

SYSTEM DEVELOPMENT LIFE CYCLE METHODOLOGY

BASIC CONCEPTS

1. System Development Process

- 1.1 **System Development Life Cycle:** Preliminary Investigation, Requirements analysis, Designing of system, Development of Software, Systems Testing, Implementation and Maintenance
- 1.2 **Achieving systems development objectives**
- 1.3 **Approaches to Systems Development:** Traditional and alternative approach

2. Preliminary Investigation

- 2.1 Definition of the scope of the study
- 2.2 **Conducting the Investigation:** Reviewing internal documents, and conducting interviews
- 2.3 Identifying Viable Options
- 2.4 **Testing Project's Feasibility:** Technical Feasibility, Economic Feasibility, Operational Feasibility, Schedule Feasibility, and Legal Feasibility
- 2.5 Estimating costs and benefits
- 2.6 Reporting results to management

3. Requirements Analysis

- 3.1 **Fact finding techniques:** Documents, Questionnaires, Interviews, Observations
- 3.2 **Analysis of the Present System:** Review historical aspects, Analyze inputs, Review data files maintained, Review methods, procedures and data communications, Analyze Outputs, Review Internal controls, Model the existing physical system and logical system, Undertake overall analysis of present system.

- 3.3 **System Development Tools:** Systems Flow Chart, Data Flow Diagrams, Layout Forms and Screens, System Components Matrix, CASE Tools, Data Dictionary

4. **Systems Design**

- 4.1 Designing Systems Output
- 4.2 **Important Factors in Output Design:** Content, Form, Output Volume, Timeliness, Media, Format
- 4.3 Designing printed output
- 4.4 **Designing visual display output:** Layout of display screen, Designing of Windows
- 4.5 **Designing Systems Inputs:** Many of the issues involved in input are also similar to those of output
- 4.6 **Guidelines for form design:** Making forms easy to fill, Meeting the intended purpose, Ensuring accurate completion, and Keeping forms attractive
- 4.7 **Coding Methods:** Some of the desired characteristics are: Individuality, Space, Convenience, Expandability, and Suggestiveness
- 4.8 Designing efficient data entry
- 4.9 Data Storage
- 4.10 Design of data communication
- 4.11 System Manual
- 4.12 Reporting to Management

5. **Systems Acquisition and Software Development**

- 5.1 Procuring Computer Hardware
- 5.2 Software acquisition
- 5.3 **Advantages of Application Packages:** Rapid Application, Low Risk, Quality, Cost
- 5.4 **Validation of vendors' proposals:** The factors have to be considered are: The performance capability of each proposed system in relation to its Costs, The Costs and benefits of each Proposed System, The Maintainability of each Proposed System, The Compatibility of each proposed system with existing systems, Vendor Support

- 5.5 **Method for validating the proposal:**
 - 5.5.1 **Checklists:** Example of software validation checklist and Support Service Checklists
 - 5.5.2 Point Scoring Analysis
 - 5.5.3 Public Evaluation Reports
- 5.6 **Software Development:** It involves six stages: Program Analysis, Program Design, Program Coding, Debug the Program, Program documentation, and Program Maintenance
- 5.7 **Alternative Development Methodology**
 - 5.7.1 **Prototyping Approach:** It involves four steps: Identify Information System Requirements, Develop the initial Prototype, Test and Revise, obtain User Signoff for the approved prototype
 - 5.7.2 End User Development Approach
 - 5.7.3 Systematic Approach for development in small organizations
 - 5.7.4 Rapid Application Development (RAD)
- 6. **System Testing**
- 7. **System Implementation**
 - 7.1 **Equipment Installation:** Site Preparation, Equipment installation, Equipment Check out
 - 7.2 **Training Personnel:** Training System Operators, User Training
 - 7.3 **Conversion and Start-up from manual to Computerized System**
 - 7.3.1 **Conversion Strategies:** There are five strategies: Direct changeover, Parallel conversion, Gradual conversion, modular prototypes conversion, Distributed Conversion
 - 7.3.2 **Activities involved in Conversion:** Procedure conversion, File conversion, System conversion, Scheduling personnel and equipment, and alternative plans in case of equipment failure
 - 7.4 **Post Implementation Review:** Development evaluation, Operation evaluation, and Information Evaluation
- 8. **System Maintenance:** Scheduled maintenance and rescue maintenance
- 9. **Organizational Structure of IT Department**
 - 9.1 **Management Structure:** Line Management Structure, and Project Management Structure. In Line Management, there are following management subsystems: Top

Management, IS Management, Systems Development Management, Programming Management, Data Administration, Security Administration, Operations Management, and Quality Assurance Management

9.2 Duties and responsibilities: Data entry, File library, Control Groups, Operations, Security Administration, Physical Security, Data Security, Conducting a security program, Production work flow control, Quality Assurance, System Analysis, Application Programming, Systems Programming, LAN Administration, Help Desk administration

Question 1

State and briefly explain the six stages of System Development Life Cycle (SDLC).

Answer

System Development Life Cycle: The system development process is initiated when it is realized that a particular business process of the organization needs computerization or improvement. The system development life cycle is a set of six activities which are closely related. These activities after a certain stage can be done parallel to each other. For example the development can be started for some components (sub-systems) which are at the advance stage of designing. The systems development life cycle method consists of the following activities:

- (i) Preliminary investigation
- (ii) Requirements analysis or systems analysis
- (iii) Design of system
- (iv) Development of software
- (v) Systems testing
- (vi) Implementation and maintenance

The activities are briefly explained below:

- (i) *Preliminary investigation:* When the user comes across a problem in the existing system or a totally new requirement for computerization, a formal request has to be submitted for system development. It consists of three parts; request classification feasibility study and request approval. Generally the request submitted is not stated clearly hence requires detailed study. On receipt of request and identification of needs, the feasibility study is conducted which includes the aspects related to technical, economic and operational feasibility and is normally conducted by a third party depending upon the quantum and size of the requirements. The approval is sought from top management to initiate the system development.

- (ii) *Requirements analysis or systems analysis*: Once the request of the system development is approved, the detailed requirement study is conducted in close interaction with the concerned employees and managers to understand the detailed functioning, short-comings, bottlenecks and to determine the features to be included in the system catering to the needs and requirements of the users. This process is termed as "System Requirement Study (SRS) or System analysis.
- (iii) *Design of the system*: This activity evolves the methodology and steps to be included in the system to meet the identified needs and requirements of the system. The analyst designs the various procedures, report, inputs, files and database structures and prepares the comprehensive system design. These specifications are then passed on to the Development Team for program coding and testing.
- (iv) *Acquisition and development of software*: Once the system design details are resolved and SRS is accepted by the user, the hardware and software details along with services requirements are determined and procured choosing the best-fit options. Subsequently, choices are made regarding which products to buy or lease from which vendors. The choice depends on many factors such as time, cost and availability of programmers. In case of in-house development, the analyst works closely with the programmers. The analyst also works with users to develop documentation for software and various procedure manuals.
- (v) *Systems testing*: Once all the programs comprising the system have been developed and tested, the system needs to be tested as a whole. System testing is conducted with various probable options and conditions to ensure that it does not fail in any condition. The system is expected to run as per the specifications made in the SRS and users' expectations. Live test data are input for processing, and results are examined. If it is found satisfactory, it is eventually tested with actual data from the current system.
- (vi) *Implementation and maintenance*: By the time of accomplishment of the above activities, it is ensured that the requisite hardware and software are installed and the users are trained on the new system to carry out operations independently. For sometime, hand-holding may be done by the system development team. The operations are monitored closely to ensure the users satisfaction. The system is maintained and modified to adapt to the changing needs of the users and business to ensure long-term acceptance of the system.

Question 2

Write short notes on the following:

- (a) *Advantages of Application Packages*

- (b) *Information System Maintenance*
- (c) *System Manual*

Answer

- (a) The four most compelling advantages of using pre written application packages are:
- (i) *Rapid implementation:* Application packages are readily available to implement after they are purchased. In contrast, software developed in-house may take months or even years until it is ready for implementation.
 - (ii) *Low risk:* Since the application package is available in the finished form, the organisation knows what it is going to get for the price it has paid. With in-house developed software, the long development time breeds uncertainty with regard to both the quality of the final product and its final cost.
 - (iii) *Quality:* The firms engaged in application package developments are typically specialist in their products' niche area. Generally, they have a lot of experience in their specialised application field and hence can provide better software. In contrast, in-house programs often have to work over a wide range of application areas; they may not be possessing expertise for undertaking proposed software development.
 - (iv) *Cost:* Software cost can be leveraged as copies are generated and sold. Application packages, sometimes, turn out to be cheaper compared to in-house developed software.
- (b) **Information Systems Maintenance:** Most information systems require at least some modification after development. The need for modification arises from a failure to anticipate all requirements during system design and/or from changing organizational requirements. Hence periodic system maintenance is required for most Information Systems. Systems maintenance involves adding new data elements, modifying reports, adding new reports, changing calculations, etc. Maintenance can be categorized in the following two ways:
1. Scheduled maintenance is anticipated and can be planned for. For example, the implementation of a new inventory coding scheme can be planned in advance.
 2. Rescue maintenance refers to previously undetected malfunctions that were not anticipated but require immediate solution. A system that is properly developed and tested should have few occasions of rescue maintenance.

