Niraj b. Pal
Section A

Date.
Page No. 1

1. Define system development life cycle (SDLC). Explain each phase of SDLC in detail. (2+8)

ans: Most organizations use a standard set of steps, called a systems development methodology to develop and support their information system. It is a standard process followed in an organization to conduct all the steps necessary to analyze, design, implement and maintain information systems. And System Development Life Cycle (SDLC) is the traditional methodology used to develop, maintain, and replace information systems. It is a framework that defines the steps involved in the development of software. It includes different phases as shown in figure below.

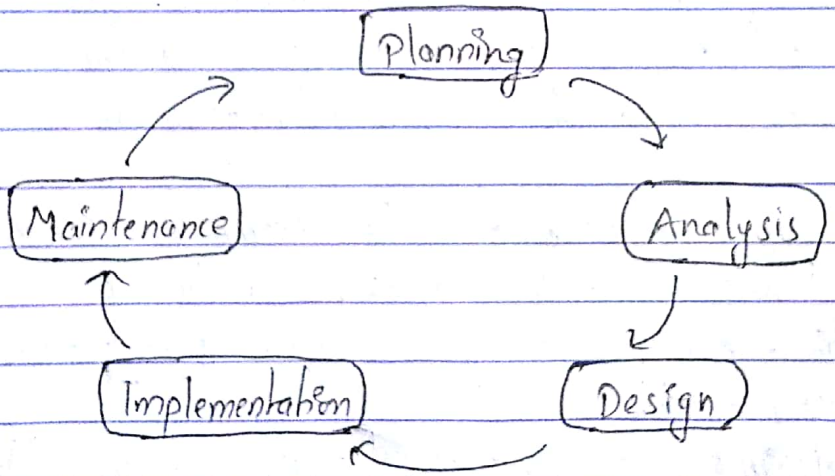

fig: The systems development life cycle

Planning

The first phase of the SDLC in which an organization's total information system needs are analyzed and arranged, and in which a potential information systems project is identified and an argument for continuing or not continuing with the project is presented. At the heart of systems development analysis and design are the second and third phases of SDLC.

↳ Define business problem and scope
↳ Produce detailed project schedule
↳ Confirm project feasibility
  • Economic, organizational, technical, resource, and schedule
↳ staff the project (resource management)
↳ Launch project → offical announcement

Analysis : The analysis phase usually requires a careful study of the current system, which continues two sub-phases: requirements determination and analysis study. Requirement determination process usually involves in a careful study of the current manual and computerized systems that may be replaced or improved within the project. Analysis study process usually involves analysts to study the structural requirements according to the components interrelationships and eliminate redundancies.

Design : In design phase, the description of the recommended solution is converted into logical, and then physical system specification. Analysis design an aspects to reports, databases, and computer processes.
Logical design is the part of the design process that is independent of any specific hardware and systems software.
Physical design is the part of the design phase in which the logical specifications of the system from logical design are transformed into technology-specific details from which all programming and system construction can be accomplished.

Implementation: In this phase, the information system is ~~coded~~ coded, tested, installed, and supported in the organization. During coding, programmers ~~and analysts~~ write the programs that make up the information system. During testing, programmers ~~write the programs that make up the information system~~. and analysts test individual programs and the entire system in order to find and correct errors. During installation, the new system becomes a part of the daily activities of the organization. Implementation activities also include initial user support such as the finalization of documentation, training programs, and ongoing user assistance.

Maintenance: This is the final phase of SDLC in which information system is ~~sys~~ systematically repaired and improved. When a system is operating in an organizations, users sometimes find problems with how it works and often think of better ways to perform its functions. Also the organization's needs ~~the~~ with respect to the system change over time.

write
Products,
outputs,
or
Deliver-
ables
~~Tasks~~

Date.
Page No. 5

Q2 Assuming monetary benefits of an information system at $85,000 per year, one-time costs of $75,000, recurring costs of $35,000 per year, a discount rate of 12 percent, and a five-year time horizon, calculate the net present value of these costs and benefits of an information system. Also calculate the overall return on investment of the project and then present a break-even analysis. At what point does breakeven occur? (10)

Soln.

