task. As part of the design he must also create a system test plan.

8. Evaluating Systems :

An analyst must critically evaluate a system after it has been in use for a reasonable period of time. The time at which evaluation is to be done, how it is to be done, and how users' comments are to be gathered, must be decided by the analyst. He must have an open mind to accept valid criticism and he must be a good critic himself to enable him to carry out necessary improvements.

ATTRIBUTES OF A SYSTEM ANALYST :

To be effective, a system analyst must have several attributes. These are as follows:

1. Knowledge of Organizations :

A systems analyst must understand the way in which various organizations function. He must understand the management structure and the relationship between the departments in organizations. He must also find out how day-to-day operations are performed in the organization for which the information system is being developed. As many systems are built

for marketing, accounting, and materials management, he must have a working knowledge of these areas. As a generalist he must try to familiarize himself with a variety of organizations.

2. Knowledge of Computer Systems and Software :

The analyst must also know about recent developments in computer systems and software. He need not be an expert programmer or computer manager, but know enough technical details to interact effectively with program designers and computer managers. He acts as the intermediary in understanding users' needs and advising an applications programmer on how the needs can be realized on a computer system. He must also advise on the information presentation techniques, appropriate use of packaged softwares, newer computer languages and environments.

An analyst's knowledge of computer systems must be deep enough to determine the feasibility of developing the required systems on a given computer network configuration. Conversely, an analyst must be able to advise on the computer network configuration needed to develop the required applications. Sometimes, the analyst may also advise on augmentation of existing computer network to implement new systems.

3. Good Inter-personal Relations :

An analyst must be able to interpret and sharpen fuzzily stated user needs, must be a good listener, a good diplomat and win users over as friends. He must be able to resolve conflicting requirements and arrive at a consensus. He must understand people and be able to influence them to change their minds and attitudes. He must understand their needs and motivate them to work under stressful conditions such as meeting deadlines.

4. Ability to Communicate :

An analyst is also required to orally present his design to groups of users. Such oral presentations are often made to non-technical management personnel. He must thus be able to organize his thoughts and present them in a language easily understood by users. Good oral presentations and satisfactory replies to questions are essential to convince management about the usefulness of computer based information systems.

5. An Analytical Mind :

Analysts are required to find solutions to problems. A good analyst must be able to perceive the core of a problem and discard redundant data and information in the problem statement. Any practical solution is normally non-ideal and required appropriate trade-offs. A good analyst would use appropriate analytical tools as necessary and use commonsense.

6. Breadth of Knowledge :

A systems analyst has to work with persons performing various jobs in an organization. He may have to interact with accountants, sales persons, clerical staff, production supervisors, stores officers, purchase officers, directors, etc. A system analyst must understand how they do their jobs and design systems to enable them to do their jobs better. During his career he will be working with a variety of organizations such as hospitals, hotels, departmental stores, transport companies, educational institutions, etc. Thus a general broad base education is very useful.

TOOLS USED BY SYSTEMS ANALYST

One of the most important tasks of a systems analyst is to understand users' requirements. There are two aspects in this understanding.

1. Understanding the flow of documents in an organization. (Documents incorporate the basic data available in the organization and hence it is essential to know where they originate and how they flow).
2. Understanding the rules used to process data. (Very often the rules are complex and orally stated, leading to misunderstanding).

Two important tools are used to assist in the above tasks:

1. Data flow diagram which specify the origin of data and how they flow through a system and where they are processed.
2. Decision tables which are used to specify complex processing rules known as business rules in a concise and easily understood form.

Besides these tools used in specifying users' requirements, there are also other tools used in a system design. These are database management systems and associated languages which allow rapid prototyping of systems. Quickly obtaining a prototype is very useful to get good user feedback. Tools such as spreadsheets are very useful in answering questions such as, "If the cost of raw materials x, y, z change by p, q, r percent how will it affect the cost of the final product?" Further, report generators and graphics systems are used in visualizing information. A system analyst must be conversant with all these tools and know how to effectively use them.

INFORMATION GATHERING

Gathering information in large and complex organizations is difficult and takes time. All relevant personnel should be consulted and no information overlooked. Very often what hurts an analyst most is what is not stated by users because they assume that it is "obvious and everyone knows it". The analyst should perceive such situations. A clear strategy should be evolved by the analyst to gather information. The strategy consists of

- Identifying information sources,
- Evolving a method of obtaining information from the identified sources, and
- Developing an information flow model of the organization.

INFORMATION SOURCES

The main sources of information are :

1. Users of the system
2. Forms and documents used in the organization
3. Procedure manuals and rule books which specify how various activities are carried out in the organizations
4. Various reports used in the organization
5. Computer programs of existing systems with their documentation

Information should be obtained from all the above sources. The consistency between them should be checked and then they should be summarized and consolidated.

METHODS OF SEARCH FOR INFORMATION

Information gathering first starts with interviewing top level management. An overview of the organization, available information, and objectives to be met by the proposed system are normally gathered from top management. A gross system model is then worked out and verified.

The next step is to interview middle level management and operational staff. At this level day-to-day operational requirements and information required for current use are gathered. The earlier gross model is now expanded and refined.

It should be remembered that operational staff at the day-to-day working level such as clerks, storekeepers and foremen can make or break a system. It is essential to gain their confidence and explain to them what the intended system would do. They should understand their responsibilities when the system is implemented. Being deeply involved in day-to-day operation, these personnel will have a lot of information on operational problems. Many persons at this level would have been on their jobs for many years and have rich experience. Qualitative information based on their experience is often very valuable.

It is therefore clear that interviewing is the most important method of gathering information. Before starting interviewing an analyst must decide on:

- Who will be interviewed
- In what order they will be interviewed, and
- What specific questions will be asked in each interview

Besides individual interviews, we also saw that a consensus has to be reached by all users in assigning priorities among objectives of the system. Thus leading group discussions and encouraging frank expression of opinions are also the responsibilities of an analyst. During such group discussions many bits of information are revealed. Thus organizing and steering these discussions need to be carefully planned.

It is not normally feasible to obtain all information during the course of a single interview with a user. Usually two or three interviews are needed. The first interview is normally to get to know a person and his areas of responsibilities and the type of information he has. Subsequent interviews are used to verify facts and gather more information of relevance.

INTERVIEWING TECHNIQUE

The primary purpose of interviewing is to obtain both quantitative and qualitative data (current as well as desired data) regarding user requirements, policies, procedures and practices. It is essential to gain the confidence of the interviewee and obtain frank and complete answers to questions. No user likes an analyst to tell him how to run his business. Obviously an analyst's job is not this. His job is to let the user clearly define for themselves the goals of an effective information system.

We have given below some guidelines to ensure a successful interview.

1. Make a prior appointment with the person to be interviewed and inform the purpose of the interview, and how much time you would require. An interview should be brief and not exceed 40 minutes.
2. Read the background material and go prepared with a checklist.
3. State again the purpose of the interview at the beginning of the interview.
4. Good manners are essential. Introduce yourself. Be punctual and pay attention to what the user says. Obtain permission to take notes or record the conversation.
5. Do not use computer jargon. Explain all technical terms. If a user employs a word (jargon) not known to you, immediately ask what it means.
6. Avoid yes/no answers. Try to obtain both quantitative and qualitative information. Obtain both facts and opinions. Discriminate between essential requirements and desirable requirements.
7. State what you understood as a fact and confirm this.
8. Watch for signs of impatience of the interviewee and do not prolong the interview in such a case.
9. Summarize the information gathered by you during the interview and verify this with the user.

QUESTIONNAIRES

Detailed questionnaires are useful to gather quantitative data such as sales statistics. They are no substitutes for interviews as questionnaires do not get qualitative information. When quantitative data is to be collected from a large number of persons or organizations, questionnaires are useful. Usually questionnaires sent by mail are not promptly answered. Continuous follow-up by letters and sometimes personal calls are needed to get back the filled-up questionnaires. The shorter a questionnaire, the higher is the probability of getting it back quickly.

OTHER METHODS OF INFORMATION SEARCH

Other methods of information search are to examine:

1. Systems used in other similar organizations;
2. Trade journals and reports of conferences describing similar systems; and
3. Trade and national statistics.

Apart from interviewing, if an analyst spends some time in the work place carefully observing the existing system, he will learn many important facts. Some of these facts may not be revealed in interviews since a person who is part of the system may think it is “obvious”. Sometimes some facts are hidden and no one may be willing to tell the whole truth.

When available records are too many, an analyst may sample a smaller subset which is representative of the entire data set.

Fact Recording: The results of fact finding are summarized as a report if a large number of analysts are taking part in a project, a standard format may be used for recording facts. The report should contain the following data:

- Background information
- Sources used in obtaining information
- Method used in gathering information
- Current procedures
- Currently available data

SYSTEM REQUIREMENTS SPECIFICATION

When an organization feels dissatisfied with its current information system, it would normally request an information systems analyst to design a system which will meet its requirements in a more satisfactory fashion. There are also occasions when an organization wants information systems designed from the beginning. The first case is more common.

In order to design an information system, the analyst requests the user to state his requirements. He also finds out how they are met (may be partially) in the current system. Normally user's statement of requirements is descriptive and not precise. Further, many points are not explicitly stated by the user. A systems analyst should also try to find out whether he has understood fully the user's statements. He must therefore use a method that will enable him to precisely inform the user his understanding of the requirements. Two graphical specification tools are useful in doing this job:

1. Physical document flow diagram
2. A logical data flow diagram

SYSTEM REQUIREMENT SPECIFICATION: EXAMPLE

We will illustrate the method used to obtain a specification with an example. Usually an imprecise statement of the needs of an organization is given by the management. We now give a sample of such a statement, based on which a more precise definition of the requirements is evolved by an analyst.

- (i) **User's narrative of requirements:** "Our Company receives a number of items from many vendors and they are received at the receiving office. As we receive over 1000 items a day it is now virtually impossible for the receiving office to check whether the vendor has supplied items against an order, or sent a wrong item and informs the purchase office. We are also not able to find out if there are excesses or deficiencies in delivery and whether the vendor adhered to the delivery schedule as per the order. The items received at the receiving office are sent for physical inspection. The physical inspection consists of checking whether the quantities stated in the delivery note agree with the physical count, whether the item is the correct one ordered, and a check on the quality of item. We would like to keep a record of rejections due to bad quality, incorrect items, excess/deficient supply, etc., determined during inspection. This will enable us to assess vendor's reliability to guide us in placing orders in the future, besides keeping track of supplies. Items cleared

by the inspection office are taken into the inventory by the stores office which keeps a ledger of items stocked and quantity available of each item. Customers send requisitions to the stores. The stores fulfill the requests based on availability and update the ledger. Currently we are not able to meet some of our customers' requests. We would like to incorporate automatic reordering by our purchase office if the inventory level of an item is low. We would also like to keep track of unfulfilled requests and meet them when items reach the store. Currently we are not able to pay our vendors promptly due to delays in payment order reaching our accounts office. We would like to rectify this. We would also like to bill our customers promptly and keep track of customer's payments".

- (ii) **Analysis of Statement:** Reading the statement carefully we find that the first three sentences starting with "our company receives a number of items..." and ending with "... vendor adhered to the delivery schedule as per order" relate to what happens at the receiving office of the company. This is depicted in Figure 5.1 which shows the physical entities, namely, the vendor(s), the receiving office and the purchase office and the documents which flow between them. The diagram is called the physical *document flow diagram*. In this diagram rectangles are used to depict offices, and a straight line with an arrow is used to show flow of documents. The arrow shows the direction of flow. We give below the line, the name of the document flowing between offices. In figure we also show a dashed line to depict flow of physical items. This is not relevant to the development of a computer-based information system but is useful to the user/manager to verify whether the analyst has understood him. In this diagram a line connecting purchase office and vendor depicts the actual order. This is not clearly stated by the user as it is assumed that a vendor supplies items against orders. This point should be told to the user as situations may arise when a vendor by mistake sends items not ordered at all and action is needed in such a case.

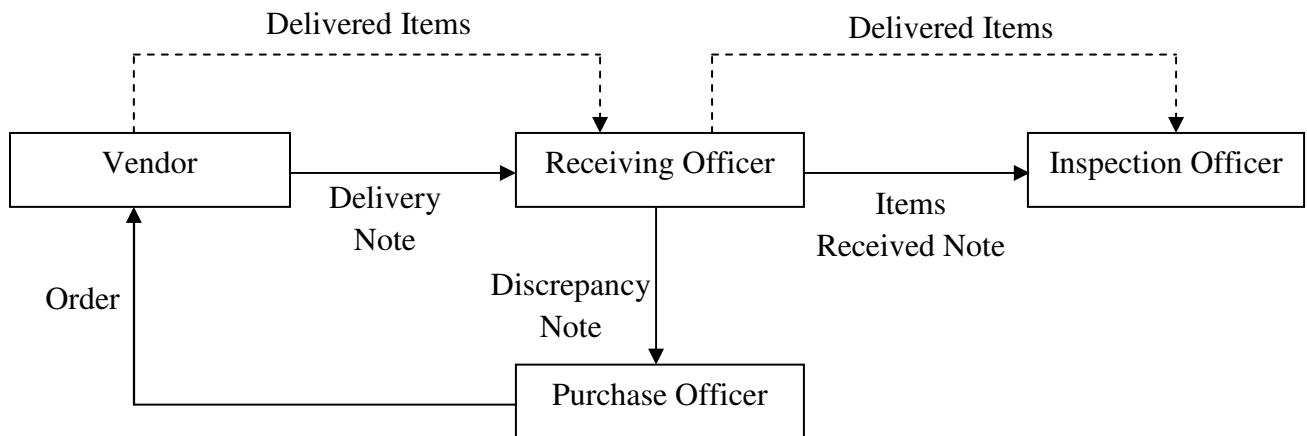


Figure 5.1 Document flow diagram in an organization.

The input to the receiving office is a delivery note and the outputs are items received note and discrepancy note. We now find out the data contained in these notes and the data processing rules followed by the receiving office. This is again depicted as a diagram called a *data flow diagram* in which squares are used to indicate physical entities from which data originates or terminates. Labelled directed lines are used to indicate data records which flow in and flow out of sections where data processing is performed. A label is used to name the data record. The arrow indicates the direction of flow of data. A circle is used to name the data carried out on input data to produce output data. Two parallel lines depict a data store. If data from the store is to be only read by a process, an arrow is shown from it to the process. If a data store is modified by the process, an arrow from the process points to the data store. Currently the data contained in the delivery note are:

- Order number, vendor name and address, item name, delivery data, quantity supplied and units.

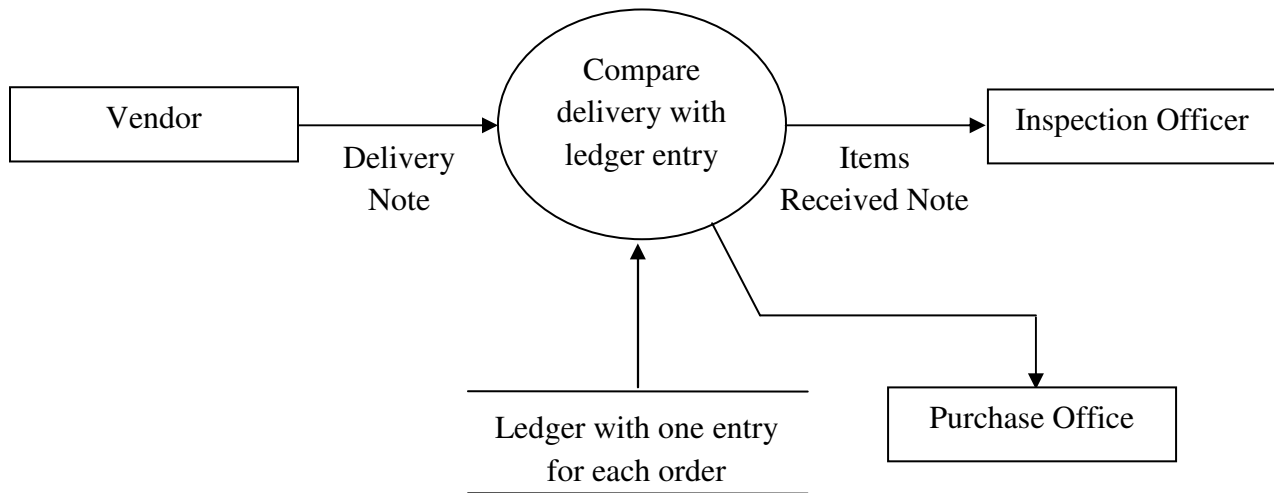


Figure 5.2 Logical data flow diagram of manual process

The data contained in the items received note are:

- Order number, item name, delivery data, quantity supplied and units.

The data contained in the discrepancy note are:

- Order number, vendor name and address, item name, order date, delivery date, quantity supplied, units, excess or deficiency, no. of days late/ early.

The receiving office also retains a ledger containing one record per item ordered. Each record has the following data:

- Order number, order date, item name, vendor name and address, quantity ordered, delivery period.

The clerk at the receiving office compares the order number and details in the delivery note with the corresponding order number and details in the ledger. If the two do not agree, there is discrepancy and a discrepancy note is generated.

The next step is to show the document flow diagram and the logical data flow diagram to the user to make sure that we have understood him. In this particular case it is very simple, but if we had taken the entire word statement given at the beginning of section 5.1, the diagram would have been complex. Having made sure that we have understood what the user said, the next step is to clarify the user's information requirements. For this example, the following information requirements for the receiving office are arrived at after discussion with users.