One problem that occurs in systems development and maintenance is that as more and more systems are developed, a greater portion of systems analyst and

programmer time is spent on maintenance. An information system may remain in an operational and maintenance mode for several years. The system should be evaluated periodically to ensure that it is operating properly and is still workable for the organization. When a system becomes obsolete i.e. new opportunities in terms of new technology are available or it no longer satisfies the organization's needs, the information system may be replaced by a new one generated from a fresh system development process.

- (c) **System Manual:** The basic output of the system design is a description of the task to be performed, complete with layouts and flowcharts. This is called the job specifications manual or system manual. It contains:
- (i) General description of the existing system.
 - (ii) Flow of the existing system.
 - (iii) Outputs of the existing system - the documents produced by existing system are listed and briefly described, including distribution of copies.
 - (iv) General description of the new system - its purposes and functions and major differences from the existing system are stated together with a brief justification for the change.
 - (v) Flow of the new system - this shows the flow of the system from and to the computer operation and the flow within the computer department. .
 - (vi) Output Layouts.
 - (vii) Output distribution - the distribution of the new output document is indicated and the number of copies, routing and purpose in each department shown. The output distribution is summarized to show what each department will receive as a part of the proposed system.
 - (viii) Input layouts - the inputs to the new system are described and complete layouts of the input documents and input disks or tapes provided.
 - (ix) Input responsibility - the source of each input document is indicated as also the user department responsible for each item on the input documents.
 - (x) Macro-logic- the overall logic of the internal flow will be briefly described by the systems analyst, wherever useful.
 - (xi) Files to be maintained - the specifications will contain a listing of the tape, disk or other permanent record files to be maintained, and the items of information to be included in each file. There must be complete layouts for intermediate or work file; these may be prepared later by the programmer.

- (xii) List of programs - a list of the programs to be written shall be a part of the systems specifications.
- (xiii) Timing estimates - a summary of approximate computer timing is provided by the system analyst.
- (xiv) Controls - this shall include type of controls, and the method in which it will be operated.
- (xv) Audit trail - a separate section of the systems specifications shows the audit trail for all financial information. It indicates the methods with which errors and defalcation will be prevented or eliminated.
- (xvi) Glossary of terms used.

Question 3

The top management of company has decided to develop a computer information system for its operations. Is it essential to conduct the feasibility study of system before implementing it? If answer is yes, state the reasons. Also discuss three different angles through which the feasibility study of the system is to be conducted.

Answer

Yes, it is essential to carry out the feasibility study of the project before its implementation. After possible solution options are identified, project feasibility-the likelihood that these systems will be useful for the organization-is determined. A feasibility study is carried out by the system analysts for this purpose. Feasibility study refers to a process of evaluating alternative systems through cost/benefit analysis so that the most feasible and desirable system can be selected for development. It is carried out by the system analysts.

The feasibility study of the system is undertaken from three angles i.e. technical, economic and operational. The proposed system is evaluated from a technical view point first and if technically feasible, its impact on the organization and staff is assessed. If a compatible technical and social system can be devised, it is then tested for economic feasibility.

Technical feasibility: It is concerned with hardware and software. Essentially, the analyst ascertains whether the proposed system is feasible with existing or expected computer hardware and software technology. The technical issues usually raised during the feasibility stage of investigation include the following:

- (i) Does the necessary technology exist to do what is suggested (and can it be acquired)?

- (ii) Does the proposed equipment have the technical capacity to hold the data required to use the new system?
- (iii) Will the proposed system provide an adequate response to inquiries, regardless of the number or location of users?
- (iv) Can the system be expanded if developed?
- (v) Are there technical guarantees of accuracy, reliability, ease of access, the data security?

Some of the technical issues to be considered are given in the Table-1 below.

Design Considerations	Design Alternatives
Communications channel configuration	Point to point, multidrop, or line sharing
Communications channels	Telephone lines, coaxial cable, fiber optics, microwave, or satellite
Communications network	Centralized, decentralized, distributed, or local area
Computer programs	Independent vendor or in-house
Data storage medium	Tape, floppy disk, hard disk, or hard copy
Data storage structure	Files or database
File organization and access	Direct access or sequential files
Input medium	Keying, OCR, MICR, POS, EDI, or voice recognition
Operations	In-house or outsourcing
Output frequency	Instantaneous, hourly, daily, weekly, or monthly
Output medium	CRT, hard copy, voice, or turnaround document
Output scheduling	Predetermined times or on demand
Printed output	Preprinted forms or system-generated forms
Processor	Micro, mini, or mainframe
Transaction processing	Batch or online
Update frequency	Instantaneous, hourly, daily, weekly, or monthly

Table-1: Technical Issues

Due to tremendous advancements in computer field these days, the technology is available for most business data processing systems but sometimes not within the constraints of the firm's resources or its implementation schedule. Therefore, trade offs

are often necessary. A technically feasible system may not be economically feasible or may be so sophisticated that the firm's personnel cannot effectively operate it.

Economic feasibility: It includes an evaluation of all the incremental costs and benefits expected if the proposed system is implemented. This is the most difficult aspect of the study. The financial and economic questions raised by analysts during the preliminary investigation are for the purpose of estimating the following:

- (i) The cost of conducting a full system's investigation.
- (ii) The cost of hardware and software for the class of applications being considered.
- (iii) The benefits in the form of reduced costs or fewer costly errors.
- (iv) The cost if nothing changes (i.e. the proposed system is not developed).

The procedure employed is the traditional cost-benefit study.

Operational feasibility: It is concerned with ascertaining the views of workers, employees, customers and suppliers about the use of computer facility. The support or lack of support that the firm's employees are likely to give to the system is a critical aspect of feasibility. A system can be highly feasible in all respects except s the operational and fails miserably because of human problems. Some of the questions which may help in conducting the operational feasibility of a project are stated below:

- (i) Is there sufficient support for the system from management and from users? If the current system is well liked and used to the extent that persons will not be able to see reasons for a change, there may be resistance.
- (ii) Are current business methods acceptable to user? If they are not, users may welcome a change that will bring about a more operational and useful system.
- (iii) Have the users been involved in planning and development of the project? Early involvement reduces the chances of resistance to the system and changes in general and increases the likelihood successful projects.
- (iv) Will the proposed system cause harm? Will it produce poorer results in any respect or area? Will loss of control results in any areas? Will accessibility of information be lost? Will individual performance be poorer after implementation that before? Will performance be affected in an undesirable way? Will the system slow performance in any areas?

Question 4

Define the following terms in brief:

- | | |
|---------------------------|---------------------------|
| (i) Systems Flow Chart | (ii) Data Flow Diagram |
| (iii) CASE Tools | (iv) Data Dictionary |
| (v) Technical Feasibility | (vi) Economic Feasibility |

Answer

- (i) **Systems Flow Chart:** It is a graphic diagramming tool that documents and communicates the flow of data media and information processing procedures taking place in an information system. This is accomplished by using a variety of labeled symbols connected by arrows to show the sequence of information processing activities. System flow charts typically emphasize the media and hardware used and the processes that take place within an information system. Thus, they represent a graphic model of the physical information system that exists or is proposed. Systems flow charts are widely used to communicate the overall structure and flows of a system to end-users.
- (ii) **Data Flow Diagram:** A Data Flow Diagram (DFD) graphically describes the flow of data within an organization. It is used to document existing systems and to plan and design new ones. There is no ideal way to develop a DFD; different problems call for different methods. A DFD is composed of four basic elements: data sources and destinations, data flows, transformation processes, and data stores. Each is represented on a DFD by one of the symbols.
- (iii) **CASE Tools :** The data flow diagram and system flow charts that users review are commonly generated by systems developers using the on-screen drawing modules found in CASE (Computer-Aided-Software Engineering) software packages. CASE refers to the automation of any thing that humans do to develop systems. In 1980s, these tools enabled system analysts and programmers to create flow charts and data flow diagrams on a mini computer or a micro computer workstation. Today, CASE products can support virtually all phases of traditional system development process. For example, these packages can be used to create complete and internally consistent requirements specifications with graphic generators and specifications languages. CASE products are still relatively new and evolving. However numerous organizations have already reported great success with them.
- (iv) **Data Dictionary:** A data dictionary is a computer file that contains descriptive information about the data items in the files of a business information system. Thus, a data dictionary is a computer file about data. Each computer record of a data dictionary contains information about a single data item used in a business information system. This information may include:
 - Codes describing the data item's length (in characters), data type (alphabetic, numeric, alphanumeric, etc.), and range (e.g., values from 1 to 99 for a department code)
 - The identity of the source document(s) used to create the data item.