Here,

Monetary benefits of an IS = $85,000 per year (Y)
One time costs = $75,000
Recurring costs = $35,000 per year. (
Discount rate = 12% (i)
Time Period = 5 years (n)

Net present value of Benefits and costs:
Present Value of Benefits or Costs can be calculated using the formula:

$$PV_n = Y \times \frac{1}{(1+i)^n}$$, where PV_n is the present value of Y dollars (currency) n years from now when i is discount rate.

Benefits ~~start~~ start from year 1, so the calculation of PV from year 1 onwards.

$$PV_1 = 85,000 \times \frac{1}{(1+0.12)^1} = 85,00 \times 0.8929 = 75,893$$

$$PV_2 = 85,000 \times \frac{1}{(1+0.12)^2} = 85,000 \times 67,761.$$

$PV_3 = 85,000 \times \frac{1}{(1+0.12)^3} = 85,000 \times = 60,501$

$PV_4 = 85,000 \times \frac{1}{(1+0.12)^4} = 85,000 \times = 54,019$

$PV_5 = 85,000 \times \frac{1}{(1+0.12)^5} = 85,000 \times = 48,231$

Net Present Value of Benefits : The net value of benefit will be the sum of overall benefits and will be calculated using following formula:

$NPV = PV_1 + PV_2 + PV_3 + PV_4 + PV_5$

$= 75893 + 67761 + 60501 + 54019 + 48231$

$= 306405$

Present Value (PV) calculations for costs: Here, the one-time cost ($75,000) is treated as cost occurring in year 0 (now).

$PV_0 = \frac{75000 \times 1}{(1+0.12)^0} = \$75000$

& Recurring cost ($35,000) happens every year starting at year 1.

$PV_1 = 35,000 \times \frac{1}{(1+0.12)^1} = 31250$

$PV_2 = 35,000 \times \frac{1}{(1+0.12)^2} = 27901$

$PV_3 = 35,000 \times \frac{1}{(1+0.12)^3} = 24,912$

$PV_4 = 35,000 \times \frac{1}{(1+0.12)^4} = 22,243$

$PV_5 = 35,000 \times \frac{1}{(1+0.12)^5} = 19860$

Net Present value of costs: (NPV) = $PV_0 + PV_1 + PV_2 + PV_3 + PV_4 + PV_5$

= $75000 + $31250 + $27901 + $24912 + $22243 + $19860

= $201168

then,

~~Over~~. Over..

Overall NPV = (NPV of All Benefit - NPV of all costs)

= $306405 - $201168

= $105239

And,

overall return on ~~inver~~ investment (ROI)

$= \frac{\text{Overall NPV}}{\text{NPV of all costs}}$

$= \frac{105239}{201168}$

$= 0.523$

Again

Break-Even Ratio = $\frac{\text{Yearly NPV Cash flow} - \text{Overall NPV Cashflow}}{\text{Yearly NPV cash flow}}$

Yearly NPV cash flow are calculated by substracting both one time cost and the present values of the recurring cash from the present value of the yearly benefit

i.e

Yearly NPV Cash flow = PV of Benefits − PV of Recurring Cash

Here,

PV of benefit for one time cost is 0.

So, yearly NPV cashflow at year 0 = $75,000.

" " " " " 1 = PV of benefit − PV of recurring costs

= $75,893 − $ 31250

= 44,643

at year 2 = $ 67,761 − $27901

= $ 39860

at year 3 = $ 60,501 − $ 24,912

= $ 35589

at year 4 = $ 54,019 − $ 22,243

= $ 31776

at year 5 = $ 48,231 − $ 19860

= $ 28371

Now, Over all NPV Cash flow ~~for~~ for i^{th} year = Yearly NPV ~~for i^{th} year~~. cash flow for i^{th} year + overall NPV cash flow for $(i-1)^{th}$ year. and overall NPV cash flow for one time cost ~~i=0 year~~ i.e 0 year is $-(\$75000)$

then,

Overall NPV cashflow for 1st year.