- (i) **Operational information requirements.** Automatically check vendor's delivery notes with the orders placed with the vendor. Find whether delivery is for a data on deviations from purchase order.
- (ii) **Tactical information requirements.** Vendor performance index may be evolved using information on excess, short, early and late deliveries. The index must also use data on rejections if any.
- (iii) **Strategic information requirements.** We may use vendor performance index as one criterion in deciding on proportion of items to be ordered from different vendors.

Having found the information requirements we ask:

1. What new data elements (if any) are required in the input and output documents, namely, delivery note, discrepancy note and items received note?
2. What data should be maintained by the receiving office in order to create the output documents from the input document?
3. What processing rules are to be applied on input document to obtain the output document?

DATA REQUIREMENTS :

In order to find the data elements required in the various documents; we work backwards. In other words, we ask what data elements are required to meet the information needs and find out the data elements required in the input documents and that required to be maintained at the receiving office. The data elements in the output are also determined by the specifications of information requirements. In this example the data elements in the input documents, namely, the delivery notes are:

(i) **Delivery Note :**

Order number, vendor name and address, item name, delivery date, quantity supplied, units.

Examining this with operational information requirements we see that item delivered is to be checked. The item name is not enough as a spelling mistake in it will make the comparison invalid. Thus we need a unique identification code for items. This must be included in the delivery note. To meet the tactical information need, we require data on vendors to be accumulated. Vendor name and address is not suitable as any spelling mistakes or minor change of address will distract a computer based system. We need unique vendor identification. Hence vendors must be given a unique code which we will call vendor code. Thus the modified delivery note is :

Order number, vendor code, vendor name and address, item code, item name, delivery date, quantity supplied, units.

One may ask whether both vendor code, and name and address are necessary. They are used for different purposes. It is necessary to have the name and address of the vendor if a rejected item is to be returned.

(ii) **Discrepancy Note :** Using the same arguments, the modified discrepancy note must contain the following data items :

Order number, vendor code, vendor name and address, item code, item name, delivery date, quantity supplied, units, excess or deficiency, no. of days late/early

The receiving process has to create the discrepancy note using the delivery note and data store containing records of all orders. Individual records of this data store containing records of all orders. Individual records of this data store must have the data to create the discrepancy note given the delivery note. The data items in the data store containing the order records are: **Order records:** Order number, vendor code, vendor name and address, item code, item name, order date, quantity ordered, units, specified delivery period (in days).

The specified delivery period is necessary to determine late/early delivery.

(iii) Items received note :

Order number, vendor code, vendor name and address, item code, item name, delivery date, quantity supplied, units.

The codes for vendor and item are needed for easy computer processing as explained earlier. The data elements in each of the documents are listed below :

Delivery note = Order no. + vendor code + vendor name + vendor address + item code + item name + delivery date + quantity supplied + units.

Discrepancy note = Order no. + vendor code + vendor name + vendor address + item code + item name + delivery date + quantity supplied + units + excess / deficiency + no. of days late/early.

This can also be written as :

Discrepancy note = Delivery note + (excess / deficiency) + (no. of days late/early)

The data element discrepancy note is written within parentheses to indicate that it may be empty, that is, not generated at all. The discrepancy note will not be generated if there is no discrepancy, that is, exact quantity is delivered as per order and on time. In the discrepancy note, one of the elements, namely, excess/deficiency or no. of days late/early, may not be present. The items received note has the same data items as the delivery note.

Item-received note = Delivery note

Order records = Order no. + vendor code + vendor name + vendor address + item code + item name + order date + quantity ordered + units + delivery period.

After individual data elements are determined, they are consolidated in a data dictionary. A data dictionary contains data about data which is called metadata. In the data dictionary the data elements are arranged in alphabetical order. The data dictionary thus forms an essential part of the documentation of a system. The detailed data dictionary is developed during the system design phase.

Having obtained the data elements in the input, outputs and the order data store at the receiving office, the next step is to specify how the input will be processed to obtain the outputs. A logical data flow diagram depicts this. Processing rules may be specified in English so that a lay person can understand it. The English used is more precise and is known as Structured English. Whenever many conditions have to be checked to arrive at actions, a tabular specification tool called Decision Table is used.

Thus the logical specification consists of :

1. Data elements in the input and output documents.
2. Data elements in the data store (if any) required for processing inputs to obtain specified outputs.
3. Document and data flow diagrams which graphically depict the flow of data and the places where they get transformed.
4. A statement of the processing rules used to transform the input document to output document (the processing rules are expressed in Structured English or as one or more Decision tables)
5. A data dictionary which consolidates all the data in the documents and data store.
6. A statement (mostly descriptive) of requirements met by the system.

STEPS IN SYSTEM ANALYSIS

We first study the current system and how documents flow in the system. Using the model we derive a logical equivalent of a system and represent it by a logical data flow diagram. This is refined after finding out from the user his information requirements and a new logical data flow diagram is obtained.

Along with this the processing rules (expressed in Structured English or Decision Tables) the data dictionary and information provided by a system is obtained. The design process is also shown and feasibility document as input in modeling the system. In our example, we assumed that the system was feasible and we did not impose any constraints.

MODULARIZING REQUIREMENTS SPECIFICATIONS

Going back to the user's narrative of requirements, we observe that there are three major operations performed in the organization. They are :

1. Ordering items from vendors
2. Processing of items received by the company
3. Issue of items to customers

CHAPTER – 3 : FEASIBILITY AND DATA FLOW

At the end of the information gathering phase, we have a reasonable idea about the data available currently and the deficiencies of the current system. We also reach a consensus on requirements and priorities among these requirements. Using these data, it is possible to define broad goals for the project and detailed sub-goals. It is necessary at this stage to quantify the goals and sub-goals. For instance, a goal “Prepare student mess bills within 5 days of the end of the month” is well quantified, whereas a goal “Ensure prompt payment to vendors” is not quantified. If we say “Ensure that payment is made to vendors within 10 days of their presenting their bill”, it is quantified. Once these goals are quantified, the next step is to find out whether these goals can be met, and if yes, how they will met and at what cost.

The following are the various steps involved in feasibility analysis:

1. DECIDING ON PROJECT GOALS :

Deciding on the goals of a project, quantifying them and obtaining consensus of user are an important task of system analyst. The important guidelines for arriving at goals are:

1. Identify deficiency by pinpointing
 - Missing functions
 - Unsatisfactory performances, and
 - Excessive cost of operations
2. Set goals to remove these deficiencies
3. Goals must be
 - Quantified,
 - Realizable within the constraints of an organization,
 - Broken down into sub-goals, and
 - Agreeable to all concerned.
4. Set goals not only to remove deficiencies but also to effectively meet competition, For instance, goals may be based on what competitors do.

Example 1 :

In the case study of Hostel Management, the deficiencies identified in the current manual system are as follows :

1. Missing functions.
 - 1.1 Forecasting of stores requirements not done
 - 1.2 Purchases not consolidated
 - 1.3 Daily rate calculation not updated frequently
 - 1.4 Menu not planned for balanced nutrition and low cost.
2. Unsatisfactory performance.
 - 2.1 Billing not accurate and prompt.
 - 2.2 Students’ bills not itemized.
 - 2.3 Stores issues to cooks not systematic.
 - 2.4 Payments to vendors not prompt.
 - 2.5 Large variations in mess bills every month.

3. Excessive cost of operations due to the following :
 - 3.1 Unpaid long outstanding dues from students.
 - 3.2 Extras and rebates not reflected in stores issues.
 - 3.3 Frequent unplanned visits to city to buy out-of-stock items.
 - 3.4 High transport cost (small purchases at high cost) due to not consolidating stores requirements.

Example 2 :

The main goal and sub-goals to remove deficiencies 1.3, 2.1, 2.2, 2.5, 3.1 (mentioned in above example) are given below.

Main Goal

M1 Send the bills to students within 5 days of the end of the month (2.1, 3.1)

Sub Goals

- S1.1 Itemize bills indicating extras and rebates with dates. (2.2)
- S1.2 Ensure less than 5% variation of bills from month to month (2.5)
- S1.3 Bring to the attention of the Chief Warden the bills which are not paid within 10 days of issue (3.1)
- S1.4 Update daily rate. Calculate bills every day (1.3, 2.5)

The main goals and sub goals to remove deficiencies 1.1, 1.2, 2.3, 2.4 and 3.2 to 3.4 (mentioned in Example 6.1.1) are given below:

Main Goal

M2 Control inventory of items and issues to cooks so as to bring down mess bill by 10% (1.1, 1.2)

Sub Goals

- S2.1 Ensure payment to vendors within five days of supply of items. (2.4)
- S2.2 Make sure that at most four trips per month are made to the town for purchase and consequently transport cost is less than 1% of item cost. (3.3)
- S2.3 See that inventory levels are not more than 10% of monthly requirements. (3.4)
- S2.4 Make sure that cooks do not get more than 5% of calculated requirements. (2.3, 3.2)

Goal to add function 1.4

Main Goal

- M3.1 Balanced menu top meet nutritional requirements.
- M3.2 Cost of food not to exceed current cost.

Sub Goals

- S3.1 Randomize menu

2. EXAMINING ALTERNATIVE SOLUTIONS

During the feasibility phase, broad alternative solutions to problems are examined. It is not necessary to get into details at this stage. For each alternative solution the cost and the benefits have to examine before deciding one of the alternatives.

Broad solution will consist of

1. Specification of information to be made available by the system.
2. Description of what will be done manually and what will be done by the computer, and
3. Specification of new computing equipment needed or specification of expansion of an existing computer.

Solution A

One can improve the existing manual system by carrying out the following :

- Keeping the up to date running total of extras and rebates of each student. This is done by the assistant mess manager between lunch and tea each day.
 - Keeping a quick reference table of requirements of each item for a specified number of members expected to take food on a day.
 - Costing each day's issues and keeping a running total of expenses. This will enable quick preparation of mess bills.
 - Calculating standard values of stores needs by averaging issues of a few months. These standard values may be used for consolidating orders to vendors.
 - Keeping duplicates of bills issued to students in a box and transferring paid bills to a "paid" box.
 - The attention of the Chief Warden can be drawn to the bills which are unpaid after 10 days.
- This modification would meet main goals M1, M2 and sub-goals S1.3, S2.2, S2.3 and S2.4.

It will not satisfy other goals. The extra cost will be negligible.

The solution is rejected as it does not meet the important goals M3.1, M3.2 and sub-goals S1.1, S1.2, S3.1.

Solution B

The subsystems involved in this solution are now described.

(i) System for Student Billing

- (i) *Billing Subsystem* : An extras/rebates register will be maintained in the mess for students to enter the requests. One page per student is assigned. The register entries are codified for the use of computer processing. The blank register pages are printed on the computer each month and stapled together and kept in the mess for entries by students in appropriate columns.

Entries in the register are keyed into the PC each day by the mess clerk. A program will check whether sufficient notice has been given for rebates, whether number of days rebate asked is as per rules. The data entered is used by a program to create a summary statement giving expected number of meals to be prepared 48 hours from now. This is passed on to the mess manager to control issues. This program also updates each student's record with details of extras and dates of absence.

- (ii) *Subsystems in billing system* : Subsystem for finding meals to be cooked.

INPUT : Extras/rebates requests of each students each day.

PROCEDURE :

- Check each input record to see if rebate is admissible and extras are correct.
- Enter admissible rebates and extras in student billing file.
- Find number of meals to be cooked two days from now. Print note to mess manager.

OUTPUT : Note to mess manager giving number of members and meals to be cooked 48 hours from now.

(iii) *Subsystem for mess bill calculation :*

INPUT : Items issued each day (perishable and non-perishable)

PROCEDURE :

- From items issued each day find total expenses each day.
- Accumulate daily expense and add fixed overhead (salaries, etc)
- Using number of members calculate up to date daily rate.
- Using student billing information file and expense file, calculate the itemized bill for each student at the end of the month.
- Enter in student billing file.

OUTPUT : Itemized bills to students.

(Updating daily rate is run each day whereas students billing system is run once a month)

(iv) *Subsystem for unpaid bills*

INPUT : Payments information.

PROCEDURE :

- Enter all payments in student billing file.
- Five days after last date for payment, examine this file and create a list of students with unpaid bills.

OUTPUT : List of overdue bills sent to Chief Warden.

(This system runs once a month).

The billing system described above satisfies main goal M1 and sub-goals S1.1 and S1.3. To satisfy sub-goal S1.2 the mess secretary who gets an updated daily rate each day must adjust menu, using a menu planning system.

(ii) System for stores issue and control

Subsystem for stores issues to cooks.

INPUT :

- Menu for (today's date + 2) i.e., if today's date is 20.04.2009 menu is given for 22.04.2009.
- Number of meal to be cooked for (today's date + 2)

PROCEDURE :

- Based on past month's total consumption of each item, estimate consumption of current month. Add 2 days consumption as buffer.
- Work out minimum level (= 4 days needs) of all critical items.
- Decide on order quantities, and place orders.
- When goods come in, check in order file and update inventory if items are accepted.
- Send the cheques to vendors on item acceptance.
- Update stores inventory after each issue.
- When critical items go below minimum level inform mess manager.

OUTPUTS :

- Orders to vendors
- Cheques to vendors
- Low item stock message to mess manager

(This system is run once a day)

This system satisfies main goal M2 and sub-goals S2.1 to S2.4

(iii) System for menu planning

INPUT :

- Number of items in menu
- Alternative for each item
- Cost of each item
- Maximum cost.

PROCEDURE :

- Reduce total cost by trying alternative items in menu.
- Try an optimization package such as Linear Programming.
- Rank menus by cost and keep 14 different menus for each meal.
- Randomize menus each week.

OUTPUT : Balance menu at reduced cost. (This system run once a month)

This system satisfied main goals M3.1, M3.2 and sub-goals S3.1

Equipment needed : File size estimate

Items sorted

Non-perishable : 500

Perishable : 100

Record size per item = 200 bytes

Storage needed = $600 * 200 = 1,20,000$ bytes

Inventory file size = 120 KB

Student file

No. of students = 400

Record size for student = 200 bytes

Storage for students' file = 80 Kbytes

Vendor file

No. of vendors = 20

Record size per vendor = 400 bytes

Storage for vendor file = 8 Kbytes

Storage needed = 118 Kbytes

Processing is not extensive and database is small.

One PC with 20 Mbytes hard disk, 1 floppy drive, a CD drive and a printer (80 column dot matrix) would be more than adequate. The minimum configuration now is 400 GB disk, 1 GB main memory and a 32 MB Pen drive. It is advisable to have a writable CD ROM for backing up of files. We have to settle for this configuration. In future years the capacity of computers is bond to increase but the cost will remain almost same; around Rs. 50,000 with printer and software such as Windows 7 OS, Open Office and Anti-Virus software.

Solution C

This solution will require entering data online to a server from the mess, stores and accounts offices as and when a transaction such as stores issue, money receipt, and extras request takes place. The advantage is up to the minute information available on disk. As the number of transaction is small and online query answering is not needed, such a solution is not appropriate. It will also cost

more as a server and client PCs are required. The operating system on server should handle multiple transactions simultaneously.

3. EVALUATING PROPOSED SOLUTION

After looking at broad alternative solutions, a short list of solutions is kept. These solutions are further evaluated to find out the following :

- Their *technical feasibility* : By this we mean whether the technology needed is available and if available whether it is useable.
- Their *operational feasibility* : To find this, we ask whether the proposed solution can fit in with existing operations and whether the right information at the right time is provided to users.
- Their *economic feasibility* : To find this we ask whether finances are available for implementing the proposed solution and whether the money spent is recovered by the savings or by better user satisfaction.

Example :

In example, Solution A was rejected as it is not operationally feasible to meet the proposed new goals. Solution C is rejected as it is an expensive solution which is not appropriate for the problem. Thus in this case only Solution B is appropriate.

4. COST BENEFIT ANALYSIS

A cost benefit analysis is necessary to determine economic feasibility. The primary objective of cost-benefit analysis is to find out whether it is economically worthwhile to invest in the project. If the returns on the investment is good, then the project is considered economically worthwhile.

Cost benefit analysis is performed by first listing all the costs associated with the project. Costs consist of both direct costs and indirect costs. Direct costs are those incurred in buying equipments, employing people, cost of consumable items, rent for accommodation, etc., Indirect cost include those involving time spent by user in discussing problems with system analysts, gathering data about problem, etc., Details of direct costs are :

1. Cost of computer, peripherals and software. It could be either a capital cost for buying a computer or the cost of renting one.
2. Cost of space such as rent, furniture, etc., In a place like Bombay the cost of space occupied by a system analyst (5 sq. meters) in prime location could be Rs.10,000 per month.
3. Cost of systems analysts and programmers (salary during the period of assignment)
4. Cost of materials such as stationery, CD ROMs, toner, ribbon etc.,
5. Cost of designing and printing new forms, user manuals, documentation, etc
6. Cost of secretariat services, travel, telephone etc. An estimate is sometimes made of indirect cost if it is very high and added to the direct cost.
7. Cost of training analysts and users.

Benefits can be broadly classified as tangible benefits and intangible benefits. Tangible benefits are directly measurable. These are :

1. Direct savings made due to reducing (a) inventories, (b) delays in collecting outstanding payments, (c) wastage, (d) cost of production, and increasing production, as also its speed.
2. Savings due to reduction in human resources or increasing volume of work with the same human resources.

Intangible benefits are :

1. Better service to customers
2. Superior quality of products
3. Accurate, reliable and up to date strategic, tactical and operational information which ensures better management and thereby more profits.

The sum of all costs (direct and indirect) is compared with the sum of all savings (tangible and intangible). It is not always easy to assign money value to intangible benefits. It is arrived at by discussion amongst users of the information system.