- The names of the computer files that store the data item.
 - The names of the computer programs that modify the data item.
 - The identity of the computer programs or individuals permitted to access the data item for the purpose of file maintenance, upkeep, or inquiry.
 - The identity of the computer programs or individuals not permitted to access the data item.
- (v) Technical Feasibility: It is concerned with hardware and software. Essentially, the analyst ascertains whether the proposed system is feasible with existing or expected computer hardware and software technology. The technical issues usually raised during the feasibility stage of investigation include the following:
- Does the necessary technology exist to do what is suggested (and can it be acquired)?
 - Does the proposed equipment have the technical capacity to hold the data required to use the new system?
 - Will the proposed system provide adequate responses to inquiries, regardless of the number or location of users?
 - Can the system be expanded if developed?
 - Are there technical guarantees of accuracy, reliability, ease of access, and data security?
- (vi) Economic Feasibility: It includes an evaluation of all the incremental costs and benefits expected if the proposed system is implemented. This is the most difficult aspect of the study. The financial and economic questions raised by analysts during the preliminary investigation are for the purpose of estimating the following:
- The cost of conducting a full systems investigation.
 - The cost of hardware and software for the class of applications being considered.
 - The benefits in the form of reduced costs or fewer costly errors.
 - The cost if nothing changes (i.e., the proposed system is not developed)
 - The procedure employed is the traditional cost-benefit study.

Question 5

What is Prototyping? Discuss its advantages and disadvantages in brief.

Answer

Prototyping: The traditional approach sometimes may take years to analyze, design and implement a system. In order to avoid such delays, organizations are increasingly using prototyping techniques to develop smaller systems such as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all of a system. A prototype is a usable system or system component that is built quickly and at a lesser cost, and with the intention of being modifying or replacing it by a full-scale and fully operational system. As users work with the prototype, they make suggestions about the ways to improve it. These suggestions are then incorporated into another prototype, which is also used and evaluated and so on. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is used to develop the real system.

Experimenting with the prototype helps users to identify additional requirements and needs that they might have overlooked or forgotten to mention. In addition, with prototyping, users have a clearer visual picture of what the final version will look like and they do not have to sign off on a system which is presented to them in the form of diagrams and specification lists. Decision supports semi-structured or unstructured management decision environment, are ideal for the experimentation and trial-and-error development associated with prototyping. Expert systems are other ideal candidates for prototyping approach because expert knowledge usually requires continual refinements. Prototyping can also be used in the development of transaction processing system. It is most commonly used during the system design stage, for instance, to develop the mock screen for input etc.

Advantages of Prototyping: The major advantages of this approach are as follows:

- Prototyping requires intensive involvement by the system users. Therefore, it typically results in a better definition of these users' needs and requirements than does the traditional systems development approach.
- A very short time period (e.g., a week) is normally required to develop and start experimenting with a prototype. This short time period allows system users to immediately evaluate proposed system changes. In contrast, it may take a year or longer before system users can evaluate proposed system changes when the traditional systems development approach is used.
- Since system users experiment with each version of the prototype through an interactive process, errors are hopefully detected and eliminated early in the developmental process. As a result, the information system ultimately implemented should be more reliable and less costly to develop than when the traditional systems development approach is employed.

Disadvantages of Prototyping: The major disadvantages of this approach are as follows:

- Prototyping can only be successful if the system users are willing to devote significant time in experimenting with the prototype and provide the system developers with change suggestions. The users may not be able or willing to spend the amount of time required under the prototyping approach.
- The interactive process of prototyping causes the prototype to be experimented with quite extensively. Because of this, the system developers are frequently tempted to minimize the testing and documentation process of the ultimately approved information system. Inadequate testing can make the approved system error-prone, and inadequate documentation makes this system difficult to maintain.
- Prototyping may cause behavioral problems with system users. These problems include dissatisfaction by users if system developers are unable to meet all user demands for improvements as well as dissatisfaction and impatience by users when they have to go through too many interactions of the prototype.

In spite of above listed limitations, to some extent, systems analysis and development has been greatly improved by the introduction of prototyping. Prototyping enables the user to take an active part in the systems design, with the analyst acting in an advisory role. Prototyping makes use of the expertise of both the user and the analyst, thus ensuring better analysis and design, and prototyping is a crucial tool in that process.

Question 6

Write short notes on the following:

- | | |
|----------------------------------|---------------------------------------|
| (i) <i>Audit Trails</i> | (ii) <i>Crypto systems</i> |
| (iii) <i>Preventive Controls</i> | (iv) <i>Public Key Infrastructure</i> |

Answer

- (i) **Audit Trails:** Audit trails are logs that can be designed to record activity at the system, application, and user level. When properly implemented, audit trails provide an important detective control to help accomplish security policy objectives. Many operating systems allow management to select the level of auditing to be provided by the system. This determines which events will be recorded in the log. An effective audit policy will capture all significant events without cluttering the log with trivial activity. Audit trails can be used to support security objectives in three ways:
- Detecting unauthorized access to the system,
 - Facilitating the reconstruction of events, and
 - Promoting personal accountability.

(ii) **Cryptosystems:** A cryptosystem refers to a suite of algorithms needed to implement a particular form of encryption and decryption. Typically, a cryptosystem consists of three algorithms: one for key generation, one for encryption, and one for decryption. The term cipher (sometimes cypher) is often used to refer to a pair of algorithms, one for encryption and one for decryption. Therefore, the term "cryptosystem" is most often used when the key generation algorithm is important. For this reason, the term "cryptosystem" is commonly used to refer to public key techniques; however both "cipher" and "cryptosystem" are used for symmetric key techniques.

(iii) **Preventive Controls:** Preventive controls are those inputs, which are designed to prevent an error, omission or malicious act occurring. An example of a preventive control is the use of passwords to gain access to a financial system. The broad characteristics of preventive controls are:

- A clear-cut understanding about the vulnerabilities of the asset
- Understanding probable threats
- Provision of necessary controls for probable threats from materializing

Any control can be implemented in both a manual and computerized environment for the same purpose. Only, the implementation methodology may differ from one environment to the other. Some examples of preventive controls are as under:

- Employ qualified personnel
- Segregation of duties
- Access control
- Vaccination against diseases
- Documentation
- Prescribing appropriate books for a course
- Training and retraining of staff
- Authorization of transaction
- Validation, edit checks in the application
- Firewalls
- Anti-virus software (sometimes this acts like a corrective control also), etc
- Passwords

(iv) **Public Key Infrastructure (PKI):** Public key infrastructure, if properly implemented and maintained, can provide a strong means of authentication. By combining a

variety of hardware components, system software, policies, practices, and standards, PKI can provide for authentication, data integrity, defenses against customer repudiation, and confidentiality. The system is based on public key cryptography in which each user has a key pair—a unique electronic value called a *public key* and a mathematically related *private key*. The *public key* is made available to those who need to verify the user's identity.

The *private key* is stored on the user's computer or a separate device such as a smart card. When the key pair is created with strong encryption algorithms and input variables, the probability of deriving the private key from the public key is extremely remote. The private key must be stored in encrypted text and protected with a password or PIN to avoid compromise or disclosure. The private key is used to create an electronic identifier called a *digital signature* that uniquely identifies the holder of the private key and can only be authenticated with the corresponding public key.

Question 7

Explain the System Development Life Cycle.

Answer

System Development Life Cycle Activities:

The system development life cycle method can be thought of as a set of activities that analysts, designers and users carry out to develop and implement an information system.

The system development life cycle method consists of the following activities:

- (i) Preliminary investigation
 - (ii) Requirements analysis or system analysis
 - (iii) Design of system
 - (iv) Development of software
 - (v) System testing
 - (vi) Implementation and maintenance.
- (i) Preliminary investigation: A preliminary investigation is undertaken when users come across a problem or opportunity and submit a formal request for a new systems to the MIS department. This activity consists of three parts: request clarification, feasibility study and request approval. Before any system investigations can be considered, the system request must be examined to determine precisely what the originator wants. Thereafter, the analyst tries to determine whether the system requested is feasible or not. Aspects of technical, economic and operational feasibility of the system are

covered in the feasibility study. The third part of the investigation relates to approval of the request. Not all requested systems are desirable or feasible. Based on the observations of the analyst, the management decides which system should be taken up for development.