$= \$44643 + (-\$75000) = -(\$30357)$

for 2nd year $= \$39860 + (-\$30357) = \$9503$

for 3rd year $= \$35589 + \$9503 = \$45092$

for 4th year $= \$31776 + \$45092 = \$76868$

for 5th year $= \$28371 + \$76868 = \$105239.$

Here, the breakeven occurs between years 1 and 2. Because year 2 is the first in which overall NPV cash is non negative.

So Break-even rate $= \frac{\$39860 - \$9506}{\$39860} = 0.76$

Therefore, project breakeven occurs at approximately in 1.76 years.

Date.
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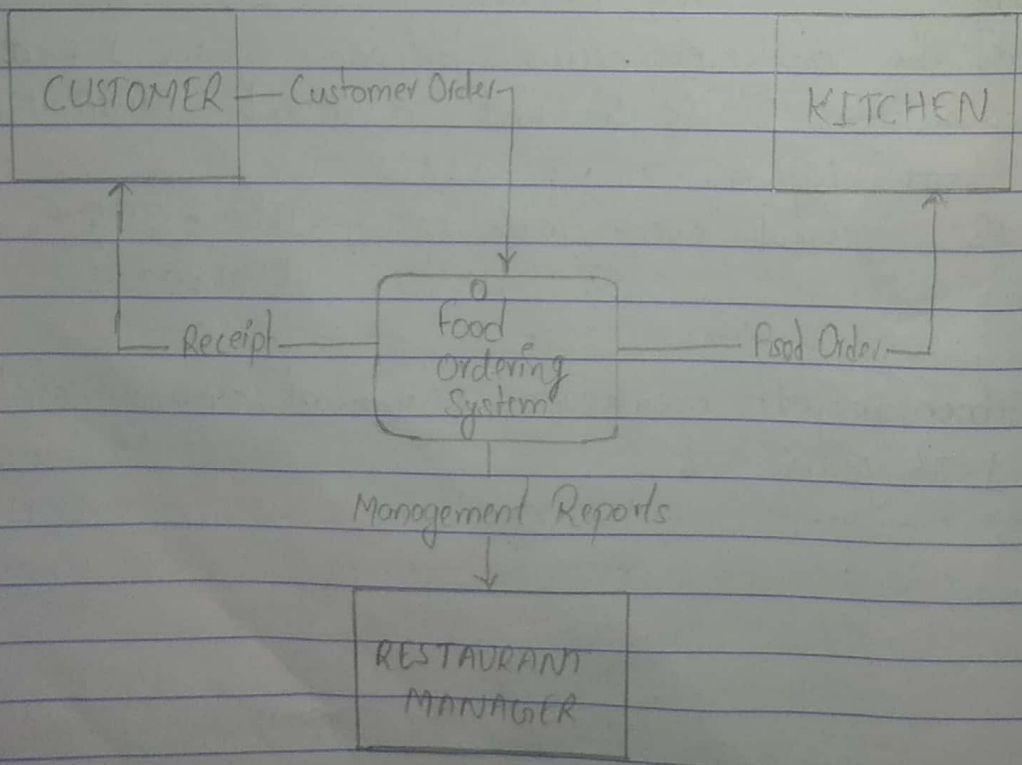
3. What is process modeling? Draw context diagram and DFD for a burger restaurant in Kathmandu City where many people frequently order burger at the restaurant. The restaurant uses an information system that takes customer orders, sends the orders to the kitchen, monitors goods sold and inventory, and generates reports for management. (2+8)