If the project is a high cost one, extending over a period of time, then it is necessary to estimate costs during various phases of development of the system so that they can be budgeted by the management.

Example :

Consider Solution B of the hostel mess management problem. The direct costs are :

1. Cost of PC, printer, uninterrupted power supply = Rs. 70,000
2. Cost of space (nil). No extra space allocated.
3. Cost of Systems analysts / Programmers / Consultants for 3 months = Rs. 60,000
4. Recurring costs : Stationery cost, CD ROM cost, Maintenance / Electricity = Rs. 2000 per month.
5. One time cost = Rs. 1,30,000

Benefits (Direct Savings)

1. Savings per month due to inventory reduction and wastage
= 5 % of mess bill of 400 students
= $2.25 * 400 * 30$
= Rs. 27,000
(Assume Rs. 45 bill per day per student. Savings per day is 2.25 per student 30 days in a month)
2. Savings in transport cost (estimate) Rs. 800 per month.
3. Savings due to early payment to vendors
= 1.2% of total billing to vendors
= $37.5 * 400 * 30 * 0.012$
= Rs. 5,400 per month
(Rs. 37.50 per day is assumed to be material cost in mess bill)

Intangible Benefits

1. Student satisfaction due to itemized bills and less variation
2. Better menu planning

Total benefits = Rs. 33,740 per month

Recurring cost = Rs. 2,000 per month

Net benefit per month = Rs. 31,740

Total capital cost = Rs. 1,30,000

5. PAYBACK PERIOD

Simple Payback Method

Once the cost of the project and benefits has been quantified, the next step is to find out whether the benefits justify the cost. There are two ways of finding out this. They are known as the *payback method* and the *present value method*. The payback method is used to find out in how many years the money spent is recovered as benefits. In the example considered, we found that the cost was Rs. 1,30,000 and the benefits Rs. 31,740 per month. Thus in 4.1 months we recover Rs. 1,30,134 which exceeds the cost. The payback is thus 4.1 months.

Payback Method with Interest

The payback method is a simple method of computing benefits. In this method, we have not taken into account the fact that if Rs. 1,30,000 is invested in a bank, we will get interest. Hence the benefit should be reduced by the amount of interest which would be earned. If an interest rate of 1.5% per month is used, then the interest per month on Rs. 1,30,000 will be Rs. 1,950. Therefore, net monthly benefit in the example being considered is Rs. 29,790. Thus the payback period for a payback method with interest becomes nearly 4.36 months. Even this method is not entirely correct as benefits themselves would earn interest.

Present Value Method

The correct application of the present value method is to ask the question: what is the present value of earnings which may accrue after n years ? Thus if r% is the interest rate per annum, the present value of earnings x accruing in the nth year is

$$\text{Present Value} = x / (1 + r / 100)^n$$

We show the present value of benefits for the mess management system. The cumulative benefits are also shown. Thus we see that with 1.5% interest rate, per month, the cumulative benefit at the end of 5 months exceeds the cost.

Cost benefit (Present value method) for the Mess Management Systems.

Month	Cost (Rs)	Net Benefit	Present Value of Benefit	Cumulative Present Value
0	1,30,000	--	--	--
1		31,740	31,271	31,271
2		31,740	30,809	62,080
3		31,740	30,354	92,434
4		31,740	29,905	1,22,339
5		31,740	29,463	1,51,802

Cost benefit (Present value method) for the Mess Management Systems

(Net profit varying every year)

Month	Cost (Rs)	Net Benefit	Present Value of Benefit	Cumulative Present Value
0	1,50,000	--	--	--
1		40,000	33,898	33,898
2		60,000	43,091	76,989
3		80,000	48,691	1,25,680
4		70,000	36,105	1,61,785

6. FEASIBILITY REPORT

At the end of feasibility study, it is necessary to prepare a feasibility report. This report is meant for the management. The primary objectives of this reports are to inform the management about the following matters.

1. What the proposed system will achieve.
2. Who will be involved in operating it in the organization
3. The organizational changes needed for its successful implementation
4. The benefits the system will give
5. The estimated cost of the system

These are given in a simple non-technical language at the beginning of the report as an “Executive Summary”. It is then followed by a detailed System Proposal if the management approves the feasibility report and requests a detailed proposal. The detailed proposal will contain the following items :

1. An introduction with an outline of proposal
2. A broad data flow diagram of the existing system
3. A modified data flow diagram of the proposed system
4. Alternative solutions
5. Any new equipment to be installed
6. Expected benefits
7. Cost of the system
8. New procedures to be implemented and involvement of persons in operating the new system.
9. Any anticipated problem in implementation
10. Plan for implementing the system. This will include time schedules for prototyping and final implementation.

7. SYSTEM PROPOSAL

On a request from the Chief Warden of the student hostel, a study was initiated to find out how the operation of the hostel could be improved by using a better information system. After lengthy discussion with various personnel in the hostel, it was concluded that the problem which had to be tackled on a high priority basis was a better information system for billing, accounting, inventory control and stores issues in the students’ mess. The deficiencies identified in the current system are to be removed in the proposed information system.

Goal of the proposed system : The main goals and the sub-goals of the proposed system are already discussed.

Existing document flow in the hostel mess : The existing organizational structure and data/document flow in the hostel mess is already discussed.

Modified data flow for proposed system : The data flow diagram were examined. There are already discussed.

Alternative solutions examined : Three alternative solutions were examined. These are already discussed.

Selected Solution : Solutions B and C are technically and operationally feasible. The cost-benefit of Solution B is as above and Solution C costs around 3 times Solution B with no commensurate increase in benefits. It is thus rejected. The final system to be implemented is Solution B.

New equipment to be installed : PC and printer with the following features.

Hardware

- IBM compatible PC
- 1 GB main memory
- 1 GB pen drive
- 400 GB hard disk
- 15” colour monitor
- Read/write CD ROM
- 132 character 80 cps dot matrix printer

Software

- Windows 7 Operating System
- Open Office
- C and Visual Basic
- Anti-Virus

Infrastructure

- 500 VA, Uninterrupted Power Supply with 30 minutes backup battery.
- Need a dust free room to locate PC

Benefits expected : These are already discussed.

Cost of the system : As calculated earlier, the cost of the new system will be

- Capital Cost = Rs. 70,000
- System analysts / design cost = Rs. 60,000
- Recurring Cost = Rs. 2,000 per month

New procedure to be implemented : These are already discussed.

Anticipated Problems : Procedures should be set up to regularly back up all files and store billing information on CD ROM. Power failure may lead to difficulties, if it is very frequent. Hostel management may consider installing higher capacity batteries for 1 hour back up for the uninterrupted power supply system.

Implementation Plan : Implementation may begin with the billing system first. It may be followed by stores issues and inventory control and finally menu planning.

Start Time	System	Time Schedule Design, Implement and Test (man weeks)
0	Billing System	3
0 + 3 weeks	Stores Issue System	3
0 + 6 weeks	Inventory System	3
0 + 9 weeks	Menu planning	3

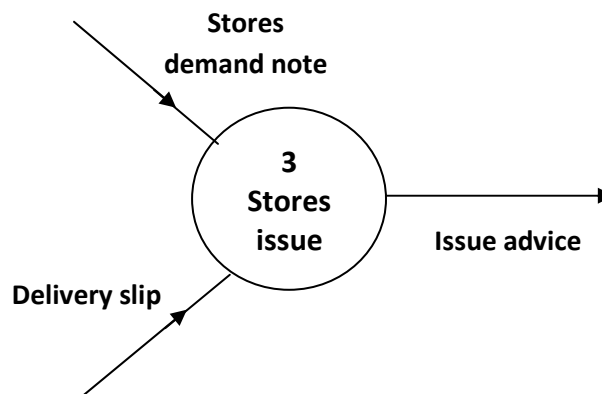
DATA FLOW DIAGRAMS

Data Flow Diagram (DFD) was introduced by De Marco (1978) and Gane and Sarson (1979), and is an important tool used by system analysts. A data flow diagram models a system by using external entities from which data flows to a process which transforms the data and creates output data flows which go to other processes or external entities or data stores. Stored data may also flow to processes as inputs.

The graphical representation of the system makes it a good communication tool between a user and an analyst on the one hand and the analyst and a system designer on the other. DFDs are structured in such a way that starting from a diagram which gives a broad overview at a glance.

SYMBOLS USED IN DFDs

Four symbols are used in drawing data flow diagrams. A circle is used to depict a process. A process describes what a system does. Both inputs and outputs to a process are data flows. Processes are numbered and given a name. The term bubble is also sometimes used instead of circle.

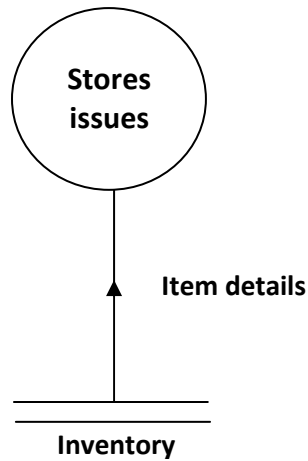


Data flows are represented by a *line with an arrow*. The arrow shows the direction of flow of data. The name of the data appears below the line. In the above diagram the data flows are labelled : Stores demand slip, Delivery slip and Issue advice. *External entities* are represented by *rectangles*, and are outside the system, such as vendors or customers with whom the system interacts. The designer has no control over them. They either supply or consume data. Entities supplying data are known as *sources* and those that consume data are called *sinks*.



External Entities

A *data store* stores data. Processes may store or retrieve data from a data store. A data store is depicted by *two parallel lines*. If an arrow points to the store, it indicates operation of writing in the store. If it points away from the store, it indicates operation of reading from the store. If both arrows are there, it indicates that one may write in or read from the store.



A data store.

Data flow can take place between processes, from (i) a data store to a process, (ii) a process to a data stores, (iii) an external entity to a process, or (iv) from a process to an external entity. Data flows cannot take place between two data stores as they are passive or between two external entities. Besides the symbols we have used, other variations exist as there is no universal standard. In several books a process is depicted by a rectangle with round edges and a data store by a long open rectangle as shown below.



Alternative notations used in DFDs

DESCRIBING A SYSTEM WITH A DFD

As a first step, an entire system can be modeled by a data flow diagram with one process which gives a system overview. It is called context diagram. The context diagram for the mess management system is shown in Figure 7.5. This diagram gives very little detail. Thus a more detailed diagram with the process split up into major processes is drawn. This is called top level DFD and is shown in Figure 7.6. This DFD can be further expanded by taking one of the circles and detailing the procedures. In the example being considered, the billing system in the DFD of Figure 7.6 is expanded to the DFD of Figure 7.7. Observe that in detailing the DFD we still do not specify how the processing is done. We emphasize gross flow of data and specify what is to be done.

The successive expansion of a DFD from the context diagram to those giving more details is known as *leveling of DFD*.

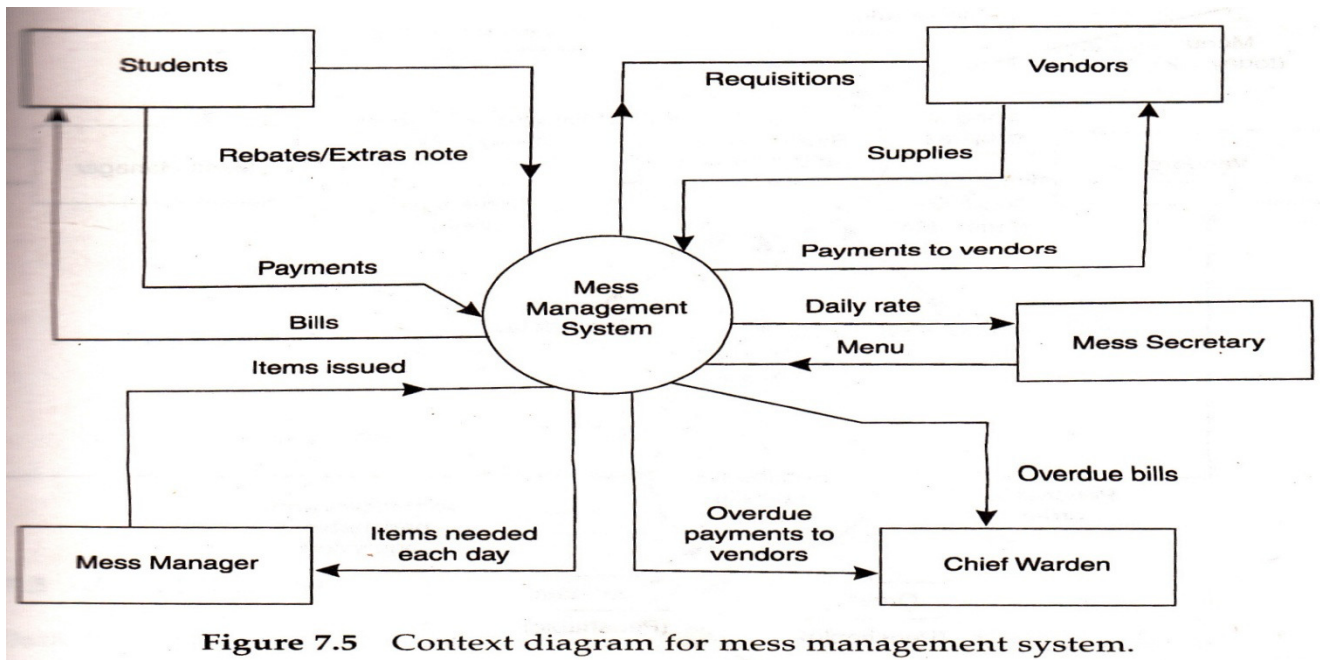


Figure 7.5 Context diagram for mess management system.

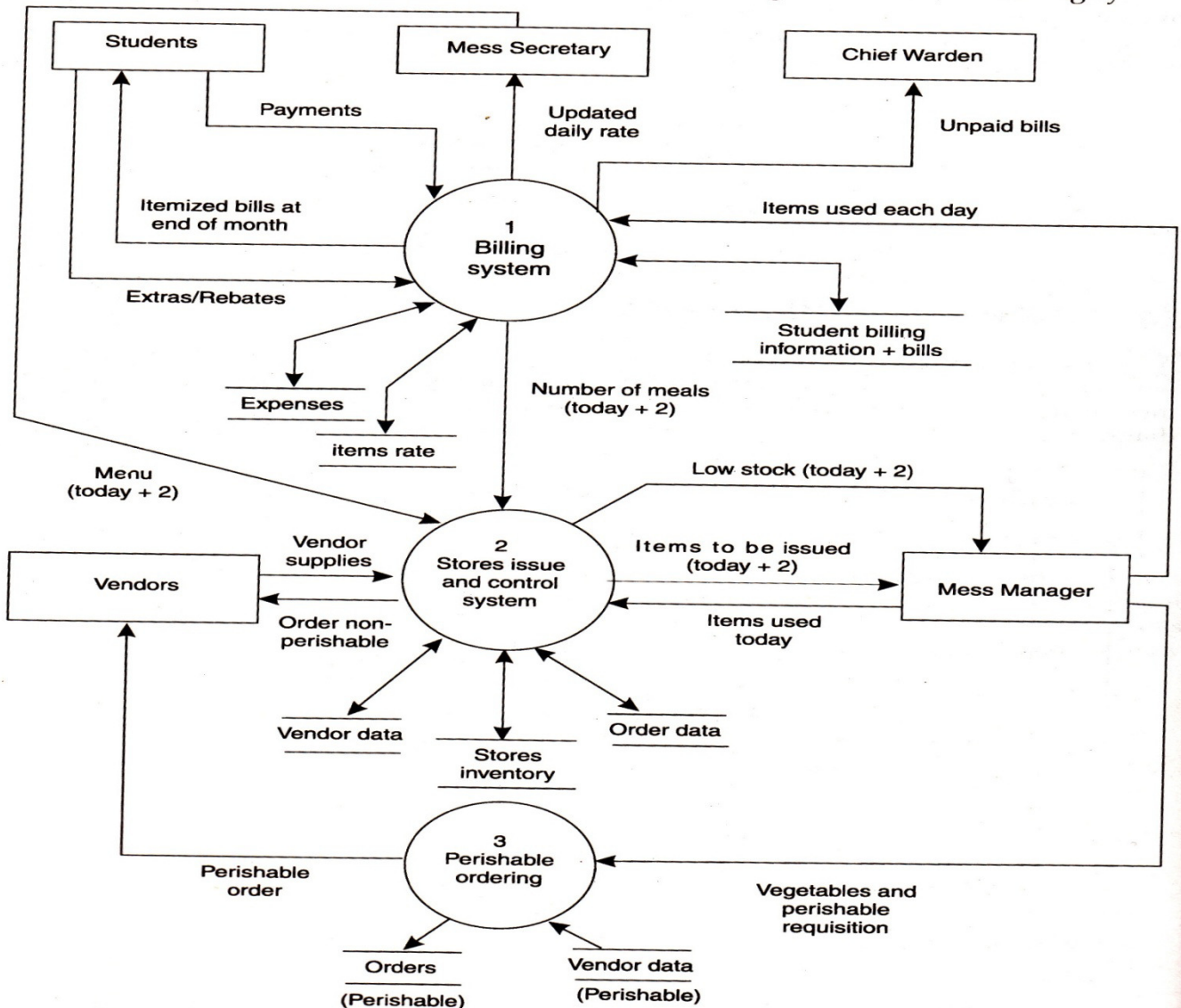


Figure 7.6 Data flow diagram for a hostel mess.