- (ii) Requirements analysis or system analysis: If, after studying the result of preliminary investigation, management decides to continue the development process, the needs of the users are studied. Several fact-finding techniques and tools such as questionnaires, interviews, observing decision-maker behaviour and their office environment etc. are used for understanding the requirements. All details are gathered, the analysts study the present system to identify its problems and shortcomings and identify the features, which the new system should include to satisfy the new or changed user application environment.
- (iii) Design of system: The design of an information system produces the details that state how a system will meet the requirements identified above. The analyst designs various reports / outputs, data entry procedures, inputs, files and database. He also selects file structures and data storage devices. These detailed design specifications are then passed on to the programming staff so that software development can begin.
- (iv) Acquisition and development of software: After the system design details are resolved, such resources needs as specific type of hardware, software and services are determined. Subsequently, choices are made regarding which products to buy or lease from which vendors. Software developers may install or modify and then install purchased software or they may write new, custom-designed program. The analyst works closely with the programmers if the software is to be developed in-house. During this phase, he analyst also works with users to develop worthwhile documentation for software, including various procedure manuals.
- (v) System testing: Before the information systems can be used, it must be tested. System testing will run according to its specifications and in the way users expect. If it is found satisfactory, it is eventually tested with actual data from the current systems.
- (vi) Implementation and maintenance: After the system is found to be fit, it is implemented with the actual data. Hardware is installed and users are then trained on the new system and eventually work on it is carried out independently. The results of the development efforts are reviewed to ensure that the new system satisfies user requirements. After implementation, the systems is maintained, it is modified to adapt to changing users and business needs so that the system can be useful to the organization as long as possible.

The system development life cycle should be viewed as a continuous interactive process that recycles through each stage for many applications. Thus, even when a system is fully specified, designed, purchased and running, it is continually being enhanced or maintained. Enhancement and maintenance may require returning to one of the earlier stages of system development life cycle.

Question 8

What are the Systems Development Tools? Explain briefly.

Answer

System Development Tools: Tools and Techniques have been developed to improve current information systems and to develop new ones. The major tools used for system development can be grouped into the following four categories based on the systems features each document has:

- (i) **System Components and flows:** These tools help the system analysts to document the data flow among the major resources and activities of an information system. System flow charts are typically used to show the flow of data media as they are processed by the hardware devices and manual activities. A data flow diagram uses a few simple symbols to illustrate the flow of data among external entities (such as people or organization etc) processing activities and data storage elements.
- (ii) **User Interface:** Designing the interface between end users and the computer system is a major consideration of a system analyst while designing the new system. Layout forms and screens are used to construct the formats and contents of input / output media and methods. Dialogue flow diagrams analyse the flow of dialogue between computers and people.
- (iii) **Data attributes and relationships:** The data resources in information system are defined, catalogued and designed by this category of tools. A data dictionary catalogs the description of the attributes (characteristics) of all data elements and their relationships to each other as well as to external systems. Entity-relationships diagrams are used to document the number and type of relationship among the entities in a systems. File layout forms document the type, size and names of the data elements in a system. Grid charts help in identifying the use of each type of data element in input / output or storage media of a system.
- (iv) **Detailed system process:** These tools are used to help the programmer develop detailed procedures and processes required in the design of a computer program. Decision trees and decision tables use a network or tabular form to document the complex conditional logic involved in choosing among the information processing alternatives in a system.

Question 9

What do you understand by feasibility study? Explain various types of feasibility studies.

Answer

Feasibility Study: It refers to the process of evaluating alternative systems through cost / benefit analysis so that the most feasible and desirable system can be selected for development. The feasibility study of a system is undertaken from three angles: technical, economic and operational feasibility.

Technical feasibility: It is concerned with hardware and software. The technical issues usually raised during the feasibility stage of investigation include the following:

- (i) Does the necessary technology exist to do what is suggested (and can it be acquired)?
- (ii) Does the proposed equipment have the technical capacity to hold the data required to use the new system?
- (iii) Will the proposed system provide adequate responses to inquires, regardless of the number or location of users?
- (iv) Can the system be expanded if developed?
- (v) Are there technical guarantees of accuracy, reliability, ease of access and data security?

Economic Feasibility: It includes an evaluation of all the incremental costs and benefits expected if the proposed system is implemented. The financial and economic questions raised by analysts during the preliminary investigation are for the purpose of estimating the following:

- (i) The cost of conducting full systems investigation.
- (ii) The cost of hardware and software for the class of applications being considered.
- (iii) The benefits in the form of reduced costs or fewer costly errors.
- (iv) The cost if nothing changes.

Operational feasibility: It is concerned with ascertaining the views of workers, employees, customers and suppliers about the use of computer facility.

Some of the questions which help in testing the operational feasibility of a project are:

Is there sufficient support for the system from management? From users? If the current system is well liked and used to the extent that persons will not be able to see reasons for a change, there may be resistance.

Are current business methods acceptable to users? If they are not, users may welcome a change that will bring about a more operational and useful system.

Have the users been involved in planning and development of the project? Early involvement reduces the chance of resistance to the system and changes in general and increases the likelihood of successful projects.

Will the proposed system cause harm? Will it produce poorer results in any aspects or areas? Will loss of control result in any areas? Will accessibility of information be lost? Will individual performance be poorer after implementation than before? Will performance be affected in an undesirable way? Will the system slow performance in any areas?

Schedule Feasibility: It involves the design team's estimation how long it will take a new or revised system to become operational and communicating this information to the steering committee.

Legal Feasibility: Legal feasibility is largely concerned with whether there will be any conflict between a newly proposed system and the organization's legal obligations. For example, a revised system should comply with all applicable federal and state statutes about financial reporting requirements, as well as the company's contractual obligations.

Question 10

State and explain any five approaches to System Development.

Answer

Organizations vary significantly in the way they automate their business procedures. Also, since each new type of system usually differs from any other, several different systems development approaches are often used within an organization. Five most commonly used approaches are discussed below:

- (i) **Traditional approach:** In traditional approach of the systems development, activities are performed in sequence. It involves basically six phases, viz. preliminary investigation, requirement analysis, system design, system acquisition, system testing and system implementation & maintenance. When traditional approach is used, managers and users interact with system analysts, system designers and application programmers during various phases. An activity is undertaken only when the prior step is fully completed. Managers and users assess and review the work performed by MIS professionals during each stage of process before proceeding to the next stage. If the work is satisfactory, they formally sign or accept the work and allow the system development team to proceed to the next phase.

This approach is applied to the development of large computer based information systems such as the transaction processing systems.

- (ii) **Prototyping approaches:** This approach is basically used for the development of such systems as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all of a system. A prototype is an useable system or component that is built quickly and at a lesser cost, and with the intention of being modified or replacing it by a full-scale and fully operational system. As users work with the prototype, they make suggestions about the ways to improve it. These suggestions are then incorporated into another prototype, which is also used and evaluated and so on. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is used to develop the real system.

Experimenting with the prototype helps users to identify additional requirements and needs that they might have overlooked or forgotten to mention. In addition, with prototyping, users have a clearer visual picture of what the final version will look like and they do not have to sign off on a system, which is presented to them in the form of diagrams and specifications lists.

- (iii) **End user development approach:** In end-user development, it is the end user and not the computer professional who is responsible for systems development activities. Many different kinds of organizations allow end-users to develop systems. For example, whenever a manager or a department acquires its own, relatively inexpensive microcomputers or office information systems, end-user development often takes place. The number and nature of systems development activities followed by the end-user often differ from those found in formal approaches such as the traditional approach.
- (iv) **Top down approach:** The top down approach assumes a high degree of top management involvement in the planning process and focuses on organizational goals, objectives and strategies. Using the top-down approach, we begin by analyzing organizational objectives and goals and end by specifying application programs and modules that need to be developed to support those goals. The various stages in top down approach are as follows:
- (a) Analyze the objectives and goals of the organization to determine where it is going and what management wants to accomplish. The analysis may be started in terms of profits, growth, expansion of product line or services, diversification, increased market share and so on. It is also determined what resources are available in terms of capital, equipment and raw material.
 - (b) Identify the functions of the organization (for example, marketing, production, research and development) and explain how they support the entire organization.
 - (c) Based on the functions identified above, ascertain the major activities, decisions and functions of the managers at various levels of hierarchy.

- (d) With activities and decisions identified, we must now identify models that guide managerial decisions processes and find out the information requirements for activities and decisions.
- (e) Prepare specific information processing programs in detail and modules within these programs. We may also identify files and data base for applications.
- (v) **Bottom-up approach:** The bottom up approach to system planning begins by identifying basic transactions and information processing programs.

The development starts from the fundamental or lifestream systems of the personnel processing systems that support day-to-day business activities. As these systems are identified, the data and file requirements for each one can also be specified.

Once the basic transactions and information processing systems are known, data requirements across applications are examined and the files and records combined in order to be usable for several applications. Thus, applications are integrated using data base concepts which enhances the sharability and evolvability of the data base, ensures that uniform data are used by all programs, and reduces the redundancy found so frequently in non-integrated, program-oriented files.

Program, system and data integration are followed by the formulation of models to support higher management level activities. Decisions are then made using the output of the model-based analysis that have been integrated into the computer information systems.