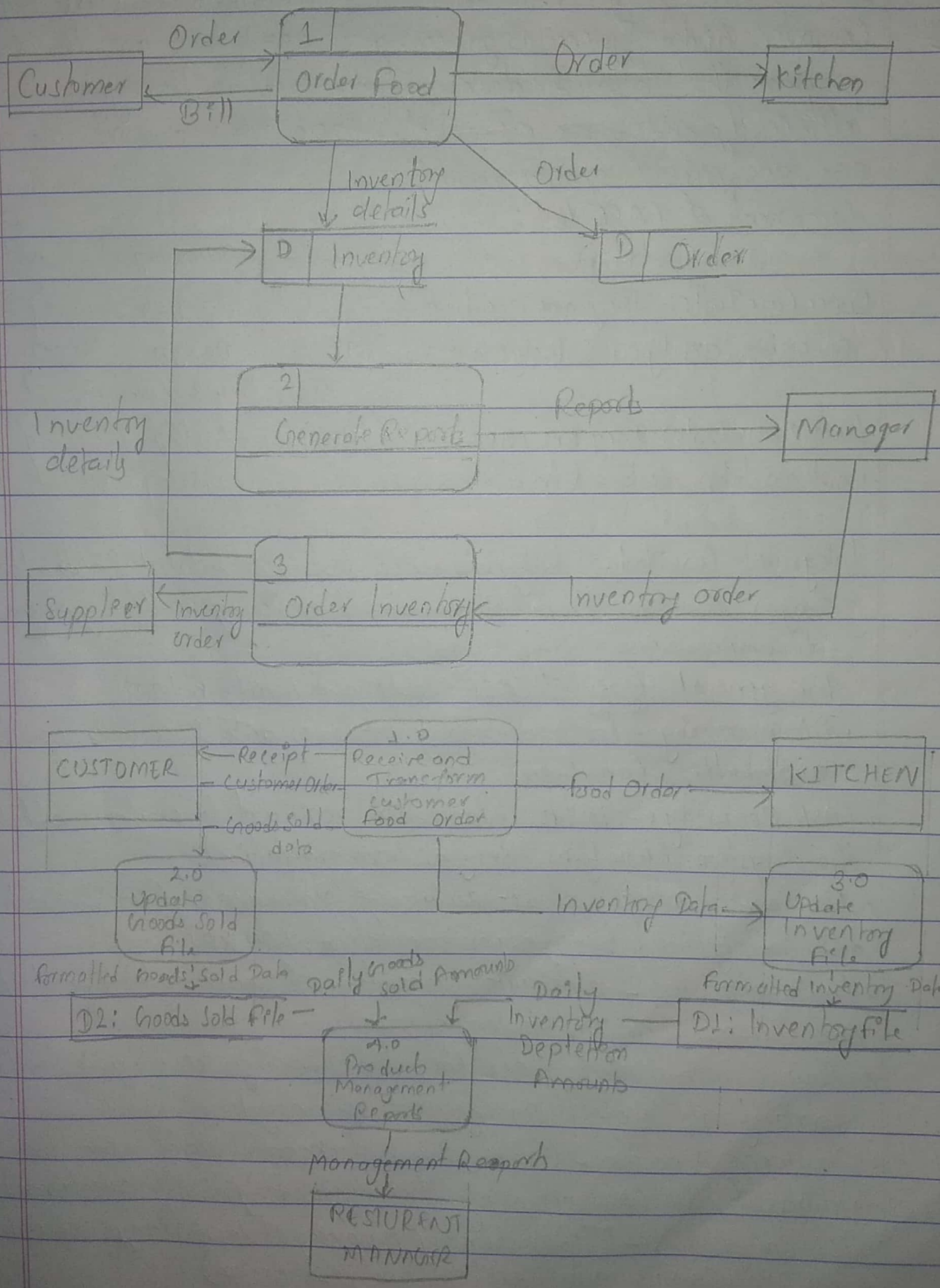
ans

Process Modeling involves graphically representing the processes, or actions, that capture, manipulate, store, and distribute data between a system and its environment and among components within a system. A common form of a process model is a data flow diagram (DFD).