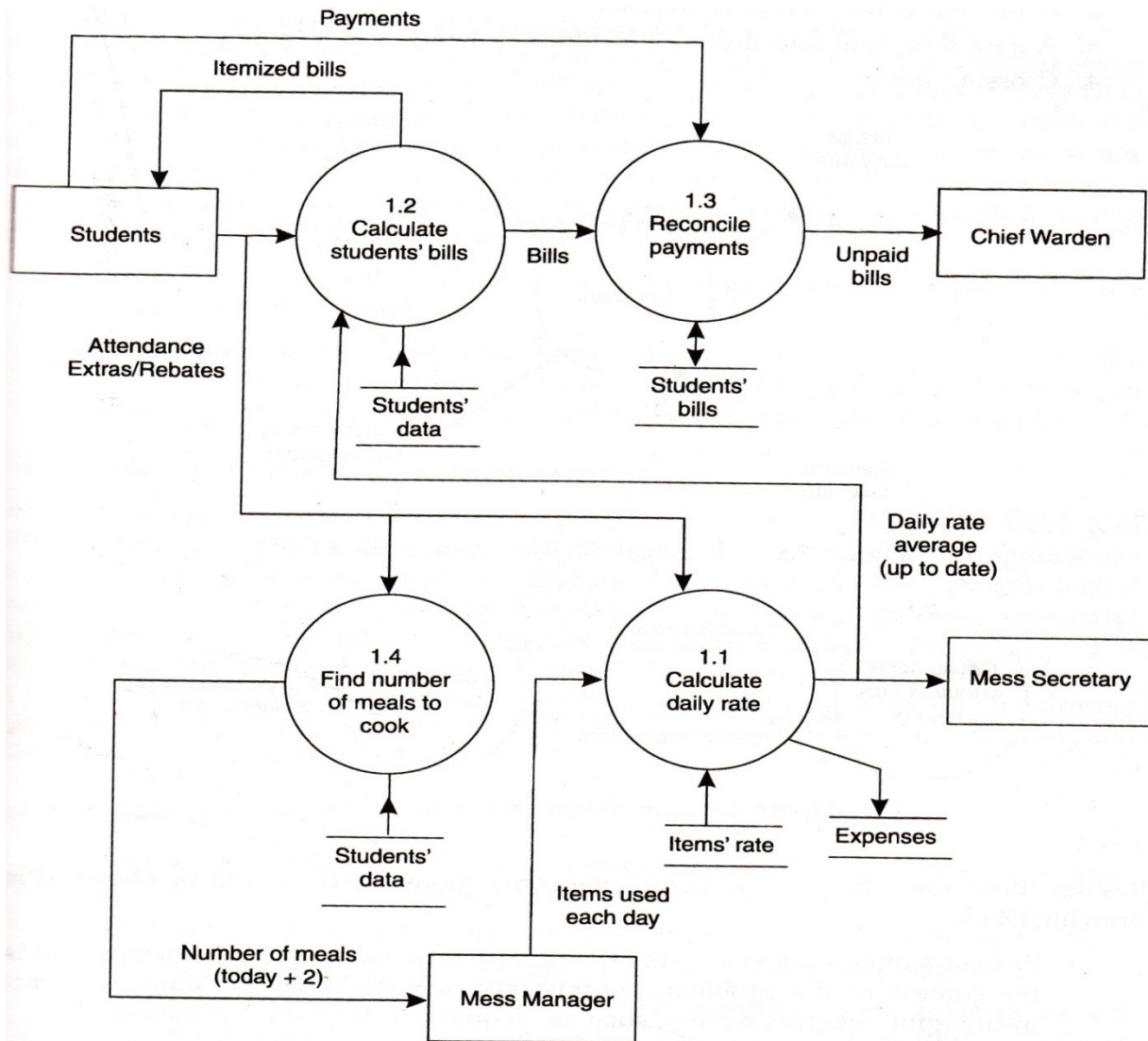


Figure 7.7 Expanded billing system process.

GOOD CONVENTIONS IN DEVELOPING DFDs

Data flow diagrams serve the dual purpose of specifying what data are needed for processing and as documentation of what procedures transform data. DFDs are different from charts. Flow charts given in detail how data is processed and include structures such as decision nodes and loops. DFDs do not have decision nodes and loops. For example, the DFDs given in Figures 7.8 and 7.9 are incorrect. Good data flow diagrams should not have the following:

1. Loops
2. A process which is a pure decision
3. A data flow split into flows with different names and meanings
4. Crossing lines

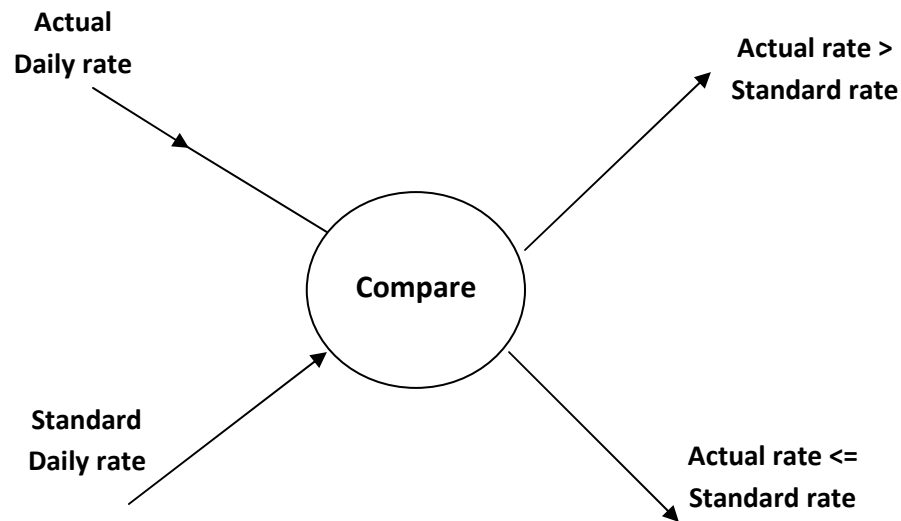


Figure 7.8 An illegal decision process in a DFD.

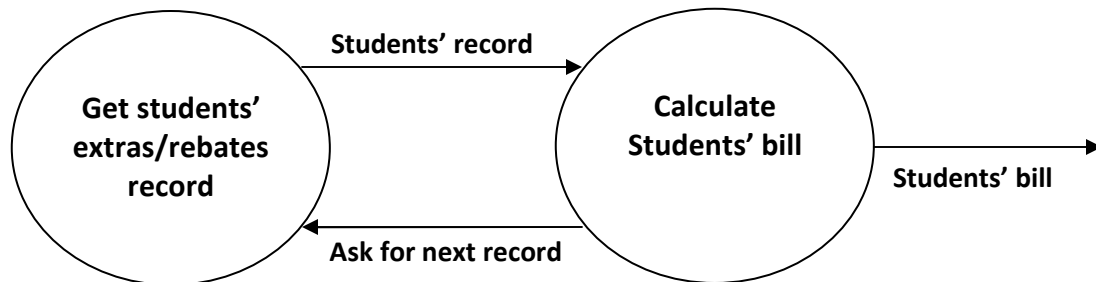


Figure 7.9 An illegal DFD with a loop.

Besides these, the following are good style conventions which should be observed in drawing DFDs:

1. Process names, data store names, and data flow names must be meaningful in the context of the problem. For instance, a name such as “data A” is not meaningful, whereas a name such as “requisition for items” is meaningful.
2. DFDs must be developed top down with lower levels giving more details.
3. Data should be conserved. A process cannot create new data. It can only transform input data to create output data. Similarly, any data retrieved from a store must have been stored in it earlier.
4. Data flows should not act as signals to activate or initiate processes.

LEVELLING OF DFDs

If a DFD contains all details, then it will have too many data flow lines. It will be mixed up and it will be difficult to understand all data flows and their processing. It is thus a good idea to start with an overview of the problem represented by a context DFD and expand the process appearing in it into an interconnected set of processes. This expanded DFD should specify the next level of detail and should be understandable at a glance. This implied that the number of processes in it should not be more than around seven. Each of the processes in this expanded DFD can in turn be expanded

into another DFD. This method of specifying data processing is called a top down method. Such a method is an excellent way of solving complex problem by breaking down the problem into smaller problems which are easier to solve. In the literature on DFD, the procedure of expanding a process in a DFD into a set of equivalent smaller processes is called leveling. The reasons why a DFD is leveled are :

1. It is a good idea to solve a problem top down, starting with an overview and then working out the details.
2. It is easier to read and understand leveled DFD namely one with around seven processes) as compared to one large detailed DFD with a large number of processes. Each leveled DFD can normally be accommodated in one page.

LEVELLING EXAMPLES

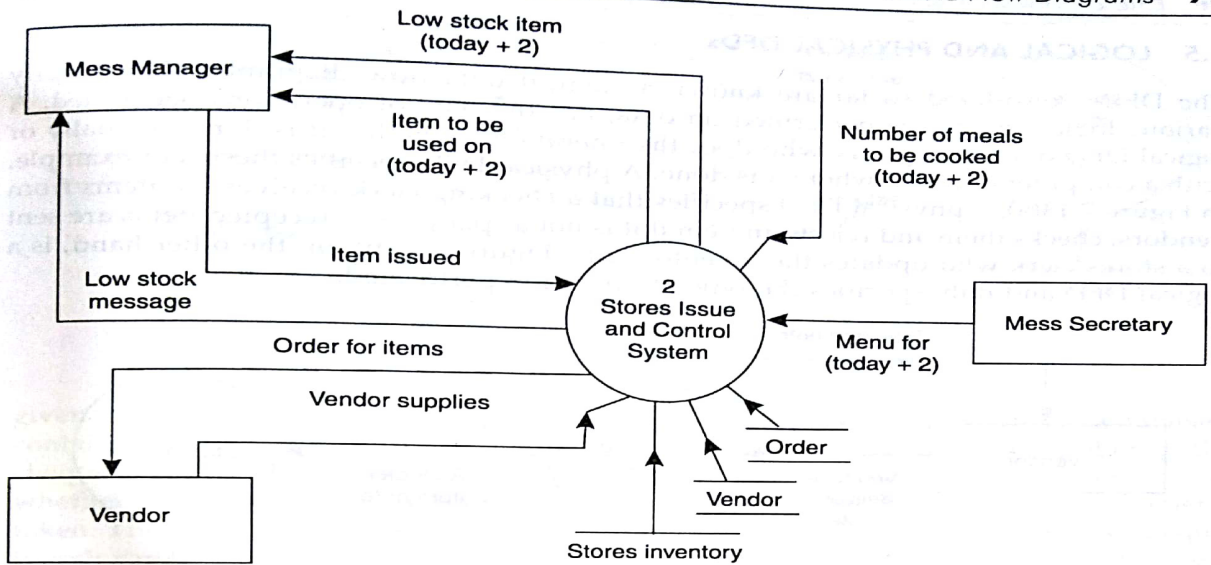


Figure 7.11 Stores issue and control system process.

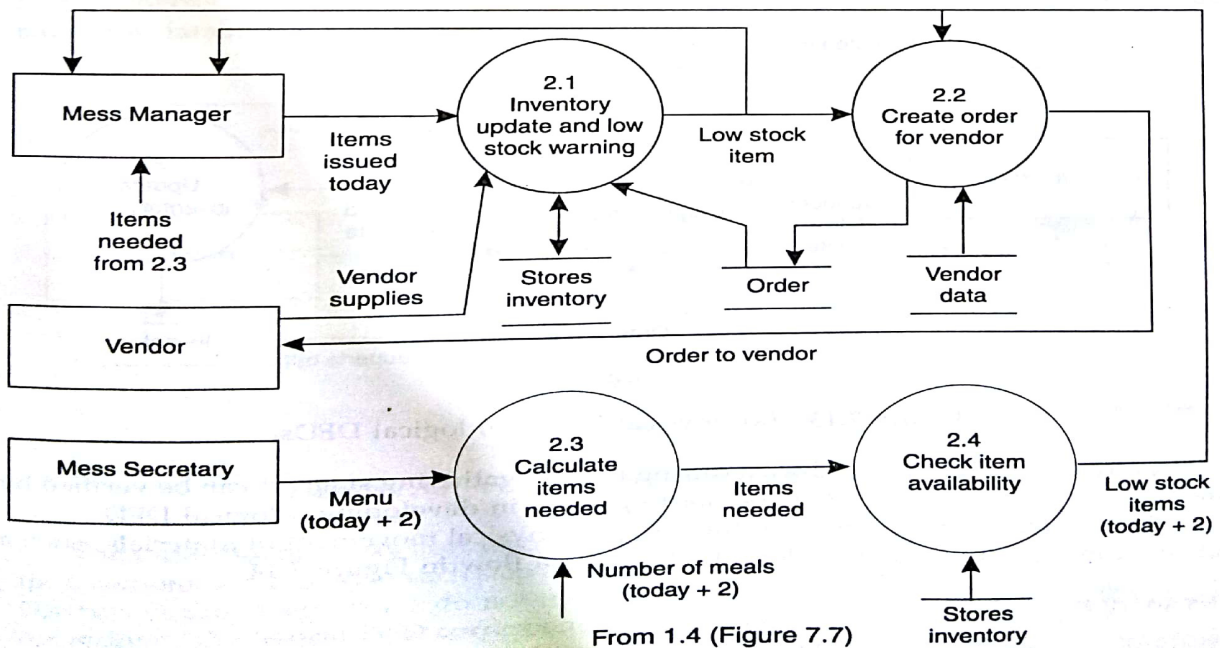


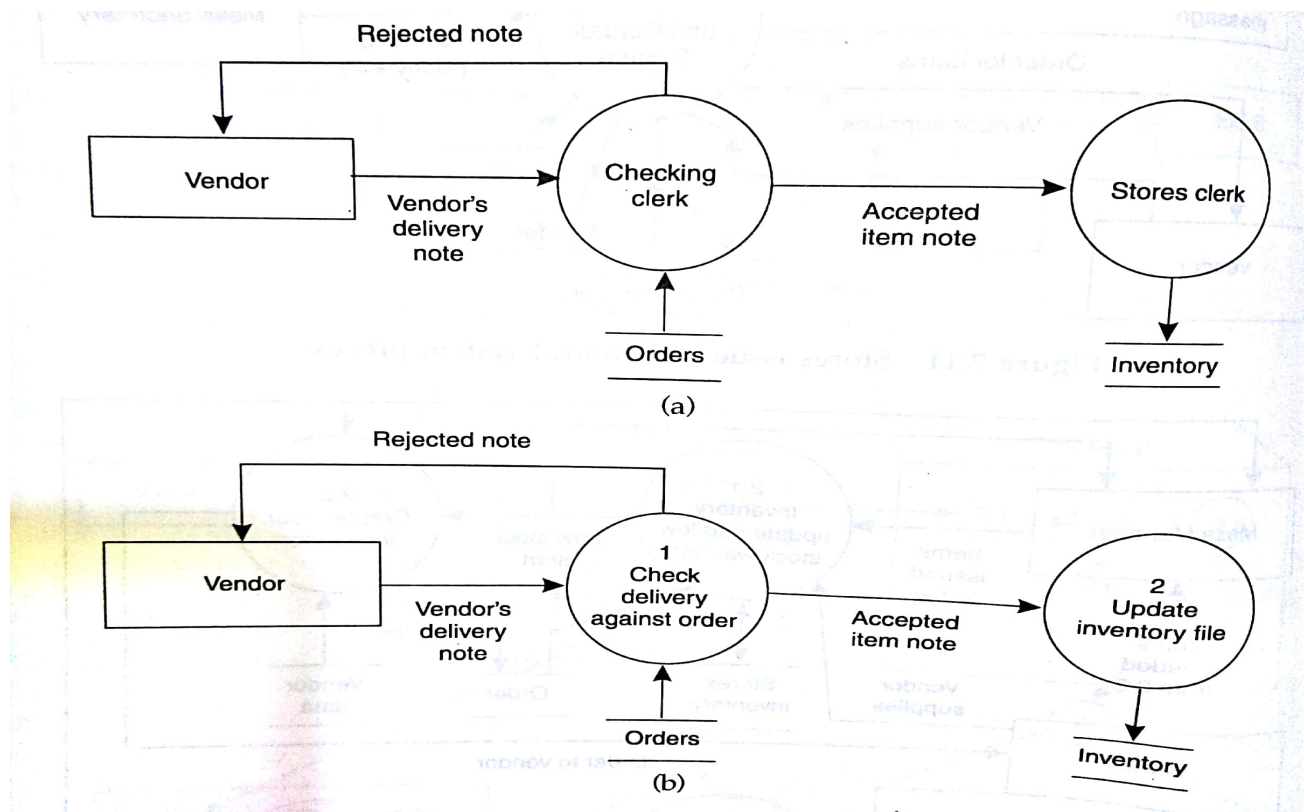
Figure 7.12 Levelled DFD stores issue and control system.

LEVELLING RULES

1. If a process numbered p in a DFD is leveled (i.e., expanded) into n processes, then each new process is numbered $p.1, p.2, \dots, p.n$ respectively.
2. All data flows entering a process must also enter its leveled equivalent DFD.
3. All data flows leaving a process must also leave its leveled DFD.
4. New data stores not referred to in a process may appear in the equivalent leveled DFD of that process. This implies that this store is local to the process and will not appear in the context diagram.
5. No external entities may appear in lower level DFDs. This is due to the fact that external entities are not part of a process.
6. The number of processes at each level is usually kept small (not exceeding 7). This is mainly to aid understanding of each level.