As more and more models are developed and used, model banks are established. A model bank is similar to a data base in that different planning and control models are developed and stored. They can be used to examine many different strategies.

Thus, the bottom-up approach takes us to higher levels of decision making in the organization. As we come closer to the strategic planning level, we need to integrate more and more data and information processing activities.

Question 11

Discuss in detail, how the analysis of present system is made by the system analyst.

Or

A Company is offering a wide range of products and services to its customers. It relies heavily on its existing information system to provide up to date information. The company wishes to enhance its existing system. You being an information system auditor, suggest how the investigation of the present information system should be conducted so that it can be further improved upon.

Answer

Detailed investigation of the present system involves collecting, organizing and evaluating facts about the system and the environment in which it operates. Enough information should be assembled so that a qualified person can understand the present system without visiting any of the operating departments. Review of existing methods, procedures, data flow, outputs, files, inputs and internal controls should be intensive in order to fully understand the present system and its related problems.

The following areas may be studied in depth:

1. **Review historical aspects:** A brief history of the organization is a logical starting point for the analysis of the present system. The historical facts should identify the major turning points and milestones that have influenced its growth. A review of annual reports can provide an excellent historical perspective. A historical review of the organization chart can identify the growth of management levels as well as the development of various functional areas and departments. The system analyst should identify what system changes have occurred in the past. These should include operations that have been successful or unsuccessful with computer equipment and techniques.
2. **Analyze inputs:** A detailed analysis of present inputs is important since they are basic to the manipulation of data. Source documents are used to capture the originating data for any type of system. The system analyst should be aware of the various sources from where the data can be initially captured, keeping in view the fact that outputs for one area may serve as an input for another area. The system analyst must understand the nature of each form, what is contained in it, who prepared it, from where the form is initiated, where it is completed, the distribution of the form and other similar considerations. If the analyst investigates these questions thoroughly, he will be able to determine how these inputs fit into the framework of the present system.
3. **Review data files maintained:** The analysts should investigate the data files maintained by each department, noting their number and size, where they are located, who uses them and the number of times per given time interval these are used. Information on common data files and their size will be an important factor, which will influence the new information system. This information may be contained in the systems and procedures manuals. The system analyst should also review all online and off line files which are maintained in the organization as these will reveal information about data that are not contained in any output. The related cost of retrieving and processing the data is another important factor that should be considered by the systems analyst.

4. **Review methods, procedures and data communications:** Methods and procedures transform input data into useful output. A method is defined as a way of doing something; a procedure is a series of logical steps by which a job is accomplished. A procedure's review is an intensive survey of the methods by which each job is accomplished, the equipment utilized and the actual location of the operations. Its basic objective is to eliminate unnecessary tasks or to perceive improvement in opportunities in the present information system. A system analyst also needs to review and understand the present data communications used by the organization. He must review the types of data communication equipment including data interface, data links, modems, dial-up and leased lines and multiplexers. The system analyst must understand how the data communications network is used in the present system so as to identify the need to revamp the network when the new system is installed.
5. **Analyze outputs:** The outputs or reports should be scrutinized carefully by the system analysts in order to determine how well they will meet the organization's needs. The analysts must understand what information is needed and why, who needs it and when and where it is needed. Additional questions concerning the sequence of the data, how often the form reporting it is used, how long it is kept on file, etc. must be investigated. Often many reports are a carryover from earlier days and have little relevance to current operations. Attempt should be made to eliminate all such reports in the new system.
6. **Review internal controls:** A detailed investigation of the present information system is not complete until internal controls are reviewed. Locating the control points helps the analyst to visualize the essential parts and framework of a system. An examination of the present system of internal control may indicate weaknesses that should be removed in the new system. The adoption of advanced methods, procedures and equipment might allow much greater control over the data.
7. **Model the existing physical system and logical system:** As the logic of inputs, methods, procedures, data files, data communications, reports, internal control and other important items are reviewed and analyzed in a top down manner, the process must be properly documented. The logical flow of the present information system may be depicted with the help of system flow charts. The physical flow of the existing system may be shown by employing data flow diagrams. During the process of developing the data flow diagram, work on data dictionary for the new information system should be begun. The data elements needed in the new system will be found in the present system only. Hence, it is wise to start the development of the data dictionary as early as possible.

The flow charting and diagramming of present information not only organizes the facts, but also helps disclose gaps and duplication in the data gathered. It allows a thorough comprehension of the numerous details and related problems in the present operation.

8. **Undertake overall analysis of present system:** Based upon the aforesaid investigation of the present information system, the final phase of the detailed investigation includes the analysis of:
- a. the present work volume
 - b. the current personnel requirements
 - c. the present benefits and costs

Each of these must be investigated thoroughly.

Question 12

What do you understand by "Requirement analysis"? What is the significance of analyzing the present system and how is it carried out? Explain briefly.

Or

What are the facts finding techniques used by a system analyst?

Answer

Requirement analysis: This is the second stage of system development life cycle (SDLC). This analysis involves determining users' needs, studying the present system of the organization in depth, and determining the features, which the new system should possess. Various fact-finding techniques and system development tools are used for requirement analysis.

During the requirement analysis phase of the traditional approach, the focus is one determining user needs, studying the application area in depth, assessing the strengths and weaknesses of the present system and reporting results to management.

The significance of studying in the present system is to know why the organization is not satisfied by this system. What are its strong and weak points? How the present system uses hardware, software and human resources to convert the data of the organization into information for end users. In addition, the system analysts should analyze how these resources are used to accomplish the activities of input, processing, output, storage and control.

Detailed investigation of the present system involves collecting, organising and evaluating facts about the system and the environment in which it operates. The survey of existing methods, procedures, data flow diagrams, outputs, files, input and internal controls should be done indepth in order to fully understand the present system and its related problems. While analyzing the present system, the following areas should be studied in depth.

1. Review of historical aspects
2. Analysis of inputs
3. Review of data files maintained

4. Review of methods, procedures and data communication
5. Analysis of output
6. Review of internal controls
7. Model of existing physical & logical systems.

In order to determine the user needs and to find weaknesses and strong points about the present system, analysts use various fact finding techniques.

The fact finding techniques used by the Analyst for requirement analysis are as follows:

1. **Documents:** Manuals, input forms, output forms, diagrams of how the current system works, organization charts showing hierarchy of users and managers responsibilities, job description for the people who work with current system, procedure manuals, program codes for applications associated with current system etc. should be looked into as thoroughly as possible, since they are the rich source of information.
2. **Questionnaires:** Users and managers are asked to complete questionnaire about the information system when the traditional system development approach is chosen. Using questionnaires, a large amount of data can be collected through a variety of users quickly.
3. **Interviews:** Users and managers may also be interviewed to extract information from them. The information so obtained provides complete picture of the present system. The interview also gives analyst the opportunity to know about the first hand user reactions and to probe for further information.
4. **Observation:** In prototype approach, observation plays a central role in requirement analysis. The analyst visits the user place to watch how the work is taking place. While the user is experimenting with the prototype, the systems analyst observes the user and puts these observations into perspective in order to determine how the prototype should be further designed. This gives him first hand information rather than relying on other methods such as analyzing documents, questionnaires etc.

Question 13

Explain prototyping approaches to systems development.

Answer

Prototyping approach: The traditional approach sometimes may take years to analyze, design and implement a system. In order to avoid such delays, organizations are increasingly using prototyping techniques to develop smaller systems such as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all

of a system. A prototype is an usable system or system component that is built quickly and at a lesser cost, and with the intention of being modifying or replacing it by a full scale and fully operational system. As users work with the prototype, they make suggestions about the ways to improve it. These suggestions are then incorporated into another prototype, which is also used and evaluated and so on. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is used to develop the real system.

Experimenting with the prototype helps users to identify additional requirements and needs that they might have overlooked or forgotten to mention. In addition, with prototyping, users have a clearer visual picture of what the final version will look like and they do not have to sign off on a system which is presented to them in the form of diagrams and specification lists. Decision support systems that are characterized by semi-structured or unstructured management decision environment are ideal for the experimentation and trial and error development associated with prototyping. Expert systems are other ideal candidates for prototyping approach because expert knowledge usually requires continual refinements. Prototyping can also be used in the development of transaction processing system. It is most commonly used during the system design stage, for instance, to develop the mock screen for input etc.

Question 14

What are the advantages of prototyping approaches?

Answer

To some extent, systems analysis and development has been greatly improved by the introduction of prototyping. Prototyping enables the user to take an active part in the systems design, with the analyst acting in an advisory role.

Prototyping makes use of the expertise of both the user and the analyst, thus ensuring better analysis and design, and prototyping is a crucial tool in that process.

Other advantages of prototyping include:

- improving the fact finding process;
- improving relations between analysts and users;
- encouraging the users to 'own' the new system;
- reducing the cost of user training;
- identification of system problems;
- ensuring quality for the eventual system.

