

SYSTEM DEVELOPMENT LIFE CYCLE METHODOLOGY

Question 1

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

(10 Marks) (Nov 2008)

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 with each other. 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, shortcomings, 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* (5 Marks) (Nov 2008)
- (b) *Information Systems Maintenance* (5 Marks) (Nov 2008)

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:** Maintaining the system is an important aspect of SDLC. As key personnel change positions in the organization, new changes will be implemented, which will require system updates. 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. Maintenance can be categorized in the following ways:

- *Scheduled maintenance:* Scheduled maintenance is anticipated and can be planned for. For example, the implementation of a new inventory coding scheme can be planned in advance.
- *Rescue maintenance:* 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.
- *Corrective maintenance:* Corrective maintenance deals with fixing bugs in the code or defects found. A defect can result from design errors, logic errors; coding errors, data processing and system performance errors.

The need for corrective maintenance is usually initiated by bug reports drawn up by the end users. Examples of corrective maintenance include correcting a failure to test for all possible conditions or a failure to process the last record in a file.

- *Adaptive maintenance:* Adaptive maintenance consists of adapting software to changes in the environment, such as the hardware or the operating system. The

term environment in this context refers to the totality of all conditions and influences which act from outside upon the system, for example, business rule, government policies, work patterns, software and hardware operating platforms. The need for adaptive maintenance can only be recognized by monitoring the environment.

- *Perfective maintenance*: Perfective maintenance mainly deals with accommodating to new or changed user requirements and concerns functional enhancements to the system and activities to increase the system's performance or to enhance its user interface.
- *Preventive maintenance*: Preventive maintenance concerns about the activities aimed at increasing the system's maintainability, such as updating documentation, adding comments, and improving the modular structure of the system. The long-term effect of corrective, adaptive and perfective changes increases the system's complexity. As a large program is continuously changed, its complexity, which reflects deteriorating structure, increases unless work is done to maintain or reduce it. This work is known as preventive change.

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.
(10 Marks) (Jun 2009)

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 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, the data security?

Some of the technical issues to be considered are given in the following Table:

Table : Technical Issues

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	
Output frequency	In-house or outsourcing
	Instantaneous, hourly, daily, weekly, or monthly
Output medium	CRT, hard copy, voice, or turnaround document
	Predetermined times or on demand
Output scheduling	Preprinted forms or system-generated forms
Printed output	Micro, mini, or mainframe
Processor	Batch or online
Transaction processing	Instantaneous, hourly, daily, weekly, or monthly
Update frequency	

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? 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 than before? Will performance be affected in an undesirable way? Will the system slow performance in any areas?

Question 4

While testing a software, how will you involve the people working in the system areas?

(5 Marks) (Jun 2009)

Answer

Following are the main testing techniques which involve the people working in the system areas:

- (i) *White Box Testing:* White box testing is a test case design method that uses the control structure of the procedural design to derive test cases. Test cases can be derived to
 - guarantee that all independent paths within a module have been exercised at least once,
 - exercise all logical decisions on their true and false sides,
 - execute all loops at their boundaries and within their operational bounds, and
 - exercise internal data structures to ensure their validity
- (ii) *Unit Testing:* In computer programming, a unit test is a method of testing the correctness of a particular module of source code. The idea is to write test cases for every non-trivial function or method in the module so that each test case is separate from the others if possible. This type of testing is mostly done by the developers.
- (iii) *Requirements Testing:* These test conditions are generalized ones, which become test cases as the SDLC progresses until system is fully operational. The main usage of this testing technique is
 - to ensure that system performs correctly
 - to ensure that correctness can be sustained for a considerable period of time.
 - system can be tested for correctness through all phases of SDLC but in case of reliability the programs should be in place to make system operational.
- (iv) *Regression Testing:* Under this testing technique, test cases, which were used previously for the already tested segment are, re-run to ensure that the results of the segment tested currently and the results of same segment being tested earlier, are same. Test automation is needed to carry out the test transactions (test condition execution) else the process is very time consuming and tedious. In this case of testing, cost/benefit analysis should be carefully performed else the efforts spent on testing would be more and payback would be minimum. The major objectives are as follows:
 - System documents remain current.
 - System test data and test conditions remain current.
 - Previously tested system functions properly without getting effected though changes are made in some other segment of application system.
- (v) *Manual Support Testing:* It involves testing of all the functions performed by the people while preparing the data and using these data from automated system. The major objectives of this testing technique are to
 - verify that manual support documents and procedures are correct,
 - determine that manual support responsibility is correct,
 - determine that manual support people are adequately trained,

- determine that manual support and automated segment are properly interfaced.
- (vi) *Internal System Testing: This technique is used to ensure interconnection between application functions correctly. The major objectives of the testing are to ensure that*
 - proper parameters and data are correctly passed between the applications,
 - documentation for involved system is correct and accurate,
 - proper timing and coordination of functions exists between the application systems.

Question 5

Briefly discuss Black Box Testing.

(5 Marks)(Nov 2009)

Answer

Black Box Testing takes an external perspective of the test object to derive test cases. These tests can be functional or non-functional, though usually functional. The test designer selects valid and invalid inputs and determines the correct output. There is no knowledge of the test object's internal structure.



This method of test design is applicable to all levels of software testing: unit, integration, functional testing, system and acceptance. The higher the level, hence the bigger and more complex the box, the more one is forced to use black box testing to simplify. While this method can uncover unimplemented parts of the specification, one cannot be sure that all existent paths are tested. If a module performs a function which is not supposed to, the black box test does not identify it.