LOGICAL AND PHYSICAL DFDs

The DFDs considered so far are known as logical data flow diagrams. They specify various logical processes performed on data, i.e., the type of operations performed. A logical DFD does not specify who does the operations, whether it is done manually or with a computer and also where it is done. A physical DFD specifies these. For example, in Figures 7.13(a), a physical DFD specifies that a checking clerk receives the items from vendors, checks them and rejects an item if it is not as per order. Accepted items are sent to a stores clerk who updates the inventory file Figure 7.13(b), on the other hand a logical DFD and only specify the types of operation performed.



(a) Physical DFDs (b) Logical DFDs

A physical DFD is easily drawn during the fact gathering stage. It can be verified by the user. A physical DFD is a good starting point in developing a logical DFD.

Physical DFD is sometimes useful to depict physical movement of materials. Such a material movement is shown along with the data flow.

PROCESS SPECIFICATIONS

Systems analysts find out the requirements to be met by a system by interviewing and looking at various documents in the organization. Requirements for processing are often imprecisely states. For instance, consider the statement: "Give a discount of 5% if a customer pays advance or if the purchase is for Rs. 10,000 or more and the customer is a regular customer". What does one do if the purchase is for Rs. 20,000 and the customer is a first time customer and pays advance ? If we apply the or connective on clauses "pays advance" and "if the purchase is for Rs. 10,000 or more" first and then apply the and connective on the clause the " customer is a regular customer" then we do not give discount. If we apply the and connective to clauses "If purchase is for Rs. 10,000 or more" and he is a "regular customer" and then apply the or connective with clause "pays advance" we give discount as the customer pays advance. Such an ambiguity is due to the possibility of different interpretations of sentences. Thus there is a need for a more precise statement which can be unambiguously transformed to computational procedures. Two main techniques are used to express computational procedures :

- Structured English
- Decision Tables

STRUCTURED ENGLISH

It tries to express verbal statements in a more logical framework. It uses natural language along with the ideas of logic and block structuring used in computer languages. This makes the description more precise and understandable. Such a technique is useful if there are not too many conditions to be checked and the procedures are sequential and repetitive.

DECISION TABLES

These are appropriate when a large number of conditions are to be checked in arriving at a set of actions. Decision tables have many other advantages for computer processing. The difference between the two methods is illustrated, taking the word statement given at the beginning of this section.

STATEMENT :

Give a discount of 5% if the customer pays advance or if the purchase is for Rs. 10,000 or more and the customer is a regular customer. This can be written in structured English as

```

If Customer pays advance
  then
    Give 5% discount
  else
    if purchase amount >= 10,000
      then
        if customer is a regular customer
          then
            Give 5% discount
          else
            No discount
          endif
        else
          No discount
      endif
    endif
  endif

```

In the structured English description the conditions are checked one after another. For each question the part after *then* states the action to be carried out if the answer to the question is “Yes”. The part after *else* states the action to be carried out if the answer to the question is “No”. Observe that the *then* and *else* parts for each *if* are properly paired. At the end, the *if* is paired with *endif* which indicates the end of the *if* statement. Indentation is used to aid the reader to see the correct grouping of answers. This style is closer to the way programs are written in a programming language.

Decision Table for Discount Decision

Conditions	Rule 1	Rule 2	Rule 3	Rule 4
Advance payments made ?	Y	N	N	N
Purchase amount >= 10,000 ?	--	Y	Y	N
Regular customer	--	Y	N	--
Actions				
Give 5% discount	X	X	--	--
No discount	--	--	X	X

RULE 1 : If advance payment made
 then give 5% discount

RULE 2 : If no advance payment is made and if the purchase amount >= 10,000 and the customer is a regular customer
 then give 5% discount

RULE 3 : If no advance payment is made and if the purchase amount >= 10,000 and the customer is not a regular customer
 then give no discount

RULE 4 : If no advance payment is made and if the purchase amount is not >= 10,000
 then give no discount

STRUCTURED ENGLISH

The methodology used in structured English description is similar to that used in block structured computer languages. The main difference is the use of English statements to specify actions. The syntax rules are also not very strict. The aim is to allow easy readability which aids documentation and maintenance and at the same time ensures some discipline in process description which will help the programmer. The following conventions are used in writing structured English process descriptions.

- (i) **Imperative Sentences** : This consist of an imperative verb followed by operations to be performed on variables. For example :
Multiply gross price by discount rate
Store result in rebate
Subtract rebate from gross prices and obtain net price.
- (ii) **Arithmetic and relational operations** : Common symbols used in arithmetic are used in structured English descriptions. Symbols used for arithmetic are :
+ add; - subtract; * multiply; / divide
Symbols used in relations are :
= equal to; > greater than; < less than; ≠not equal to; ≥ greater than or equal to; ≤ less than or equal to;
Symbols used for logical operations are :
and, or, not
Symbols used as keyword are :
If, then, else, repeat, until, while, search, retrieve, do, case, for, of, endif, elseif, Read, Write

Example :

Read 'store issue note'
Select item issued record from 'store issue note'
Cost of issued item = quantity * price of item
Balance in account = balance in account – cost of issued item

- (iii) **Decision structures** : There are two types of decision structures used in structured English statements. One of them is an **if then else** structure which is used to make a choice between two alternatives.

```
if condition
    then
        Group Y Statements
    else
        Group N Statements
end if
```

The second type of structure is to choose one out of a set of alternatives. Here a case keyword is used. The corresponding structured English description is :

case (variable)

(Variable = P) : (statements for alternative P)

(Variable = Q) : (statements for alternative Q)

(Variable = R) : (statements for alternative R)

(Variable = S) : (statements for alternative S)

None of the above : (statements for default case)

end case

In this structure, for each specified value of the case variable a different sequence of statements is executed. If the variable does not have a value within the specified values then the statements specified in 'None of the above' are to be executed.

Example :

Receive 'store issued note'

Select item issued record from 'store issue note'

Cost of issued item = quantity * price of item

Balance in account = balance in account – cost of issued item

If balance in account \leq 0

then

(issue exception note to department

Mark 'stop future issues' in department record)

else

if balance in account < minimum balance

then

issue item to department

issue warning note to department

else

issue item to department

endif

endif

Example :

A company make three products which are codified as Class A, Class B and Class C. On class A items for purchase above Rs. 5000, 10% discount is given. For class B for purchase above Rs. 8000/-, a discount of 5% is given. On Class C on a purchase of Rs. 10,000 and above, 4% discount is given.

Case (Product Class)

(Product Class = A) : **[if** Purchase > 5000

then

Discount = 10%]

(Product Class = B) : **[if** Purchase > 8000

then

Discount = 5%]

(Product Class = C) : **[if** Purchase > 10000

then

Discount = 4%]

None of the above : Discount = 0

- (iv) **Repetition** : One of the most powerful techniques used in computer procedures is repetition, i.e., a sequence of statements are carried out many times. The number of times the repetition is to take place is governed by the type of structure used in the description. If a sequence of statements are to be repeated a specified fixed number of times, a **for** structure is used. For example, if each student in a class takes 5 subjects and the marks in each subject are represented by Marks(subject) then the following **for** loop computes total marks of the student :

Total marks = 0

```
for subject = 1 to subject = 5 do  
    total marks = total marks + marks (subject);  
    write student roll number, total marks  
end for
```

DECISION TABLE

Decision tables are non-procedural specification of decision rules. The format of decision tables allows systematic and documenting complex business rules. A decision table defines a logical procedure by means of a set of conditions and related actions.

Example :

A bank uses the following rules to classify new accounts. If a depositor's age is 21 or above and if the deposit is Rs. 100 or more, classify the account (type) as A. If the depositor is under 21 and the deposit is Rs. 100 or more, classify it as account B. If the depositor is 21 or over and the deposit is below Rs. 100 classify it as account C. If the depositor is under 21 and the deposit is below Rs. 100, do not open an account.

In order to obtain a decision table corresponding to the above problem statement, one has to first isolate in each sentence a part which spells out the conditions, and another part which spells out actions which are to be performed, based on the results obtained by testing the conditions. For the above problem the relevant condition clauses and action clauses can be stated as follows:

- RULE 1 : **if** a depositor's age is 21 or above (condition 1) and
 if the deposit is Rs. 100 or more (condition 2)
 then classify the account as type A (action 1)
- RULE 2 : **if** a depositor's age is under 21 (condition 3) and
 if the deposit is Rs. 100 or more (condition 2)
 then classify the account as type B (action 2)
- RULE 3 : **if** a depositor's age is 21 or over (condition 1) and
 if the deposit is below Rs. 100 or more (condition 4)
 then classify the account as type C (action 3)
- RULE 4 : **if** a depositor's age is under 21 (condition 3) and
 if the deposit is below Rs. 100 or more (condition 4)
 then do not open an account (action 4)

These conditions can be written as

Condition 1 : Depositor's age ≥ 21

Condition 2 : Deposit \geq Rs. 100

Condition 3 : Depositor's age ≤ 21

Condition 4 : Deposit $<$ Rs. 100

	Rule 1	Rule 2	Rule 3	Rule 4
Condition C1 : Depositor's age ≥ 21	Yes	No	Yes	No
Condition C2 : Deposit \geq Rs. 100	Yes	Yes	No	No
Action 1 : Classify as account A	X	--	--	--
Action 2 : Classify as account B	--	X	--	--
Action 3 : Classify as account C	--	--	X	--
Action 4 : Do not open account	--	--	--	X

Observe that conditions 1 and 3 are not independent; they are complementary. In other words, if the answer to the question "Depositor's age ≥ 21 " is No, the answer to the question "Depositor's age < 21 " is automatically Yes. Similarly, conditions 2 and 4 are complementary. Using this, the rules may be expressed in a concise tabular form as show above table.

A decision table is divided into four parts by horizontal and vertical double lines. The part above the horizontal double lines pertains to the conditions being tested (i.e., the questions asked) and the outcomes of these test (i.e., the answers to these questions). The part to the left of the vertical double lines in the top portion of the table (to left quadrant) lists the conditions and is known as the **conditional stub**. The part to right of the double lines lists the answers to these questions, namely, Yes or No (which are usually abbreviated as Y and N). The top right quadrant of the table is said to contain the **conditions entries**. Each row in the top half of table listing a question and its answer is called **conditional row**.

The bottom half of the decision table, namely, the part below the horizontal double lines, lists the actions to be performed. The left bottom half quadrant is called the action stub and in it the actions to be carried out are listed. The right bottom quadrant has crosses (X) and dashes(--). A cross indicates that the action listed in the row has to be performed and a dash indicates that the action is not performed. These are called action entries. Each row in this half of the table is called an action row. Vertical columns to the right of the vertical double lines are called rules. A rule is interpreted by using the condition listed in the condition stub and the answers which are listed as condition entries. The corresponding actions are obtained from the action stub and entries.

Notation used in Decision Tables

	R1	R2	Rn
Condition C1 : Stub C2 : ... Ck :	Rule	Conditional row	
		Conditional entries	
Action A1 : Stub A2 : ... Am	Action row		Action entries

EXTENDED ENTRY DECISION TABLES

So far we have considered examples in which the questions asked have only Yes or No as answer. It was thus logical to separate the questions from the answers by entering the questions in the condition stub and the answers in the condition entry part of the decision table. However, there are a number of problems in which a questions being extended into the concerned entry part of the decision table.

Example :

A company markets two products to three types of customers. It has the following discount policy: The products are bulbs and fans, and the customers are classified as retailers, distributors and government agencies. If the order is from a retailer for amount up to Rs 500, it allows 5% discount. If it is from a distributor, 7.5% discount is given. On retail orders exceeding Rs. 500, 7.5% discount is allowed. For the same order from a distributor, 10% discount is given. In all the above cases a flat discount of 6% is given to government agencies. The above policies apply only to orders for bulbs. A flat discount of 5% is given on orders for fans regardless of the amount of purchase or the customer classification.

Analyzing the word statement of the problem we see that the action, namely, the percent discount to be allowed, is dependent on three conditions :

1. The type of product
2. The type of customer
3. The amount of the order

The two products, namely, bulbs and fans, may be coded respectively as 1 and 2. Similarly, the three types of customers, namely retailers, distributors, and government agencies, could be coded respectively as A, B and C. Using these codes the policy may be formulated as a decision table.

	R1	R2	R3	R4	R5	R6
C1 : Product Code	1	1	1	1	1	2
C2 : Customer Code	A	B	A	B	C	--
C3 : Order Amount	<=500	<=500	>500	>500	--	--
Discount	5%	7.5%	7.5%	10%	6%	5%

It should be observed that each question is formulated by combining the statement in the condition stub with that in the condition entry of the decision table. Such a table is called an *extended entry decision table*. This may be contrasted with the tables in the previous examples where questions are written in the condition stub and their answers in the condition entry part of the decision table. Such tables are called *limited entry decision tables*.

Extended Entry Decision Table

	R1	R2	R3	R4	R5	R6
C1 : Product code = 1 ?	Y	Y	Y	Y	Y	N
C2 : Customer Code = A ?	Y	--	Y	--	--	--
C3 : Customer Code = B ?	--	Y	--	Y	--	--
C4 : Customer Code = C ?	--	--	--	--	Y	--
C5 : Order amount <= 500	Y	Y	N	N	--	--
A1 : Discount 5%	X	--	--	--	--	X
A2 : Discount 6 %	--	--	--	--	X	--
A3 : Discount 7.5%	--	X	X	--	--	--
A4 : Discount 10%	--	--	--	X	--	--

LOGICAL DATABASE DESIGN

It is necessary to develop a conceptual model of data which specifies the relationships between data. This is used to group data into a number of tables. The tables are organized to:

1. Reduce duplication of data,
2. Simplify functions like adding, deleting and changing data, in other words, updating data.
3. Select data required for processing, in other words, retrieving data.

The method of organizing or structuring data into tables is known as normalization. The collection of tables of data is called a database. The normalized database is later converted to a physical database.

ENTITY RELATIONSHIP MODEL

The entity-relationship model for data uses three features to describe data. These are :

1. **Entities** which specify distinct real-world items in an application.
2. **Relationships** which connect entities and represent meaningful dependencies between them.
3. **Attributes** which specify properties of entities and relationships.

We will illustrate these terms with an example, A vendor supplying items to a company, for example, is an entity. The items he supplies is another entity. A vendor and an item are related in the sense that a vendor supplies an item. The act of supplying defines a relationship between vendor and an item. An entity set is a collection of similar entities. We can thus define a vendor and an item set. Each member of an entity set is described by some attributes. For example, a VENDOR may be described by the attributes.

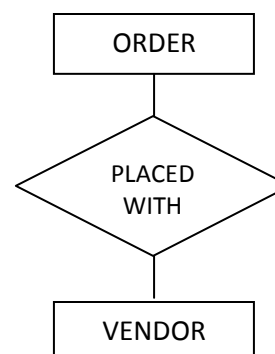
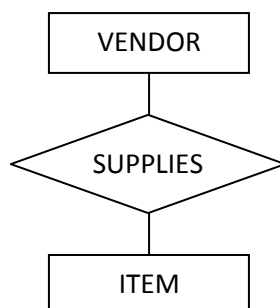
(vendor code, vendor name, address)

An ITEM may be described by the attributes

(item code, item name)

We saw that two entities may be related by a relationship. A relationship set relates two entity sets. Thus a relationship set will have several members each connecting a member of an entity set with a member of another entity set.

In the entity-relationship (E-R) diagram, an entity set is represented by a rectangle and relationship set by a diamond-shaped box. We may define another entity set called ORDER and a relationship set "PLACED WITH". The statement "Orders Placed with Vendors" is shown in the E-R diagram. In the E-R diagram entities and relationships are names using uppercase letters in singular form. Thus in the E-R diagram we have named entities as VENDOR, ITEM, ORDER and relationship as SUPPLIES and PLACED WITH. The relationships in these examples relate two entities and are called binary relationship.



RELATIONSHIP CARDINALITY AND PARTICIPATION

Relationship sets have certain constraints that limit the possible combinations of entity that may participate in relationship instances. These constraints and the cardinality mappings are generally obtained from the problem statements. The two main types of constraints are cardinality ratio and participation constraints.

1. Cardinality Ratio : The cardinality ratio for a binary relationship specifies the number of relationship instances that an entity can participate in. These are basically three types of cardinality mappings

- (a) One to One Cardinality (1:1)
- (b) One to Many (1: N) or May to One (N : 1)
- (c) Many to Many (M : N)

One-to-One Cardinality (1 : 1) :

The relationship between two entities is called as one-to-one when one and only line emanates from each of the participating entities. Then such a relationship is called as one-to-one cardinality.

For Example: A Employee can manage only one Department



One-to-Many Cardinality (1 : N) or Many-to-One Cardinality (N : 1) :

The relationship between one entity with more than one entities is called one-to-many cardinality and more entities are related with one entity is called many-to-one cardinality.

For Example : many employees works for a department



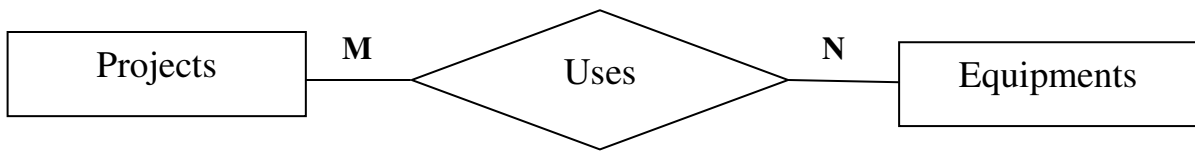
Many-to-Many Cardinality (M : N) :

The relationship between many entities with more than one entity is called many-to-many cardinality.

Example : A student is allowed to register for more than one subject and a subject may be registered by many students.