Question 15

If you are the Project Manager of a Software Company with the responsibility for developing a break-through product, combining state of the art hardware and software, will you opt for prototyping as a process model for a product meant for the intensely competitive entertainment market?

Answer

Prototyping as a process model will be inappropriate and hence inadvisable for the following reasons:

- (i) Prototyping requires user involvement. Here the users are the consumers of the product who are diffused and may not be inclined to join in.
- (ii) When we try to test the product with the involvement of customers, confidential or critical information might get leaked to the competitors on our line of thinking. The element of surprise and also the opportunity to capture the market will be lost.
- (iii) Prototyping requires significant time for experimenting. Since the product is meant for the intensely competitive entertainment market, the project manager may not have that much time to experiment, the competitor may capture the market by entering the market in advance.

Question 16

Describe briefly four categories of the major tools that are used for system development.

Answer

The major tools used for system development can be grouped into four categories based on the systems features each document has. These are:

- (i) Components and flows of a system
- (ii) User interface
- (iii) Data attributes and relationships
- (iv) Detailed system process.

Each of these categories are briefly discussed below:-

- (i) **System components and flows:** For system analysts these tools are helpful to document the data flow among the major resources and activities of an information system. System flow charts are typically used to show the flow of data media as they are processed by the hardware devices and manual activities. A system component matrix provides a matrix framework to document the resources used, the activities performed and the information produced by information system. A data flow diagram uses a few simple symbols to illustrate the flow of data among external entities.

- (ii) **User interface:** Designing the interface between end users and the computer system is a major consideration of system analysts while designing the new system. Layout forms and screens are used to construct the formats and contents of input / output media and methods. Dialogue flow diagrams analyze the flow of dialogue between computers and people. They document the flows among different display screens generated by alternative end user responses to menus and prompts.
- (iii) **Data attributes and relationships:** These tools are helpful to define, catalogue and design the data resources in information systems. A data dictionary catalogs the description of the attributes of all data elements and their relationship to each other as well as to external systems. Entity – relationship diagrams are also used to document the number and type of relationship among the entities in a system. File layout forms document the type, size, and names of the data elements in a system. Grid charts help in identifying the use of each type of data element in input / output or storage media of a system.
- (iv) **Detailed system process:** These tools are used to help the programmer to develop detailed procedures and processes required in the design of a computer program. Decision trees and decision tables use a network or a tabular form to document the complex conditional logic involved in choosing among the information processing alternatives in a system. Structure charts document the purpose, structure and hierarchical relationships of the modules in a program.

Question 17

Bring out the reasons as to why the organizations fail to achieve their Systems Development Objectives?

Answer

Following are some of the reasons due to which the organizations fail to achieve their system development objectives:

- (i) **Lack of senior management support for and involvement in information system development:** In the management of information systems, developers and users depend on the senior management for support and to determine which systems development projects are important. Their tendency is to shift away from the project, which lack senior management attention.
- (ii) **Shifting user needs:** User requirements for information technology are constantly varying. As these changes accelerate, there will be more requests for systems development and more development projects. When these changes occur during a development process, the development team may be faced with the challenge of developing systems whose very purposes have changed since the development process began.

- (iii) **Development of strategic systems:** Because strategic decision-making is unstructured, the requirements, specifications and objectives for such development projects are difficult to define and determining successful development will be elusive.
- (iv) **New technologies:** New technologies are coming in the organizations want to apply these and create a competitive situation. However, later they find that attaining systems development objectives is more difficult because personnel are not familiar with the new technology.
- (v) **Lack of standard project management and systems development methodologies:** Some organizations do not formalize their project management and systems development methodologies, thereby making it very difficult to consistently complete projects on time or within the budget.
- (vi) **Overworked or under-trained development staff:** It is generally established that there is backlog of systems development work due to lack of efficient staff. In addition to being overworked, system developers often lack sufficient educational background. Many companies do little to help their development personnel stay technically updated and in these organizations, a training plan and training budget do not exist.
- (vii) **Resistance to change:** People have a natural tendency to resist change, and information systems development projects signal changes –often radical – in the work place. Business process reengineering is often the catalyst for the systems development project. When personnel perceive that the project will result in personnel cutbacks, threatened personnel will dig in their heels, and the development project is doomed to failure. Personnel cutbacks often result when reengineering projects really attempt at downsizing (or right sizing).
- (viii) **Lack of user participation:** Users must participate in the development effort to define their requirements, feel ownership for project success, and work to resolve development problems. User-participation also helps reduce user resistance to change.
- (ix) **Inadequate testing and user training:** New systems must be tested before installation to determine that they will operate correctly. Users must be trained to effectively utilize the new system. By executing the system development process efficiently and effectively, the above problem can be solved.

Question 18

Write short notes on the following:

- (a) *Data Dictionary*
- (b) *System Development Life Cycle*

Answer

(a) **Data Dictionary:** It is a computer file that contains descriptive information about the data items in the files of a business information system. In other words, it is a computer file about data. The information included in each record of a Data Dictionary may include the following about an item:

- (i) Codes describing the data item's length, data type and range.
- (ii) Identity of the source documents used to create the data.
- (iii) Names of the computer files storing the data item.
- (iv) Identity of individuals/programs permitted to access the data item for the purpose of file maintenance, upkeep or inquiry.
- (v) Identity of programs/individuals not permitted to access the data item.
- (vi) Names of the computer programs that modify the data item.

It has variety of uses. It serves as an aid to documentation and is also useful for securities. It helps accountants and auditors in establishing audit trails and in planning the flow of transaction data through the system. Finally, it serves as an important aid in investigating or documenting internal control procedures.

(b) **System Development Life Cycle:** The process of system development starts when management realize that a particular business needs improvement. The system development life cycle method can be thought of as a set of activities that analysts, designers and users carry out to develop and implement an information system.

The system development life cycle method consists of the following activities:

- (i) *Preliminary investigation:* It is undertaken when users come across a problem or opportunity and submit a formal request for a new system to the MIS department. This activity consists of three parts; request clarification, feasibility study and request approval.
- (ii) *Requirements analysis or systems analysis:* In this stage, the analysts work closely with employees and managers of the organization for determining the information requirements of the users. Several fact-finding techniques and tools such as questionnaires, interviews, observing decision-maker behaviour and office environment, etc. are used for understanding the requirements of the users. As details are gathered, the analysts study the present system to identify its problems and shortcomings and identify the features which the new system should include to satisfy the new or changed user application environment.

- (iii) *Design of the system*: It produces the details that state how a system will meet the requirements identified in the previous step. The analyst designs various reports/outputs, data entry procedures, inputs, files and database. He also selects file structures and data storage devices. These detailed design specifications are then passed on to the programming staff for software development.
- (iv) *Acquisition and development of software*: In this stage, resource requirements such as specific type of hardware, software and services are determined. Subsequently, choices are made regarding which products to buy or lease from which vendors. Software developers may modify and then install purchased software or they may write new custom designed programs.
- (v) *System testing*: Before the information system can be used, it must be tested. Special test data are input for processing, and results are examined. If it is found satisfactory, it is eventually tested with actual data from the current system.
- (vi) *Implementation and maintenance*: After system is found to be fit, it is implemented with actual data. After implementation, the system is maintained; it is modified to adapt to changing users and business needs.

Question19

Describe any five functional areas of a system which needs to be analyzed by system analyst for detailed investigation of the present system.

Answer

Analysis of the Present System - Detailed investigation of the present system involves collecting, organizing and evaluating facts about the system and the environment in which it operates. Survey of existing methods, procedures, data flow, outputs, files, input and internal controls should be intensive in order to fully understand the present system and its related problems. There are several functional areas, which should be studied in depth. We have discussed below five major functional areas:

- (i) **Analyze Inputs** – Source documents are used to capture the originating data for any type of the system. The system analyst should be aware of the various sources from where the data are initially captured. He must keep in view the fact that outputs for one area may serve as an input for another area. He must understand the nature of each form, what is contained in it, who prepared it, from where the form is initiated, where it is completed, the distribution of the form and other similar considerations to determine how these inputs fit into the framework of the present system.

- (ii) **Review data files** – The analyst should investigate the data files maintained by each department noting their number and size, where they are located, who uses them and the number of times per given time interval these are used. This information may be contained in the system and procedures manuals. He should also review all online and off-line files which are maintained in the organization as it will reveal information about data that are not contained in any output. The related cost of retrieving and processing the data is another important feature to be considered by the system analyst.
- (iii) **Review methods, procedures and data communication** – Methods and procedures transforms input data into useful output. A procedure review is an intensive survey of the methods by which each job is accomplished, the equipment utilized and the actual location of the operations. Its basic objective is to eliminate unnecessary tasks or to perceive improvement opportunities in the present information system. The analyst must review the types of data communication equipments including data interface, data link, modems, dial-up and leased lines and multiplexers. He must understand how the data communication network is used in the present system so as to identify the need to revamp the network when the new system is installed.
- (iv) **Analyze Outputs** - The outputs or reports should be scrutinized carefully by the system analyst in order to determine how well they will meet the organization's need. The analyst must understand what information is needed and why, who needs it and when and where it is needed. Additional questions concerning the sequence of the data, how often the form reporting it is used, how long it is kept on file etc. must be investigated. Often many reports are a carry-over from earlier days and have little relevance to current operations. Attempts should be made to eliminate all such reports in the new systems.
- (v) **Review internal controls** - A detailed investigation of the present information system is not complete until internal controls are reviewed. Locating the control points helps the analyst to visualize the essential parts and framework of a system. An examination of internal controls may indicate weaknesses that should be removed in the new system. The adoption of advanced methods, procedures and equipments might allow much greater control over the data.