Question 6

How would you use Data Dictionary as a tool for file security and audit trails? (5 Marks) (May 2010)

Answer

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. Data dictionary contains the information about the identity of the computer programs or individuals permitted to access the data item for the purpose of file maintenance, upkeep or inquiry. It also maintains the identity of the computer programs or individuals, not permitted to access the data items. Because of maintaining

above mentioned information, a data dictionary is useful for the security e.g. to prohibit certain employees from gaining access to sensitive payroll data.

Accountants and auditors can also make good use of a data dictionary. For example, a data dictionary can help establish an audit trail because it can identify the input sources of data items, the computer programs that modify particular data items, and the managerial reports on which the data items are output. When an accountant is participating in the design of a new system, a data dictionary can also be used to plan the flow of transaction data through the system.

Finally, a data dictionary can serve as an important aid when investigating or documenting internal control procedures. This is because the details about edit tests, methods of file security, and similar information can be stored in the dictionary.

Question 7

As a person in-charge of System Development Life Cycle, you are assigned a job of developing a model for a new system, which combines the features of a prototyping model and the waterfall model. Which will be the model of your choice and what are its strengths and weaknesses?
(8 Marks) (Nov 2010)

Answer

As a person in-charge of system development life cycle, the spiral model will be the choice. The spiral model is a software development process, combining elements of both design and prototyping-in-stages, in an effort to combine/ advantages of top-down and bottom-up concepts. It is a system development method, which combines the features of the prototyping model and the waterfall model. The spiral model is intended for large, expensive and complicated projects. Its major distinctiveness is given as follows:

- (i) The new system requirements are defined in as much detail as possible. This usually involves interviewing a number of users representing all the external or internal users and other aspects of the existing system.
- (ii) A preliminary design is created for the new system. This phase is the most important part of 'Spiral Model' in which all possible alternatives that can help in developing a cost effective project are analyzed and strategies are decided to use them. This phase has been added specially in order to identify and resolve all the possible risks in the project development. If risks indicate any kind of uncertainty in requirements, prototyping may be used to proceed with the available data and find out possible solution in order to deal with the potential changes in the requirements.
- (iii) A first prototype of the new system is constructed from the preliminary design. This is usually a scaled-down system, and represents an approximation of the characteristics of the final product.

(iv) A second prototype is evolved by a fourfold procedure:

- evaluating the first prototype in terms of its strengths, weaknesses, and risks;
- defining the requirements of the second prototype;
- planning and designing the second prototype; and
- constructing and testing the second prototype.

Game development is a main area where the spiral model is used and needed, that is because of the size and the constantly shifting goals of those large projects.

Strengths:

- (i) Enhance risk avoidance;
- (ii) Useful in helping to select the best methodology to follow for development of a given software iteration based on project risk.
- (iii) Can incorporate waterfall, prototyping and incremental methodologies as special cases in the framework, and provide guidance as to which combinations of these models best fits a given software iteration, based upon the type of project risk.

Weaknesses:

- (i) Challenges to determine the exact composition of development methodologies to use for each iteration around the spiral.
- (ii) Highly customized to each project and thus is quite complex, limiting reusability.
- (iii) A skilled and experienced project manager required to determine how to apply it to any given project.
- (iv) No established controls for moving from one cycle to another cycle. Without controls, each cycle may generate, more work for the next cycle.
- (v) No firm deadlines cycles continue with no clean termination condition, so there is an inherent risk of not meeting budget or schedule.

Question 8

From the perspective of IS audit, what are the advantages of System Development Life Cycle?

(4 Marks) (Nov 2010)

Answer

From the perspective of the IS Audit, following are the possible advantages:

- The IS Auditor can have clear understanding of the various phases of SDLC on the basis of the detailed documentation created during each phase of the SDLC.

- The IS Auditor on the basis of the 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.

Question 9

Discuss in brief the various functional areas to be studied by a system analyst for a detailed investigation of the present system.
(8 Marks) (May 2011)

Answer

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 done intensively to fully understand the present system and its related problems.

The following areas should be studied in depth by a System Analyst for a detailed investigation of the present system:

- Review historical aspects:** A brief history of the organization is a logical starting point for an 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 and organization chart can identify the growth of management levels as well as the development of various functional areas and departments. The system analyst should investigate what system changes have occurred in the past including operations that have been successful or unsuccessful with computer equipments and techniques.
- 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 are 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.
- Review data files maintained:** 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. 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 on-line and off-line files which are maintained in the organization as it will reveal information about data that are not contained in any outputs. The related cost of retrieving and processing the data is another important factor that should be considered by the systems analyst.

- (iv) **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 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 system analyst must review the types of data communication equipments including data interface, data links, modems, dial up and leased lines and multiplexers, The system analyst must also 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.
- (v) **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 is used, how long it is kept on file, etc. must be investigated.
- (vi) **Review internal controls:** A detailed investigation of the present information system is not complete until internal control is 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 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.
- (vii) **Model the existing physical system and logical system:** As the logic of inputs, methods, procedures, data files, data communications, reports, internal controls and other important items are reviewed and analyzed in a top down manner; the process must be properly documented. 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.
- (viii) **Undertake overall analysis of the present system:** The final phase of the detailed investigation includes the analysis of the present work volume; the current personnel requirements; the present benefits and costs and each of these must be investigated thoroughly.