Example : A project may use many equipments and an equipment may be used by many projects.

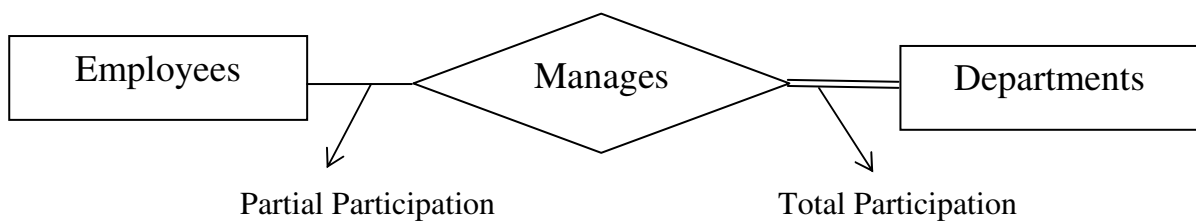


2) **Participation Constraints** : Apart from the key constraints and cardinality mapping, it is necessary to incorporate whether participation of an entity to a relationship total or partial.

(a) **Total Participation** : In total participation every entity in the entity set must be depend on another entity. It is also known as existence dependency.

In ER Diagram it is represented as a double line connecting the participating entity type to the relationship.

(b) **Partial Participation** : In partial participation some entities in the entity set are depend on another entity. In ER Diagram it is represented as a double line connecting the participating entity type to the relationship.



DATA INPUT METHODS

The input of data to a computer can be either on-line or off-line. In on-line data entry the user directly enters a data into the computer's secondary storage, namely, a disk file. This entry is through a terminal connected to the computer. In this method the computer prompts a person entering data with a menu, or commands or a form displayed on the video display. Any errors in data entry are checked immediately and the person who entered the data is sent a message within one or two seconds to correct the input data. With the advent of e-commerce and e-filing of various forms such as income tax returns, applications to colleges etc., on-line entry of forms is far more common nowadays by untrained person. On-line form design thus has to be simple and fool-proof to minimize errors.

In off-line data entry, transactions are entered on forms manually at the point where the transaction originates. Examples are sales reports filled by salesmen, application form to open a bank account, application form for a job etc., Many forms are collected to form a batch. The batches of transactions are then entered from the forms by a data entry operator into a computer's disk. In this case considerable time elapses between the entry of data on the forms and its actual entry into a computer. Errors in data entry are thus found much later than when they occur. Thus there should be well-designed method of correcting the error in data entry which is independent of elapsed time.

Data entered by operators are checked by a data validation program and data records with errors are printed in an error report. The incorrect transactions in the input are corrected and the data is entered again. The correct transactions are used by a file update program to update the database. To reduce errors in data entry, it is essential to design carefully the form in which the data is

manually entered. The main principles used in designing forms are to reduce the human errors in filling the forms and minimize the chance of mistakes in data entry.

The following points should be kept in mind while designing forms.

1. Leave enough space for writing legibly the information.
2. Give clear instructions to fill the form. Each instruction is in front of the line where the data is to be entered.
3. Use boxes to enter data. Each box must have enough space to write. The number of boxes should correspond to the size of the data, e.g., PIN Code has 6 digits and mobile numbers are 10 digits long.
4. Use standard format and given clear instructions to fill data such as date and time. Use 24 hour clock for time. For example, a standard format for entering date is

Day		Month		Year			

5. Arrange entries in such a way that the data entry operator can enter data by reading a form from top to bottom and left to right.

Name

Address

Bad design: Tendency will be to fill name on top line. Not enough space for letters of address.

Tick as applicable

Individual

Hindu undivided family

Parent/Guardian of minor

Bad design: Choices are not codified. Data entry operator will be confused.

Figure 14.2 A poorly designed form.

(iii) **Efficient storage and retrieval** : Code is a concise representation. It reduces data entry time and improves reliability. Code as a key reduces storage space required for the data. Retrieval based on key search is faster in a computer.

Requirements of a Coding Scheme

A coding scheme must be concise. In other words, the number of digits/characters used in a code must be minimal to reduce storage space of the code and retrieval efficiency. It should be expandable, that is, it must allow new items to be added easily. It should be meaningful and convey to a user some information about the characteristics of the item to enable quick recognition and identification of the item. It should be comprehensive in other words; it should include the characteristics relevant to all the related activities unique, unambiguous code.

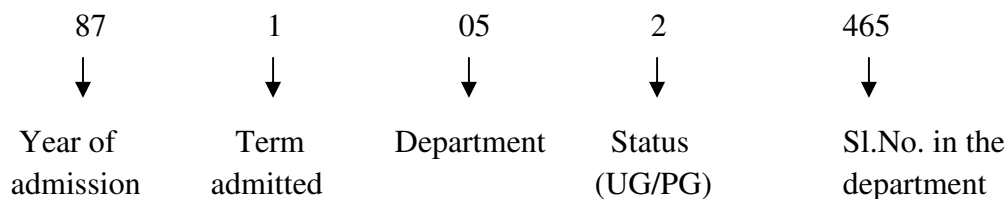
Types of Codes

(i) **Serial numbers** : For example, for bank accounts one may assign a serial number for each account holder. As and when a new account is opened, the person is given the next serial number.

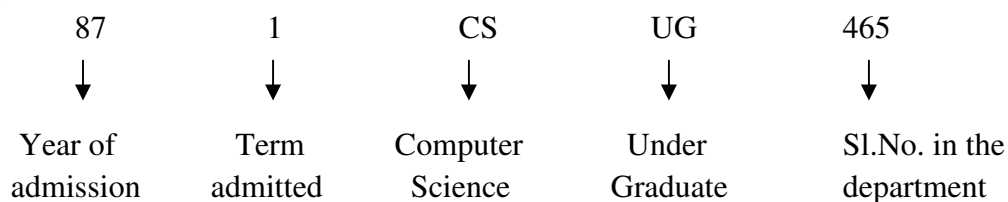
The advantage of this method is that it is concise, precise and expandable. It is, however, not meaningful. From the serial number it is not possible to find out anything about the account holder. It is also not comprehensive.

(ii) **Block codes** : The block codes use blocks of serial numbers. For example, account numbers 0000 to 9999 may be used for savings accounts in a bank; 10000 to 99999 for current account; 100000 to 999999 for special deposit accounts, etc. A similar block code can be used in other areas such as coding items in a store, and assigning roll numbers to students. This code is expandable and more meaningful than the serial number coding. It is precise but not concise or comprehensive.

(iii) **Group classification code** : This is an improvement on the block code and to more meaningful. For example, a method of assigning roll numbers to students may use the following system:



Often mnemonics instead of numbers make the code more meaningful. For instance, in the above representation we can write the code as



This code is meaningful, comprehensive, expandable and precise. It is, however, not concise. The code can become very long if an attempt is made to make it more comprehensive. This is a good coding method and is widely used. For example, the PIN code used by the Postal Department is based on this idea.

(iv) **Significant codes** : These codes use some or all of the digits to describe a value of the product being coded. For example, the code

BA	M	95	C	B	R
↓	↓	↓	↓	↓	↓
Banian	Male	Chest Size	Cotton	Colour	Style

describes a banian for males of chest size 95 cm, made of cotton of blue colour and round neck. The value may be directly used in some calculation. This code is meaningful, precise, comprehensive and expandable. It is not concise.

VALIDATING INPUT DATA

Good form design and careful entry of data will reduce incorrect data from entering a file. Special measures should, however, be taken during input preparation and later special data validation program should be written to make sure that data with errors are not stored in file.

Controls during Input Preparation

- (i) **Sequence numbering** : Each data record is given a sequence number. This provides the information to pick the incorrect record when an error is detected in it. A missing record or an out of sequence record can also be tracked using the sequence number.
- (ii) **Batch control** : Input data records consist of batches of about 50 records and each batch is numbered. One or more important fields in each record is selected and the values in the fields in all the records are manually added to form a batch control total. A batch control record is designed, which includes information such as number of records in the batch and the batch control total (also known as batch totals). This batch control record is entered at the end of each batch of records into the disk file. It is used by the data validation program to check that no records in the batch are missed and there is not data entry error in the selected field(s).
- (iii) **Data entry and verification** : The same set of data records are entered by two different operators and two files are created. Corresponding records in these two files are compared by a program. Any difference in two corresponding records indicates an error. The records are then retrieved and compared with those in the data entry forms.
- (iv) **Record totals** : Some selected fields in a record are summed and the sum is entered as a separate field in each record. The data validation program sums the fields as entered by the data entry operator and compares this sum with the manually computed hash total field. Any difference is signaled and the record is manually checked.
- (v) **Check digit** : For important fields, modulus-N check digits are used to detect errors.

DESIGNING OUTPUTS

Presenting the data processed by a computer-based information system in an attractive and usable form is very important. With advances in computer technology, many new output devices are being introduced in the market.

OUTPUT DEVICES

The most important output devices are printers and video display units. Printers are used when a large volume of output is required. Printers are of two broad types : impact printers and non-impact printers. In impact printers a print head strikes a printer ribbon which prints a character on paper. In non-impact printers there is no mechanical print head; characters are printed using a jet of ink or a laser beam. Laser printers produce excellent quality prints and are often used in Desk Top Publishing system. Impact printers are of two types: line printers in which a whole line is printed at a time and character printers which print one character at a time. Line printers are very fast (they print around 1000 lines per minutes), but expensive. They are used for large volume of printing. Character printers are slower (around 80 characters per second).

Video display units use flat panels for display. They have a keyboard which allows entering data. Twenty four lines, each 80 characters long, can be displayed on the display unit. Video display units are used in on-line systems to display results and answers to queries. Colour display units can display a large number of colours. The information displayed on a video display unit may be printed using an inkjet or laser printer or plotted using a plotter.

A new type of output unit entering the market is an audio output unit. Such an output device announces a result using a loudspeaker. Currently the most common audio output gives digits or numbers. Short words are also synthesized by the computer. The pattern of bits corresponding to a word is stored in audio output buffer storage. A speech synthesizer converts this to spoken words. The most common audio output unit answers enquiries such as a request for telephone number, balance in one's bank account, and instructions to plant operators, arrival and departure times of trains etc.,

OBJECTIVES OF OUTPUT DESIGN

In order to select an appropriate output device and to design a proper output report format, it is necessary to understand the objectives the output report is expected to serve. This can be found by asking the following questions:

1. Who will use the report ?
2. What is the proposed use of the report ?
3. What is the volume of the output ?
4. How often is the report needed ?
5. Where and when are the reports required ?

If the report is for top management, it must be summarized, highlighting important results. Graphical outputs such as bar charts and pie charts convey information in a form useful for decision making.

If the report is for middle management, it should highlight exceptions, that is, anything not normal. For example, in a stores management system, information on whether items are rapidly consumed, or not consumed for a long time should be highlighted. Exceptions convey information for tactical management.

At the operational level all relevant information should be printed. For example, in a payroll system, pay slips of all employees have to be printed each month. In a mailing system all address labels have to be printed periodically.

An information rule to be followed is to provide the volume of information appropriate for use by a person when he needs it. Irrelevant reports are worse than no reports. Short reports must be sent to the intended recipient for display on his or her desktop/laptop computer.

DESIGN OF OUTPUT REPORTS

1. A report heading which appears only on the first page of the report. It would be desirable to include date and version number. For Example :

The report heading appearing once at the start of the report is :

INDIAN INSTITUTE OF SCIENCE – ACADEMIC ROLL LIST

5-9-2001

VERSION 1

2. A page heading and sub headings which appear at the top of each page of the report.

For Example:

The page heading which will appear on top of each page is :

ROLL LIST OF STUDENTS SEM 1 / 2000-2001

3. A set of records with some common characteristics may be grouped together. Such a group is called control group. A heading, called the control heading may be given for the group.

For Example :

The control heading and sub headings are :

LIST OF STUDENTS IN AEROSPACE ENGG. DEPT.

ROLL NO. NAME

Another control heading and sub headings are :

LIST OF STUDENTS IN CHEMICAL ENGG. DEPT.

ROLL NO. NAME

4. Abstract of information contained in each such group of records is printed at the bottom of the group with a description label called control footing.

For Example :

Lines containing detailed information given in the report appear below the appropriate control headings.

97101115 A B BHATTACHARYA

Appearing below the heading :

ROLL NO. NAME

is called detail line.

5. Abstract of the information contained in a control group appears at the end of the control group and is called the control footing.

For Example :

TOTAL NO. OF STUDENTS IN AEROSPACE ENGG. DEPT. = 68

TOTAL NO. OF STUDENTS IN CHEMICAL ENGG. DEPT. = 63

are control footings.

There is another types of control footing called final control footing. This abstracts a desired information for the entire report.

TOTAL NO. OF STUDENTS IN SEM 1 / 2000-20001 = 852

6. Information written at the end of each page is known as page footing.

7. Information printed at the end of a report is called report footing.

For Example :

END OF IISc BANGALORE ROLL LIST FOR SEM 1 / 2000-2001

To summarize, we see that a printed report is divided into the following group of line, called report groups:

First group	:	Report heading
Second group	:	Page heading
Third group	:	Control heading
Fourth group	:	Detail heading and lines
Fifth group	:	Control footing
Sixth group	:	Page footing
Seventh group	:	Final control footing
Eight group	:	Report footing

The general principles to be used in designing output reports are :

1. The design must be such that it can be read from left to right and from top to bottom.
2. The most important item, such as the key field, should be the easiest to find.
3. All pages must have a heading and a page number. The date on which the report was prepared should also be printed. Version number should be indicated.
4. All columns must be labelled with meaningful labels.
5. Too many details should not be given.
6. Control footing abstracts information about groups of detail lines and must be effectively used.
7. Similarly, page and report footings give summaries and are useful.
8. If a signature is required at the end of a report there should be space and printed line provided for it.

DESIGN OF SCREENS

Most of the principles discussed for designing printed outputs are valid for displaying outputs on video display terminals. There are, however, important differences. A video display screen has normally 80 columns and 24 rows (132 column displays is now available). A display requires active participation from the user as it is displayed online. The user must be given clear instructions on how

to retrieve the information he needs. A screen layout for student information system is shown below. As in a printed report, it has a screen heading and headings for various fields.

Screen for General Student Information

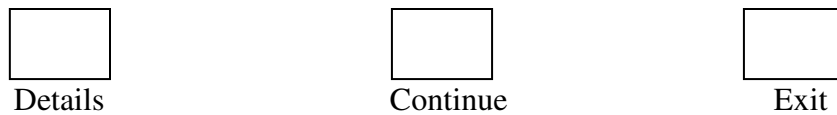
INDIAN INSTITUTE OF SCIENCE
STUDENT INFORMATION SYSTEM
05-05-2000 VERSION 1

ROLL NO.	NAME	DEPT.	YEAR
9501325	A.B. BHATTACHARYA	AEROSPACE	ME I
9602415	A.P. DAS	CSA	Ph.D
9602325	P. GANAPATHY	EE	M.Sc
9701425	G. HARI	MET	ME.H
9702112	H.JAI SINGH	CIVIL	Ph.D
-----	-----	-----	-----
-----	-----	-----	-----

PRESS D FOR DETAILS ABOUT A STUDENT
PRESS C TO CONTINUE
PRESS X TO EXIT

At the bottom of the screen an instruction is given to the user on how to get to the next screen. Instructions are also needed to allow the user to exit. The system should be able to recover if a wrong key is pressed by the user. For example, in the screen of above if a user presses E, the system should respond with a message that a wrong key is pressed and present the alternatives again to the user.

Instead of pressing keys it is more convenient to provide a Graphical User Interface (GUI) with “buttons” which when pointed to by mouse movement and clicked will take the specified actions. Thus in the screen of above the following buttons may be provided at the bottom of the screen.



Besides tabular reports, text reports are also used by businesses. Such reports must have a heading and date. They must be left justified and use upper and lower case letters. It is not essential to right justify. It is better to avoid hyphenation. Also abbreviations should be avoided unless it is universally used. It is better to give full expansion of an abbreviation when it is used for the first time, for example, Local Area Network (LAN).

USE OF BUSINESS GRAPHICS

All video terminals nowadays allow display of graphics and different types of charts. These are called business graphics. Business graphics presentation normally consists of facilities to draw graphs showing trends, bar charts, pie charts and maps. Each of these has a role to play. Graphs normally show the relationships between two variables, typical time along the X-axis, and variables

such as sales, student enrollment, and power consumption along the Y-axis. This type of presentation is used when growth or decline of some variable with respect to time has to be summarized. Graphs have the advantages of condensing and presenting the information in a form where its significance is easily comprehended.

Bar charts are normally used to show the distribution of the number of items having specified characteristics within a specified range. For example, a bar chart showing the number of employees in different age groups in a company.

Pie charts are used to show the percent or part of a total used by different activities, for example, how the budget of a company is allocated. A pie chart immediately focuses one's attention on major components of the budget.

Maps are useful to show the spread of sales offices or markets or maintenance shops in a geographic region. For example, a map of major spare areas is well covered and which are not.

We can, of course, combine these forms. For example, in a map, a bar chart can be shown for each region of a country. One more development now is the availability of colour and animation on video display terminals. This further enhances the variety of output presentation. For effectiveness it is not always necessary to have colour. Further, hard copy of colour displays is expensive and multiple copies are difficult to make forms for presentation of results must be worked out by an analyst in consultation with user's management.

UNIT IV – IMPLEMENTATION OF INFORMATION SYSTEM

Implementation is a process of ensuring that the information system is operational. It involves –

- Constructing a new system from scratch
- Constructing a new system from the existing one.