Question 20

What are the various tangible and intangible benefits that can result from the development of a computerized system?

Answer

The benefits which result from developing new or improved information systems that utilize computer can be subdivided into tangible and intangible benefits. Tangible benefits are those that can be accurately measured and are directly related to the introduction of a new system, such as decrease in data processing cost. Intangible benefits such as improved business image are harder to measure and define. Benefits that can result from the development of a computerized system are summarized below:

- (i) Increase in sales or profit (improvement in product or service quality)
- (ii) Decrease in data processing costs (elimination of unnecessary procedures and documents)
- (iii) Decrease in operating costs (reduction in inventory carrying costs)
- (iv) Decrease in required investment (decrease in inventory investment required)
- (v) Increased operational ability and efficiency (improvement in production ability and efficiency)
- (vi) New or improved information availability (more timely and accurate information and new types and forms of information)
- (vii) Improved abilities in computation and analysis
- (viii) Improved customer service (more timely service)
- (ix) Improved employee morale (elimination of burdensome and boring job tasks)
- (x) Improved management decision-making (better information and decision analysis)
- (xi) Improve competitive position (faster and better response to actions of competitors)
- (xii) Improved business and community image (progressive image as perceived by customers, investors etc.)

Intangible though, it is important to put a rupee and paise tag to each benefit for purposes of profit and loss statement. The analyst has to quantify the benefits in monetary terms.

Question 21

Write short note on top down approach of system development.

Answer

Top down Approach of system development: The top down approach assumes a high degree of top management involvement in the planning process and focuses on organizational goals, objectives and strategies. The logic here is that, above all, an information system needs to be responsive to and supportive of an organization's basic

reasons for being. Hence the organization's goals should be the driving force behind development of all the computer systems. Thus, using top down approach, we begin analyzing objectives and goals of the organization and end by specifying application programs and modules that are needed to be developed.

Various steps in top-down approach are as follows:

- (a) Analyze the objectives and goals of the organization in terms of profit, growth, diversification etc.
- (b) Identify the functions of the organization and explain how they support the entire organization.
- (c) Ascertain major activities, decisions and functions at various levels of hierarchy. It should be analyzed what decisions are made and what need to be made.
- (d) Identify models that guide managerial decision process and find the information requirements for activities and decisions.
- (e) Prepare specific information processing programs in detail and modules within these programs. Also identify files and database for applications.

Question 22

What are the project management items associated with an I.T. project system failures? Give the elements to be included in the adopted framework to avoid such failures.

Answer

Items associated with IT project system failure are as follows:

- (i) Underestimation of the time to complete the project.
- (ii) Senior management did not monitor the project closely enough.
- (iii) Underestimation of necessary resources.
- (iv) Size and scope of the project underestimated.
- (v) Inadequate project control mechanism.
- (vi) Systems specifications kept changing.
- (vii) Inadequate planning.

Elements to be included in the framework to avoid such failures are as stated below:

- (i) User participation in defining and authorizing the system.
- (ii) Assignment of appropriate staff to the system development and definition of their responsibilities and authorities.

- (iii) A clear written statement of system nature and scope.
- (iv) A feasibility study that is the basis of senior management approval to proceed with the system.
- (v) A system master plan, including realistic time and cost estimates for control of the system.
- (vi) A risk management program to identify and manage risks associated with each project.
- (vii) Division of the system into manageable processes often called phases.
- (viii) Approval of work accomplished in one phase before working on the next phase.
- (ix) Integration of the quality assurance plan including the systems development cycle (SDLC) methodology with the system master plan.

Project management, particularly the planning process and establishing the project schedule can ultimately determine the success of the project.

Question 23

Various software packages serve as aids in analysis of program logic. Explain briefly.

Answer

The following software packages serve as aids in program analysis:

- **Automated flowcharting programs**, which interpret program source code and generate a corresponding program flowchart.
- **Automated decision table programs**, which generate a decision table representing the program logic.
- **Scanning routines**, which search a program for occurrences of a specified variable name or other character combinations.
- **Mapping programs**, which identify unexecuted program code. This software could have uncovered the program code that is developed by the unscrupulous programmer who has inserted code to erase all computer files when he was terminated.
- **Program tracing**, which sequentially prints all application program steps (line numbers or paragraph names) executed during a program run. This list is intermingled with regular output so that the auditors can observe the precise sequence of events that unfold during program execution. Program tracing helps auditors to detect unauthorized program instructions, incorrect logic paths, and unexecuted program code.

Question 24

Explain different conversion strategies used for conversion from manual to computerized system. Enumerate the advantages and disadvantages of each strategy.

Answer

The five strategies used for conversion from manual to computerized system are briefly discussed below:

- (i) **Direct Changeover:** Conversion by direct changeover means that on a specified date, the old system is dropped and the new system is put into use.

Advantages: The users have no possibility of using the old system other than the new one. Adaptation is a necessity.

Disadvantages: Direct changeover can only be successful if extensive testing is done beforehand. Long delays might ensue if errors occur. Also, users may resent being forced into using an unfamiliar system without recourse. Finally, there is no adequate way to compare new results with old ones.

- (ii) **Parallel Conversion:** This refers to running the old systems and the new system at the same time, in parallel. This approach works best when a computerized system replaces a manual one. Both systems are run simultaneously for a specified period of time and the reliability of results is examined. When the same results are gained over time, the new system is put into use and the old one is scrapped.

Advantages: There is a possibility of checking new data against old data in order to catch any errors in the processing of the new system. It also offers a feeling of security to users who are not forced to make an abrupt change to the new system.

Disadvantages: Cost of running two systems at the same time is high. The workload of employees during conversion is almost doubled. In case the system being replaced is a manual one, it is difficult to make comparisons between output of the new system and the old one.

- (iii) **Gradual Conversion:** It attempts to combine the best features of the earlier two plans, without incurring the risks. In this plan, the volume of transactions is gradually increased as the system is phased in.

Advantages: It allows users to get involved with the system gradually. It also offers the possibility of detecting and recovering from the errors without a lot of downtime.

Disadvantages: It takes too long to get the new system in place. It is not appropriate for conversion of small, uncomplicated systems.

- (iv) **Modular Prototype Conversion:** This approach of conversion uses the building of

modular, operational prototypes to change from old system to new in a gradual manner. As each module is modified and accepted, it is put into use.

Advantages: Each module is thoroughly tested before being used. Users become familiar with each module as it becomes operational.

Disadvantages: Many times prototyping is not feasible and hence this conversion method can not be used for such systems. Further, under this approach, special attention must be paid to interfaces so that the modules being built actually work as a system.

- (v) **Distributed Conversion:** This refers to a situation in which many installations of the same system are contemplated, such as in banking. One entire conversion is done using any of the aforesaid four approaches at any one site. When that conversion is successfully completed, other conversions are done for other sites.

Advantages: Problems can be detected and contained at one site rather than inflicting them, in succession, on all sites.

Disadvantages: Even when one conversion is successful, each site will have its own peculiarities to work through and these must be handled.

Question 25

Discuss briefly, various activities that are involved for successful conversion of an existing manual system to a computerized information system.

Answer

Activities involved in conversion: Conversion includes all those activities which must be completed to successfully convert from the existing manual system to the computerized information system. Fundamentally these activities can be classified as follows:

1. Procedure conversion;
 2. File conversion;
 3. System conversion;
 4. Scheduling personnel and equipment;
 5. Alternative plans in case of equipment failure
1. **Procedure conversion:** Operating procedures should be completely documented for the new system. This applies to both computer operations and functional area operations. Before any parallel or conversion activities can start, operating procedures must be clearly spelled out for personnel in the functional areas undergoing changes. Information on input, data files, methods, procedures,

outputs, and internal controls must be presented in clear, concise and understandable terms for the average reader. Written operating procedures must be supplemented by oral communication during the training sessions on the system change. Brief meetings must be held when changes are taking place in order to inform all operating employees of any changes initiated. Revisions to operating procedures should be issued as quickly as possible. These efforts enhance the chances of successful conversion.

Once the new system is completely operational, the system implementation group should spend several days checking with all supervisory personnel about their respective areas.