Context diagram (containing only one process representing the entire system)



Level 1 DFD (only has three processes



Section B

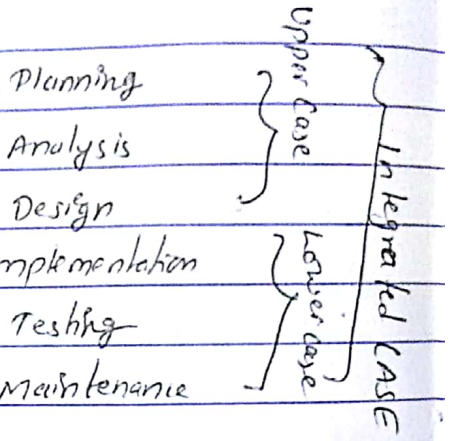
4. What is CASE tool? Explain different components of CASE tool. (3+9)

ans Computer-Aided Systems Engineering (CASE) tools are the software programs that help the development team do their jobs more efficiently and more effectively. These tools support the drawing and analysis of system models.

Components of CASE tool:

Upper Case Tools:- They are used in planning, analysis & design stages of SDLC.

Lower Case Tools: They are used in implementation, testing & maintenance.



Integrated Case tools: Integrated CASE tools are helpful in all the stages of SDLC, from Requirement gathering to Testing and documentation.

The general types of CASE tools are listed below:

- Diagramming - for representing processes, data & control structure graphically. (analysis)
- CASE Repository - holds information required to create, modify & evolve the system. (analysis, design, implementation)
- Form and report generators - automate generation of forms & reports to aid prototyping. (design, implementation, RAD, XP)
- Code generators - automate generation of source code from diagrams and forms. (design, implementation)
- Project management - aid them in the planning, tracking, controlling & reporting of project management. (planning)
- Document generator - Create standard reports based upon the contents of the CASE repository. (analysis, design, implementation)
- CASE analysis tools:- help to identify problems of inconsistency, redundancy and omissions. (more likely in analysis & design).

5. Define software project management. Explain each phase of the software project management in brief (1+4)

ans

Project management is a controlled process of initating, planning, executing, monitoring, controlling and closing project.
Five phases of project management process are explained below.

1. Initating:- The first phase of the project management process in which activities are performed to assess the size, scope, and complexity of the Project and to establish procedures to support later project activities.

Following are the Six project initiation activities

- 1. Establishing the project Initiation Team
- 2. Establishing a Relationship with the Customer
- 3. Establishing the Project Initiation Plan
- 4. Establishing the Management Procedures
- 5. Establishing the Project Management Environment and Project Workbook
- 6. Developing the Project Charter.

2. Planning the Project:

The second phase of the project management process that focuses on defining clear, discrete activities and the work needed to complete each activity within a single project.

The types of activities that can perform during project Planning are

- 1. Describing project Scope, Alternatives, and Feasibility
- 2. Dividing the project into Manageable Tasks

3. Estimating Resources and Creating a Resource Plan
4. Developing a Preliminary Schedule
5. Developing a Communication Plan
6. Determining Project Standards and Procedures
7. Identifying and Assessing Risk
8. Creating a Preliminary Budget
9. Developing a Project Scope Statement.
10. Setting a Baseline Project Plan.

3. Executing the Project:
Project execution puts the Baseline Project Plan into action. Within the context of the SDLC, project execution occurs primarily during the analysis, design, and implementation phases.

Five project executing activities are
1. Executing the Baseline Project Plan.
2. Monitoring Project Progress against the Baseline Project Plan
3. Managing Changes to the Baseline Project Plan
4. Maintaining the Project Workbook
5. Communicating the Project Status

4. Closing Down the Project:
The final phase of the project management process that focuses on bringing a project to an end. A Project can conclude with a natural or unnatural termination. A natural termination occurs when the requirements of the project have been met — the project has been completed, and is a success. An unnatural termination occurs when the project is stopped before completion.