Implementation allows the users to take over its operation for use and evaluation. It involves training the users to handle the system and plan for a smooth conversion.

Training

The personnel in the system must know in detail what their roles will be, how they can use the system, and what the system will or will not do. The success or failure of well designed and technically elegant systems can depend on the way they are operated and used.

Training Systems Operators

Systems operators must be trained properly such that they can handle all possible operations, both routine and extraordinary. The operators should be trained in what common malfunctions may occur, how to recognize them, and what steps to take when they come.

Training involves creating troubleshooting lists to identify possible problems and remedies for them, as well as the names and telephone numbers of individuals to contact when unexpected or unusual problems arise.

Training also involves familiarization with run procedures, which involves working through the sequence of activities needed to use a new system.

User Training

- End-user training is an important part of the computer-based information system development, which must be provided to employees to enable them to do their own problem solving.
- User training involves how to operate the equipment, troubleshooting the system problem, determining whether a problem that arose is caused by the equipment or software.
- Most user training deals with the operation of the system itself. The training courses must be designed to help the user with fast mobilization for the organization.

Training Guidelines

- Establishing measurable objectives
- Using appropriate training methods
- Selecting suitable training sites
- Employing understandable training materials

Training Methods

1. Instructor-led training

It involves both trainers and trainees, who have to meet at the same time, but not necessarily at the same place. The training session could be one-on-one or collaborative. It is of two types –

2. Virtual Classroom

In this training, trainers must meet the trainees at the same time, but are not required to be at the same place. The primary tools used here are: video conferencing, text based Internet relay chat tools, or virtual reality packages, etc.

3. Normal Classroom

The trainers must meet the trainees at the same time and at the same place. Their primary tools used here are blackboard, overhead projectors, LCD projector, etc.

Self-Paced Training

It involves both trainers and trainees, who do not need to meet at the same place or at the same time. The trainees learn the skills themselves by accessing the courses at their own convenience. It is of two types –

4. Multimedia Training

In this training, courses are presented in multimedia format and stored on CD-ROM. It minimizes the cost in developing an in-house training course without assistance from external programmers.

5. Web-based Training

In this training, courses are often presented in hyper media format and developed to support internet and intranet. It provides just-in-time training for end users and allow organization to tailor training requirements.

Conversion

It is a process of migrating from the old system to the new one. It provides understandable and structured approach to improve the communication between management and project team.

Conversion Plan

It contains description of all the activities that must occur during implementation of the new system and put it into operation. It anticipates possible problems and solutions to deal with them.

It includes the following activities –

- Name all files for conversions.
- Identifying the data requirements to develop new files during conversion.
- Listing all the new documents and procedures that are required.
- Identifying the controls to be used in each activity.
- Identifying the responsibility of person for each activity.
- Verifying conversion schedules.

Conversion Methods

The four methods of conversion are –

- Parallel Conversion
- Direct Cutover Conversion
- Pilot Approach
- Phase-In Method

Method	Description	Advantages	Disadvantages
Parallel Conversion	Old and new systems are used simultaneously.	Provides fallback when new system fails. Offers greatest security and ultimately testing of new system.	Causes cost overruns. New system may not get fair trail.
Direct Cutover Conversion	New system is implemented and old system is replaced completely.	Forces users to make new system work Immediate benefit from new methods and control.	No fall back if problems arise with new system Requires most careful planning
Pilot Approach	Supports phased approach that gradually implement system across all users	Allows training and installation without unnecessary use of resources. Avoid large contingencies from risk management.	A long term phasein causes a problem of whether conversion goes well or not.
Phase-In Method	Working version of system implemented in one part of organization based on feedback, it is installed throughout the organization all alone or stage by stage.	Provides experience and line test before implementation When preferred new system involves new technology or drastic changes in performance.	Gives impression that old system is erroneous and it is not reliable.

File Conversion

It is a process of converting one file format into another. For example, file in WordPerfect format can be converted into Microsoft Word.

For successful conversion, a conversion plan is required, which includes –

- Knowledge of the target system and understanding of the present system
- Teamwork
- Automated methods, testing and parallel operations
- Continuous support for correcting problems
- Updating systems/user documentation, etc

Many popular applications support opening and saving to other file formats of the same type. For example, Microsoft Word can open and save files in many other word processing formats.

Post-Implementation Evaluation Review (PIER)

PIER is a tool or standard approach for evaluating the outcome of the project and determine whether the project is producing the expected benefits to the processes, products or services. It enables the user to verify that the project or system has achieved its desired outcome within specified time period and planned cost.

PIER ensures that the project has met its goals by evaluating the development and management processes of the project.

Objectives of PIER

The objectives of having a PIER are as follows –

- To determine the success of a project against the projected costs, benefits, and timelines.
- To identify the opportunities to add additional value to the project.
- To determine strengths and weaknesses of the project for future reference and appropriate action.
- To make recommendations on the future of the project by refining cost estimating techniques.

The following staff members should be included in the review process –

- Project team and Management
- User staff
- Strategic Management Staff
- External users

System Maintenance / Enhancement

Maintenance means restoring something to its original conditions. Enhancement means adding, modifying the code to support the changes in the user specification. System maintenance conforms the system to its original requirements and enhancement adds to system capability by incorporating new requirements.

Thus, maintenance changes the existing system, enhancement adds features to the existing system, and development replaces the existing system. It is an important part of system development that includes the activities which corrects errors in system design and implementation, updates the documents, and tests the data.

Maintenance Types

System maintenance can be classified into three types –

- **Corrective Maintenance** – Enables user to carry out the repairing and correcting leftover problems.
- **Adaptive Maintenance** – Enables user to replace the functions of the programs.
- **Perfective Maintenance** – Enables user to modify or enhance the programs according to the users' requirements and changing needs.

CHAPTER – 5 : TALLY

Accounting can be defined as “the art of recording, classifying, summarizing and presenting the financial aspect of business dealings and interpreting the results thereof”.

Account is the blood of business. Every business speaks its status with accounts.

CLASSIFICATION OF ACCOUNTS

Classification of accounts means the grouping of accounts on common characteristics. There are three categories of accounts.

1] Personal Accounts :

These are the accounts of relating to persons, firms, companies, institutions etc., with whom a businessman deals e.g, debtors, creditors, bankers, capital, drawings etc.,

The personal account may further subdivided as under:

Natural Personal Accounts : These accounts relate to the living individuals. e.g. Rama's A/c, Shiva's A/c, Abdul's A/c etc.,

Artificial Personal Accounts : These accounts relate to institutions or body of individuals, which are considered as persons in the eyes of law e.g. Companies, Societies, Firms, Institutions, Government Agencies, Clubs, Banks etc.,

Representative Personal Accounts : These accounts represent some persons or group of persons. e.g. Debtors A/c, Creditors A/c, Outstanding Expenses A/c, Prepaid Expenses A/c, Accrued Income A/c, Advance Income A/c, Capital A/c, Drawings A/c, Employee's PF A/c, Gratuity Fund A/c etc.,

2] Real Accounts :

These are the accounts relating to properties, assets with which we carry on business. e.g. Cash A/c, Stock A/c, Land A/c, Building A/c, Goodwill A/c, Copy Right A/c etc.,

The Real Accounts may further subdivided into following :

Tangible Real A/c : These accounts consist of the assets which can be seen, touched, measured, bought and sold e.g. Land A/c, Building A/c, Furniture A/c, Cash A/c, Machinery A/c, Investments A/c etc.,

Intangible Real A/c : These accounts relate to the assets or rights which cannot be seen, touched or felt but they can bought and sold in terms of money. e.g. Goodwill A/c, Patents A/c, Trade Marks A/c, Copyright A/c etc.,

3] Nominal Accounts :

These are the accounts of various expenses or losses and incomes and gains. They are neither personal or real. e.g. Wages A/c, Rent A/c, Advertisement A/c, Salary A/c, Loss by Fire A/c, Interest A/c, Commission A/c, Depreciation A/c etc.,

H.W) Classify the following accounts in Personal, Real and Nominal A/c's.

- | | |
|--------------------|---------------------|
| 1) Capital A/c | 7) Ramesh's A/c |
| 2) Furniture A/c | 8) Depreciation A/c |
| 3) Rent A/c | 9) Sales A/c |
| 4) Copy Rig A/c | 10) Stock A/c |
| 5) S.G.College A/c | 11) Vehicle A/c |
| 6) Hubli & Co. A/c | 12) Canara Bank A/c |

RULES OF DEBIT AND CREDIT

The procedure of debiting and crediting the different kinds of accounts has been summarized as under :

1] Personal Accounts :

Debit the Received and
Credit the Giver

2] Real Accounts :

Debit What Comes In and
Credit What Goes Out

3] Nominal Accounts :

Debit Expenses or Losses and
Credit Incomes or Gains

Examples :

1) Commenced business with Rs, 10000/-

Capital A/c	-	Personal A/c	-	Debit
Cash A/c	-	Real A/c	-	Credit

2) Purchased goods from Ramesh Rs. 2000/- on credit.

Ramesh A/c	-	Personal A/c	-	Credit
Purchase A/c	-	Real A/c	-	Debit

3) Rent paid Rs. 500/-

Rent A/c	-	Nominal A/c	-	Debit
Cash A/c	-	Real A/c	-	Credit

4) Received Interest Rs. 500/-

Interest A/c	-	Nominal A/c	-	Credit
Cash A/c	-	Real A/c	-	Debit

5) Sold goods to Suresh Rs. 300/-

Suresh A/c	-	Personal A/c	-	Debit
Sales A/c	-	Real A/c	-	Credit

H.W) State whether the following transaction accounts are Debit or Credit

- 1) Purchased Furniture Rs. 5000/-
- 2) Advertisement paid Rs. 500/-
- 3) Received commission Rs. 200/-
- 4) Received Interest on Bank Deposit Rs. 250/-
- 5) Paid Wages Rs. 450/-
- 6) Paid for Stationery Rs. 50/-
- 7) Purchased Machinery for cash Rs. 10000/-
- 8) Purchased goods from Ganesh Rs. 4000/- on credit
- 9) Sold goods to Somesh Rs. 5000/- on credit
- 10) Purchased goods Rs. 6000/- for cash

INTRODUCTION TO TALLY

Tally is a accounting package. It is used to record day to day business transactions. It generates accounting final statements like Balance Sheet and Profit & Loss Account.

COMPONENTS OF GATEWAY OF TALLY :

The Gateway of Tally screen contains 5 major areas.

- 1) Product Info
- 2) Current Status
- 3) Tally Menu
- 4) Vertical Button Bar
- 5) Tally Calculator

1) Product Info :

At the top part of Gateway of Tally screen you get the following general particulars regarding the loaded tally software :

Software Name
Copyright Notice
User Level
User Serial Number
Link to Tally Website
Logo

2) Current Status :

At the left part of Gateway you get the following information about current working status

Current Period
Current Date
Selected Companies
Active Company

3) Tally Menu :

At right part of Gateway screen, the Gateway of Tally Menu appears showing the list of Menu Options. You have to select the respective Menu item to invoke a task or get to a subordinate Menu.

4) Vertical Button Bar :

At rightmost part of the Gateway, the Vertical Button Bar shows several buttons. These Buttons provide quick and direct access to various options and tasks.

5) Tally Calculator :

While working with Tally, you may make arithmetical calculation and also paste the result in any numerical input field. To activate Calculator, Press Ctrl+N.

STARTING TALLY :

1] Start → All Programs → Tally 9.0 → Tally 9.0

Tally will be loaded and displays the activation form to enter the product serial number, activation key and E-mail Id. To work in Educational Mode, this information need not be filled, Press ESC key. Tally will display the Company Info menu, which allows the user create or select companies.

CREATING A COMPANY :

In Tally, the term Company represents any entity for which an independent set of Accounts is maintained. It may be a Company, Partnership Firm, NGO or even a Branch Office for which a set of Account is maintained. So in Tally, the term Company is any entity for which you keep a separate set of accounts.

For the first time, to start working with Tally, a company has to be created. Creating a company involves – typing the name of company, address, state, email address, whether to user Indian VAT, tax numbers, financial year, security control etc.,

1] Company Info → Create Company

2] Type the Company Name

3] Type the Mailing Name

4] Type the Address of the Company

5] Select the State and Type PIN

6] Type the E-mail Address

7] Set yes for Use Indian VAT option

8] Type VAT TIN and other tax numbers

9] Select the method of maintaining the accounts

a) Accounts Only – to maintain only the Financial accounts of a company. Inventory management is not involved.

b) Accounts with Inventory – it allows to maintain both Financial accounts and Inventory of the company.

- 10] Type the starting date of Financial Year of the company
- 11] Type the actual date from which the accounts of the company has to be maintained in Books Beginning From.
- 12] Set Yes for Use Security Control option
- 13] Type the Name of Administrator and Password
- 14] Set Yes for Use Tally Audit Features
- 15] Click on Yes to Save the company

SELECTING A COMPANY :

After Tally is loaded, if the company is already created, in order to make the entries, it must be selected.

- 1] Company Info → Select Company or Press F1 key
- 2] Choose the Company Name from the list
- 3] Press Enter key

Note : Press Alt+F3 to invoke Company Info Menu

ALTERING A COMPANY :

If the company name, address, method of maintaining accounts, tax numbers, security control etc., is to be changed then we can alter the company information.

- 1] First select the Company
- 2] Press Alt+F3 to display Company Info menu
- 3] Select Alter option
- 4] Make the necessary changes in Company information
- 5] Press Ctrl+A to save the changes

REMOVING A COMPANY :

Tally allows to remove the unwanted company data permanently from the disc. You cannot get back a deleted company.

- 1] Press Alt+F3 to display Company Info menu
- 2] Select Alter option
- 3] Press Alt+D
- 4] Press Y to Confirm deletion
- 5] Again Press Y to Sure deletion

CLOSING A COMPANY :

Tally allows to close a company when it is not required.

- 1] Press Alt+F3
- 2] Company Info → Shut Company
- 3] Choose the Company Name from the list
- 4] Press Enter key to close

Note : Press Alt+F1 to close active company

BACKUP :

The data that is entered in Tally is stored on the hard disk. A copy of the data must be kept on another media like floppy disk, tape or CD for safety. The process of keeping a copy of data in another place is termed as Backup.

- 1] Press Alt+F3
- 2] Company Info → Backup
- 3] Press Backspace key and Specify the Destination Drive (A: D: E: etc)
- 4] Select the name of companies from the list
- 5] Select End of List option to stop selection
- 6] Press Y to backup

RESTORE :

Restore is used to copy data to the hard disk from where the Backup is kept. Restore is used when the hard disk where the data is used fails. Restore means to bring back tally data.

- 1] Press Alt+F3
- 2] Company Info → Restore
- 3] Specify the Source Drive (A: D: E: etc)
- 4] Select the name of companies from the list
- 5] Select End of List option to stop selection
- 6] Press Y to restore

ACCOUNT GROUPS :

Any account created in Tally must belong to any one of the groups. These accounts groups are based on Assets, Liabilities, Income and Expenses. Tally provides a set of 28 pre-defined groups, of those 15 are primary groups and 13 are sub-groups. The group and ledger accounts can be created under each groups is given below.

1] Capital Account :

A primary group to hold Capital and Reserves & Surplus of the company. Ledger accounts like Share Capital A/c, Partners Capital A/c, Proprietors Capital A/c and Drawings A/c belong to this group.

Reserves & Surplus [Retained Earnings] : All reserve accounts, which are also recognized as retained earnings, are placed under this group. Ledger accounts like General Reserve, Capital Reserve, Investment Allowance Reserve, Share Premium Account are placed under this group.

2] Loans (Liability) :

This is a primary group to place all loan accounts. It has 3 subgroups.

Bank OD A/c [Bank OCC A/c] : The ledger accounts related to Bank Overdraft, Cash/Credit Accounts, Hypothecation A/c, Bill Discounting A/c are created under this sub-group.

Secured Loans : The ledger accounts of Term Loans and other Medium/Long term loans taken by the company from banks, financial institutes upon furnishing security and debentures must be placed under this sub-group.

Unsecured Loans : The ledger accounts of loans received from outside parties, directors, friends and relatives to whom no security is provided are created under this sub-group.

3] Current Liabilities :

This is a primary group to hold the outstanding and statutory liabilities of the company like O/S Expenses, ESI, PF, TDS can be created under this group. It has three sub-groups.

Duties & Taxes : For all tax accounts like VAT, MODVAT, Excise, Sales and other trade taxes.

Provisions : It is used to hold all provisions like Provision for Taxation, Provision for Bad Debts, Provision for Dividend, Provision for Depreciation etc.,

Sundry Creditors : All trade creditors of the company, generally suppliers account, with whom transactions are entered through Purchase Vouchers, Debit Note and Journal should be placed under this group.

4] Fixed Assets :

This is a primary group to hold the ledger accounts of all Fixed Assets (Plant, Machinery, Building, Furniture & Fittings, Land etc.), Immovable Properties, Patents, Trade Rights, Accumulated Depreciation etc.,

5] Investments :

This is a primary group. Ledger Accounts like Investments in Shares, Bonds, Debentures, Govt. Securities and invested in other companies are placed under this group.

6] Current Assets :

This is a primary group to keep the assets of the company.

Stock-in-hand : It is used to hold opening and closing stock figures of some accounts like Raw Materials, Work-in-Progress and Finished Goods are created under this sub group.

Deposits (Assets) : Ledger accounts related to deposits made by the company like Fixed Deposits, Security Deposits in other companies, Rental Deposits can be created under this sub group.