2. **File conversion:** Because large files of information must be converted from one medium to another, this phase should be started long before programming and testing are completed. The cost and related problems of file conversion are significant whether they involve on-line files (common data base) or off-line files. Present manual files are likely to be inaccurate and incomplete where deviations from the accepted formats are common. Computer generated files tend to be more accurate and consistent.

In order for the conversion to be as accurate as possible, file conversion programs must be thoroughly tested. Adequate controls, such as record counts and control totals, should be the required output of the conversion program. The existing computer files should be kept for a period of time until sufficient files are accumulated for back-up. This is necessary in case the files must be reconstructed from scratch after a "bug" is discovered later in the conversion routine.

3. **System conversion:** After on-line and off-line files have been converted and the reliability of the new system has been confirmed for a functional area, daily processing can be shifted from the existing information system to the new one. A cut-off point is established so that data base and other data requirements can be updated to the cut-off point. All transactions initiated after this time are processed on the new system. System development team members should be present to assist and to answer any questions that might develop. Consideration should be given to operating the old system for some more time to permit checking and balancing the total results of both systems. All differences must be reconciled. If necessary, appropriate changes are made to the new system and its computer programs. The old system can be dropped as soon as the data processing group is satisfied with the new system's performance.
4. **Scheduling personnel and equipment:** Scheduling data processing operations of a new information system for the first time is a difficult task for the system

manager. As users become more familiar with the new system, however, the job becomes more routine.

Before the new design project is complete, it is often necessary to schedule the new equipment. Some programs will be operational while others will be in various stages of compiling and testing. Since production runs tend to push aside new program testing, the system manager must assign ample time for all individuals involved. Schedules should be set up by the system manager in conduction with departmental managers of operational units serviced by the equipment.

Just as the equipment must be scheduled for its maximum utilization, so must be personnel who operate the equipment. It is also imperative that personnel who enter input data and handle output data be included in the data processing schedule. Otherwise, data will not be available when the equipment needs it for processing.

5. **Alternative plans in case of equipment failure:** Alternative-processing plans must be implemented in case of equipment failure. Who or what caused the failure is not as important in case of equipment failure as the fact that the system is down. Priorities must be given to those jobs critical to an organization, such as billing, payroll, and inventory. Critical jobs can be performed manually until the equipment is set right.

Documentation of alternative plans is the responsibility of the computer section and should be fully covered by the organization's systems and procedures manual. It should state explicitly what the critical jobs are, how they are to be handled in case of equipment failure, where compatible equipment is located, who will be responsible for each area during downtime and what dead-lines must be met during the emergency. A written manual of procedures concerning what steps must be undertaken will help expedite the unfavorable situation. Otherwise, panic will result in the least efficient methods when time is of the essence.

Question 26

ABC Technologies Ltd. is in the development of application software for various domains. For the development purposes, the company is committed to follow the best practices suggested by SDLC. SDLC provides the guidelines to follow a sequence of activities. It consists of a set of steps and phases in which each phase of the SDLC uses the results of the previous one. The SDLC is document driven which means that at crucial stages during the process, documentation is produced. A phase of the SDLC is not complete until the appropriate documentation or artifact is produced. These are sometimes referred to as deliverables.

A deliverable may be a substantial written document, a software artifact, a system test plan or even a physical object such as a new piece of technology that has been ordered and delivered. This feature of the SDLC is critical to the successful management of an IS project.

Read the above carefully and answer the following:

- (a) List the possible advantages from the perspective of IS Audit.*
- (b) There are various advantages by following SDLC, but there are some shortcomings also. Briefly explain those shortcomings.*
- (c) Feasibility study is a key activity in the SDLC. What are the issues which are typically considered in the Feasibility Study?*
- (d) In the SDLC, at the end of the analysis phase, the system analyst prepares a document called 'Systems Requirements Specifications (SRS)'. Briefly explain the contents of a SRS.*

Answer

- (a)** From the perspective of the IS Audit, the following are the possible advantages:
 - The IS auditor can have clear understanding of the various phases of the SDLC on the basis of the detailed documentation created during each phase of the SDLC.
 - The IS Auditor on the basis of his examination, can state in his report about the compliance by the IS management of the procedures, if any, set by the management.
 - The IS Auditor, if has a technical knowledge and ability of the area of SDLC, can be a guide during the various phases of SDLC.
 - The IS auditor can provide an evaluation of the methods and techniques used through the various development phases of the SDLC.
- (b)** Some of the shortcomings of the SDLC are as follows:
 - The development team may find it cumbersome.
 - The users may find that the end product is not visible for a long time.
 - The rigidity of the approach may prolong the duration of many projects.
 - IT may not be suitable for small and medium sized projects.
- (c)** The following issues are typically addressed in the Feasibility Study:
 - Determine whether the solution is as per the business strategy.
 - Determine whether the existing system can rectify the situation without a major modification.
 - Define the time frame for which the solution is required.
 - Determine the approximate cost to develop the system.
 - Determine whether the vendor product offers a solution to the problem.

(d) A SRS contains the following:

- **Introduction:** Goals and Objectives of the software context of the computer-based system; Information description.
- **Information Description:** Problem description; Information content, flow and structure; Hardware, software, human interfaces for external system elements and internal software functions.
- **Functional Description:** Diagrammatic representation of functions; Processing narrative for each function; Interplay among functions; Design constraints.
- **Behavioral Description:** Response to external events and internal controls.
- **Validation Criteria:** Classes of tests to be performed to validate functions, performance and constraints.
- **Appendix:** Data flow / Object Diagrams; Tabular Data; Detailed description of algorithms charts, graphs and other such material.
- **SRS Review:** It contains the following :
 - o The development team makes a presentation and then hands over the SRS document to be reviewed by the user or customer.
 - o The review reflects the development team's understanding of the existing processes. Only after ensuring that the document represents existing processes accurately, should the user sign the document. This is a technical requirement of the contract between users and development team / organization.

EXERCISE

Question 1

What is prototyping approaches to systems development? Describe its advantages and disadvantages also.

Question 2

Write short notes on the following:

- (a) End user development approach in system development*
- (b) Program documentation*

Question 3

State main objectives of system development tools. Briefly describe the major categories of documentation tools that are used for system development with any one simple illustrative example for each.

Question 4

What are the major factors to be considered in designing User inputs? Explain.

Question 5

What are the six important factors which should be considered while designing the user outputs?

Question 6

What are the factors considered to design the ideal layout of a printed output?

Question 7

Read the data flow and activities listed in the table below carefully and draw the data flow diagram for the payroll processing system.

Activities	Data Inputs	Data Outputs
Update employee/roll file	New employee form Employee change form Employee/payroll file	Updated employee/ payroll file
Pay employees	Time cards Employee/ payroll file Tax tables	Employee cheques Payroll register Updated employee/payroll file Payroll cheques

Information Systems Control and Audit

		<i>Payroll cash disbursements voucher</i>
<i>Prepare reports</i>	<i>Employee/ payroll file</i>	<i>Payroll report</i>
<i>Update general ledger</i>	<i>Payroll tax cash Disbursements voucher Payroll cash Disbursements voucher</i>	<i>Updated general ledger</i>

Question 8

As a system analyst, you need to assess the successful implementation and stakeholder's actual requirements of an enterprise system in a retail chain organization across its branches to provide the following features:

- Lower operational costs,
- Better information for managers, and
- Smooth operations for users or better levels of service to customers.

Justify your answer with the necessary techniques used to determine the requirements of a system.

Question 9

Answer in brief the important factors the system analysts should consider while application prototyping to develop display screen output to allow users to react to both the content and form of the output.

Question 10

What are the cost elements that need to be considered for cost estimate of a system? What are the major benefits that a system can provide?

Question 11

Discuss the system development approach whose components are time boxing, incremental prototyping and clean rooms.

Question 12

State the five strategies of conversion from an existing manual system to the new computerized system.

Question 13

Write short notes on the following:

- (a) *Guidelines for input form design,*
- (b) *Factors for validation of vendor's proposals, and*
- (c) *Point-Scoring Analysis.*

Question 14

As an internal IS Auditor of an enterprise which is undergoing the phase of system acquisition, how will you prepare the checklists for the following:

- (a) *Evaluation and validation of the software package to be acquired,*
- (b) *The support service to be given by the vendor, and*
- (c) *Evaluation of the Software License Agreement (SLA).*

Question 15

An organization is in the stage of systems development to implement an enterprise wide information system, where the following conditions exist:

End users are not aware of the information needs.

The new system is mission critical and there is a hasty need.

The business risks associated in implementing the wrong system are high.

Read the above case carefully and answer the following with proper justification/s:

- (a) *Identify the system development approach and the steps to be followed in the above stated conditions.*
- (b) *State the reasons for choosing the particular approach for system development.*
- (c) *Identify the risks, when end-users are involved in the system development process.*

Question 16

Write a short note on System maintenance.