Loans & Advances (Asset) : All advances of non-trading nature like Salary Advance, Loans to Employees, all short term loans given by the company, advances to purchase fixed assets etc., can be placed under this sub-group.

Sundry Debtors : Ledger account of customers is created under this sub group. Advances received from customers can also be kept under this sub-group.

Cash in Hand : Cash A/c is created automatically by tally when the company is created, under this sub-group. Ledger accounts like petty Cash A/c, Cash at Bank A/c etc., can be created under this sub-group.

Bank Accounts : All current and savings bank accounts are created under this sub-group.

7] Branch/Divisions :

This primary group is used by multi-branch companies for inter-branch reconciliation and consolidation. The companies Branches, Divisions, Affiliates, Sister Concerns, Subsidiaries etc., can be placed under this group.

8] Misc. Expenses (Asset) :

It is rarely used primary group. According to Schedule VI of the Companies Act, all Preliminary, Pre-Operative expenses that have been capitalized to the extent of not written off to profit and Loss A/c, are placed under this group.

9] Suspense Account :

This is a primary group, which appears in Balance Sheet. It is used to create any suspense ledger account to record amount paid or received temporarily or whose nature of transaction is not yet known like Traveling Advance, can be created under this group.

10] Sales Account :

This is a primary group to record regular business sales and sales returns. Generally, Sales A/c, Sales Exempt A/c and Sales Returns A/c will be created under this group.

11] Purchase Account :

This is primary group to hold all regular business purchases and purchase returns. Generally Purchase A/c, Purchase Returns A/c are created under this group.

12] Direct Income [Income Direct] :

It is a primary group to hold the ledger accounts of income, which will be used to calculate Gross Profit. Professional Service Charges, Servicing Charges etc., can be created under this group.

13] Indirect Income [Income Indirect] :

This is a primary group to record all Rent, Interest on Deposits, Commission, Dividend etc., received, Packing and Forwarding charges, Distribution charges collected from the customers.

14] Direct Expenses[Expenses Direct] :

This is a primary group to hold all ledger accounts of all trading expenses like Carriage Inwards, Unloading charges, Wages, Coolie, Fuel, Freight etc., can be created under this group.

15] Indirect Expenses [Expenses Indirect] :

This is a primary group to record all expenses paid by the company like Advertisement, Rent, Traveling Expenses, Maintenance & Cleaning Expenses, Salary, Electricity Expenses, Telephone Expenses, Printing and Stationary, Postage & Stamps, Depreciation, Interest on loan etc.,

CREATING GROUPS :

- 1] Gateway of Tally → Account Info → Groups → Single Create
- 2] Type the Group Name
- 3] Choose the parent group from Under field
- 4] Set Yes for Net Dr/Cr balance for reporting
- 5] Click on Yes to Save

DISPLAY OR ALTER GROUPS :

Groups can only display using Display option. We can display and alter the group individually using Alter option.

- 1] Gateway of Tally → Account Info → Groups → Display / Alter
- 2] Make the necessary changes
- 3] Click on Yes to save modifications

DELETING GROUPS :

- 1] Gateway of Tally → Account Info → Groups → Alter
- 2] Select the Group from the List & Press Enter key
- 3] Press Alt+D
- 4] Click on Yes for deletion

Practical : Create the following Groups

Sl.No	Group Name	Under Group
01.	Administrative Expenses	Indirect Expenses
02.	Syndicate Bank	Bank Account
03.	Furniture	Fixed Assets
04.	Marketing Expenses	Indirect Expenses
05.	Canara Bank A/c	Bank Account
06.	Building	Fixed Asset

LEDGER ACCOUNT :

A ledger is the actual account head to which we identify a transaction. You pass all transaction entries using ledgers. It allows classifying transactions into groups. Tally automatically creates two ledger accounts when a company is created.

CREATING LEDGER ACCOUNTS :

- 1] Gateway of Tally → Accounts Info → Ledgers → Single Create
- 2] Type the ledger name and Alias name.
- 3] Choose the appropriate Group to which the ledger belongs.
- 4] Set Yes/No for inventory values are affected.

- 5] Type the opening balance, if provided.
- 6] Type the Personal Details of Ledger A/c, if necessary.
- 7] Click on Yes to save

DISPLAY LEDGER ACCOUNTS :

For the purpose of confirmation, the account details such as the ledger account name, account group, the opening balance, the address and tax numbers of Sundry Debtors and Sundry Creditors can be displayed.

- 1] Gateway of Tally → Accounts Info → Ledgers → Display
- 2] Select the name of the ledger
- 3] Press Enter key

ALTERING A LEDGER ACCOUNT :

If any changes are to be made in the Ledger A/c such as, changing the name of account, group of account, opening balance, name and address of sundry debtors and sundry creditors, to enter closing balance of stock items, the ledger account can be altered.

- 1] Gateway of Tally → Accounts Info → Ledgers → Alter
- 2] Select the name of the ledger & Press Enter key
- 3] Make necessary changes
- 4] Click on Yes to save modifications.

DELETING LEDGER ACCOUNTS :

If there are no journal entries in a ledger account, it can be deleted.

- 1] Gateway of Tally → Accounts Info → Ledgers → Alter
- 2] Select the name of the ledger & Press Enter key
- 3] Press Alt + D
- 4] Click on Yes to confirm deletion

MULTIPLE LEDGER CREATION :

All accounts pertaining to a particular group can be created once using multiple ledger option.

- 1] Gateway of Tally → Accounts Info → Ledgers → Multiple Ledger Create
- 2] Select a group from the list
- 3] Type the ledger name
- 4] Type the Opening Balance, if provided.
- 5] Repeat 3 and 4 step for next ledgers
- 6] Click on Yes to save

Practical : Create the Ledgers for the following transactions.

- 1] Suresh commenced business with cash Rs. 10000/-
- 2] Paid into Bank Rs. 5000/-
- 3] Purchased goods from Krishna Rs. 4000/-
- 4] Sold goods to Raman Rs. 2000/-
- 5] Returned Goods to Krishna Rs. 500/-
- 6] Raman returned Goods Rs. 100/-
- 7] Bought Office Stationary Rs. 50/-
- 8] Paid for Repairs Rs. 100/-
- 9] Bought Office Furniture Rs. 1000/-
- 10] Paid Advertisement Rs. 50/-
- 11] Paid Rent Rs. 100/-
- 12] Cash Sales Rs. 500/-

VOUCHERS :

The most frequently used area of account is voucher. A voucher is the basic recording document. To input any data into tally, you must use a voucher. All your day-to-day transaction of the business can record using vouchers.

The voucher entry screen takes the following information :

1] Type of voucher :

At the top of voucher displays the type of voucher like Payment, Receipt etc., You can change type of voucher using function keys F1 to F10.

2] Voucher Number :

Voucher displays the voucher number to specify total number of transaction.

3] Date of Voucher :

At the right top of voucher displays the date which represents the date of transaction. Press F2 to change the date.

4] Particulars :

This part of voucher takes information about the ledgers you debit or credit. It specify By or Dr for Debit information and To or Cr from Credit information.

5] Debit & Credit :

These are the columns which takes values of transaction in terms of money (amount).

6] Narration :

This column specify the description of the transaction.

TYPES OF VOUCHERS :

1] CONTRA VOUCHER :

This voucher is used to record fund transfer between cash and bank accounts only. We can record the transaction for depositing cash into bank and withdraw cash from the bank. Press F4 key to invoke Contra Voucher.

Debit & Credit Entry Syntax :

To	Credit Ledger A/c		XXX
By	Debit Ledger A/c	XXX	

Example :

1] Cash deposited into Canara Bank Rs. 5000/-

To	Cash A/c		5000
By	Canara Bank A/c	5000	

2] Withdraw Cash from Syndicate Bank Rs. 1000/-

To	Syndicate Bank A/c		1000
By	Cash A/c	1000	

If one Bank's cheque is deposited into another bank, then the first Bank A/c credited and later Bank A/c is debited.

Example :

1] Syndicate Bank cheque deposited into Canara Bank Rs. 5000/-

To	Syndicate Bank A/c		5000
By	Canara Bank A/c	5000	

2] PAYMENT VOUCHER :

This voucher is used to record all transactions for payments made through cash or bank. Payment of salary, wages, commission, rent, advertisement, electricity bill, traveling etc., expenses, loan installment, making term deposit, giving loans and advances, payment to sundry creditors etc., will be entered using Payment Voucher. Even the amount paid for the purchase of Fixed Assets like purchase of Machinery, Land, Furniture etc., must also be treated as Payments. Press F5 key to invoke payment voucher.

To enter both Debit and Credit aspects of a transaction for receipts, payments and contra, press **F12**, set **No** to **Use Single Entry mode for Payment/Receipt/Contra ?**

Debit & Credit Entry Syntax :

By	Debit Ledger A/c	XXX	
To	Credit Ledger A/c		XXX

Example :

1] Rs. 2500/- paid for Salary and Rs. 75/- paid for Travelling Expenses.

By	Salary A/c	2500	
By	Travelling Expenses A/c	75	
To	Cash A/c		2575

2] Rent Paid Rs. 500/-

By	Rent A/c	500	
To	Cash A/c		500

3] RECEIPT VOUCHER :

Receipt voucher is used to enter all receipts of cash or bank (receipts of bank cheques or interest on bank deposits). Amount received from customers, capital introduced into the business, loans taken, loans and advances refunded, commission, rent, dividend, interest etc., income received, amount taken back from term deposits etc., will be entered using Receipt Voucher. Even the amount received from the sale of fixed assets must also be treated as Receipts. Press F6 to invoke Receipt Voucher.

Debit & Credit Entry Syntax :

To	Credit Ledger A/c		XXX
By	Debit Ledger A/c	XXX	

Example :

1] Commission Received Rs. 500/-

To	Commission A/c		500
By	Cash A/c	500	

2] Started business with Building Rs. 75000/-, Furniture Rs. 20000/- and Cash Rs. 25000/-

To	Capital A/c		120000
By	Building A/c	75000	
By	Furniture A/c	25000	
By	Cash A/c	20000	

4] SALES VOUCHER :

Sales Voucher is meant for Sale entries. Sales made in the regular course of business will be entered in this voucher. Sales of fixed assets must be entered through Receipt Voucher (cash sales) or Journal Voucher (credit sales) and not Sales Voucher. Generally, business sales are made on credit. Tally allows the user to enter both cash and credit sales. Press F8 key to invoke Sales Voucher.

Debit & Credit Entry Syntax :

By	Debit Ledger A/c	XXX	
To	Credit Ledger A/c		XXX

Example :

1] Goods sold to Murthy Rs. 5000/- on credit.

By	Murthy's A/c	5000	
To	Sales A/c		5000

Note : Press Ctrl+V for voucher mode screen.

2] Sold goods to Suresh for Rs. 6000/- with Discount Rs. 500/- including VAT Tax Rs. 250/-

By	Suresh's A/c	5750	
By	Discount A/c	500	
To	Sales A/c		6000
To	VAT Tax A/c		250

Note : If in **F12 : Configurations**, the options **Use Common Ledger Account for Item Allocation ?** and **Allow Selection of VAT/Tax class during entry ?** are set to No, Sales Ledger Account and VAT/Tax class is not selected at the beginning, instead, after specifying each details.

5] PURCHASE VOUCHER :

Purchase Voucher is meant for Purchase entries. Purchases made in the regular course of business will be entered in this voucher. Purchase of fixed assets must be entered through Payment Voucher or Journal Voucher and not Purchase Voucher. Generally purchases are made on credit. Tally allows you to enter both cash and credit purchases. Press F9 key to invoke Purchase Voucher.

Debit & Credit Entry Syntax :

To	Credit Ledger A/c		XXX
By	Debit Ledger A/c	XXX	

Example :

1] Goods purchased from Santosh Rs. 5000/- on credit.

To	Santosh's A/c		5000
By	Purchase A/c	5000	

Note : Press Ctrl+V for voucher mode screen.

2] Purchase goods from Ganesh for Rs. 6000/- with Discount Rs. 500/- including VAT Tax Rs. 250/-

To	Ganesh's A/c		5750
To	Discount A/c		500
By	Purchase A/c	6000	
By	VAT Tax A/c	250	

6] JOURNAL VOUCHER :

A Journal Voucher is an adjustment voucher. All amounts to be adjusted between two accounts are to be passed as a journal. By adjustment between the accounts we mean, there is not physical movement of funds. Depreciation of Fixed Assets, Interest on Loan, Purchase or Sale of Fixed Assets on Credit, adjustment between two parties or accounts etc., can be entered through the journal. Press F7 key to invoke Journal Voucher.

Debit & Credit Entry Syntax :

By	Debit Ledger A/c	XXX	
To	Credit Ledger A/c		XXX

Example :

1] Charged depreciation Rs. 300/- on Furniture and Rs. 500/- on Building.

By	Depreciation A/c	800	
To	Furniture A/c		300
To	Building A/c		500

2] Office Furniture stolen Rs. 500/-

By	Furniture Stolen A/c	500	
To	Furniture A/c		500

3] Discount Received from Mohan Rs. 50/-

By	Mohan's A/c	50	
To	Discount A/c		50

7] CREDIT NOTE VOUCHER :

Credit Note is used to enter the transaction related to Sales Returns or when there is an excess debit to a party. To enter the VAT, better to enter Credit Note in invoice mode. To do so, in F11:Company Features, select Yes to the options **Use Debit/Credit Notes ?** and **Use Invoice Mode for Credit Notes ?** Press Ctrl+F8 to invoke Credit Note Voucher. Press Ctrl+V for Voucher Mode screen.

Debit & Credit Entry Syntax :

To	Credit Ledger A/c		XXX
By	Debit Ledger A/c	XXX	

Example :

1] Goods returned by Mr. Akbar, which were sold to him for Rs. 5000/-

To	Mr. Akbar's A/c		5000
By	Sales Returns A/c	5000	

8] DEBIT NOTE VOUCHER :

Debit Note is used to enter the transaction related to Purchase Returns or when a customer is short billed. Press Ctrl+F9 to invoke Debit Note Voucher.

Debit & Credit Entry Syntax :

By	Debit Ledger A/c	XXX	
To	Credit Ledger A/c		XXX

Example :

1] Goods returned to Samsung, which were purchase for Rs. 6000/-

By	Samsung's A/c	6000	
To	Purchase Returns A/c		6000

Practical : Pass the vouchers for the following transactions :

- 1] Shankar commenced business with cash Rs. 10000/-
- 2] Bought Furniture Rs. 2000/-
- 3] Purchased Goods from Rao & Co. Rs. 4000/-
- 4] Bought Office Stationary Rs. 100/-
- 5] Sold goods to Gopal Rs. 1500/-
- 6] Sold goods Rs. 600/-
- 7] Bought goods Rs. 500/-
- 8] Paid Rao & Co. Rs. 3000/-
- 9] Received cash from Gopal Rs. 1000/-
- 10] Sold goods to Harish Rs. 2000/-
- 11] Returned Goods to Rao & Co. Rs. 200/-
- 12] Gopal returned goods Rs. 300/-
- 13] Received cash from Harish Rs. 2000/-
- 14] Paid for advertisement Rs. 250/-
- 15] Paid for printing charges Rs 150/-
- 16] Received commission from Lucky Trading Co. Rs. 400/-
- 17] Paid for wages Rs. 50/-
- 18] Paid Office Rent Rs. 350/-
- 19] Withdrawn cash for personal use Rs. 450/-
- 20] Paid salary Rs. 800/-

NON ACCOUNTING VOACHERS :

1] MEMORANDUM VOUCHER (CTRL+F10)

This is purely non accounting voucher. That is the entries in this voucher do not affect the accounts because, these entries are not posted to ledgers and they do not affect the final result of the company. Tally stores Memo Vouchers in a separate register called Memo Register.

Memorandum entries are made if any suspense payments are made, if vouchers not verified at the time of entry or if the items are given on approval basis. Memo Vouchers are entered by pressing the function key Ctrl+F10.

2] REVERSING JOURNALS (F10)

Reversing Journals are special journals that are automatically reversed after the date of journal. They exist only from voucher date to the specified effective date. Moreover, they are effective only when they are called for in the reports.

For example: it is 30th June and you want to view the Balance Sheet as of today but June salaries are not paid until the first week in July. There is, therefore, a large liability, which would not be reflected in the Balance Sheet. To overcome this, you would enter a reversing journal voucher dated 30th June, which would look something like this:

Dr	Salaries	5,000
Cr	Provisions (Current Liabilities)	5,000

When you view the Balance Sheet, you would ask Tally for the report with the reversing journals included. The voucher affects the report only for that day, i.e., 30th June.

To enter Reversing Journals, Press F11 and specify Yes to the option Use Rev. Journals & Optional Vouchers. Press F10 to invoke Reversing Journals.

3] OPTIONAL VOUCHERS

This is another **non-accounting** voucher. However, it differs from the Memo voucher in that it is not a separate voucher type. You mark an existing voucher, (e.g., a payment voucher or a receipt voucher) as 'Optional'. Press [CTRL+L] or click on the button. This button toggles with 'Regular'. By marking it 'Optional' the voucher does not get posted anywhere but remains in the Optional Register.

If a transaction has not been completed, you may not want it to affect the accounts. You might want to see the impact of transactions without actually posting them. Optional vouchers allow you to do so.

4] POST DATED VOUCHER

While entering vouchers, you can post-date them, and Tally will not update the ledgers until the date in question. This is most useful for entering transactions that take place on a regular basis. For example, if you pay for something by installments, you can set-up the payments in advance, and Tally will only enter them in the ledgers as they fall due. Mark vouchers 'Post Dated' by [CTRL+D] or click on the button. The button toggles with 'Regular'.