Summarizes the project closedown activities:

1. Closing Down the Project
2. Conducting Postproject Reviews
3. Closing Closing the Customer Contract.

Q.6. Explain the process of identifying and selecting information system development project in brief. (5)

ans: The first phase of the SDLC is planning, consisting of project identification and selection, and project initiation and planning. During project identification selection, a senior manager, a business group, an IS manager, or a steering committee identifies and assesses all possible systems development projects that an organization unit could undertake.

Project identification and selection consists of three primary activities:

1. Identifying potential development projects
2. Classifying and ranking IS development projects
3. Selecting IS development projects.

1. Identifying potential development projects: Organizations vary as to how they identify projects. The process can be performed by
   - a key member of top management, either the CEO of a small-or medium-sized organization or a senior executive in a larger organizations
   - a steering committee, composed of a cross section of managers with an interest in systems;
   - user departments, in which either the head of the requesting unit or a committee from the requesting department

decides which projects to submit (often, you, as a systems analyst, will help users prepare such requests); or
y the development group or a senior IS manager.

2. Classifying and ranking IS development projects:
As with the project identification process, classifying and ranking projects can be performed by top managers, a steering committee, business units, or the IS development group. Additionally, the criteria used when assigning the relative merit of a given project can vary. In any given organization, one or several criteria might be used during the classifying and ranking process.
As with the project identification & selection process, the actual criteria used to assess projects will vary by organization.
If, example

3. Selection IS development projects: The final activity in the project identification and selection process is the actual selection of projects for further development. Project selection is a process of considering both short- and long-term projects and selecting those most likely to achieve business objectives. Additionally, as business conditions change over time, the relative importance of any single project may substantially change.
Thus, the identification and selection of projects is a very important and ongoing activity.

7. Explain the ~~process~~ JAD method for determining requirements? What are the benefits of using JAD?

Ans: Joint Application Design (JAD) is a structured process in which users, managers, and analysts work together for several days in a series of intensive meetings to specify or review system requirements.

Joint Requirements Planning is a process whereby highly structured group meeting is conducted to analyze problems and define requirements. JRP is a subset of a more comprehensive joint application development (JAD). The JRP participants are:

↳ Sponsor:- This person is normally an individual who is in top management and has authority that spans the different departments and users who are to be involved in the systems project.

↳ Facilitator:- The JRP facilitator or leader is usually responsible for leading all sessions that are held for a systems project.

↳ Users and Managers: Users devote themselves to the JRP sessions to effectively communicate business rules and requirements, review design prototypes and make acceptance decisions. Managers approve project objectives, establish project priorities, approve schedules & costs, and approve identified training needs & implementation plans.

↳ Scribe(s):- Scribes are responsibles for keeping records pertaining to everything discussed in the meeting.

↳ IT staff:- IT personnel listen and take notes regarding issues and requirements voiced by the users and managers. Normally, IT personnel do not speak unless invited to do so.

Benefits:

- It actively involves users & managers in the development project
- It reduces the amount of time required to develop systems.
- When JRP incorporates prototyping as a means for confirming requirements and obtaining design approvals, the benefits of prototyping are realized.

8. What is data modeling? How is it different from process modeling? How do you use entity relationship model for data modeling? (1+2+2)

ans: A conceptual data model is a detailed model that captures the overall structure of organizational data that is independent of any database management system or other implementation considerations. Data modeling is the process of creating a data model for the data to be stored in a Database. This data model is a conceptual representation of Data objects, the associations between different data objects and the rules. The two types of Data Models techniques are 1. Entity Relationship (E-R) Model
2. UML (Unified Modelling Language)

Data modeling	Process modeling
It explains the characteristics and structure of data independent of how the data may be stored in computer memories and is usually developed iteratively.	It involves graphically representing the processes, or actions, that capture, manipulate, store, and distribute data between a system & its environment & among components within a system.

↳ The most common format used for it is entity-relationship diagramming ~~(E-R)~~ (ERD)

↳ The most common format used for it is data-flow diagram (DFD).

The basic E-R modeling notation uses three main constructs: data entities, relationships and their associated attributes which are used for data modeling.

↳ Entities

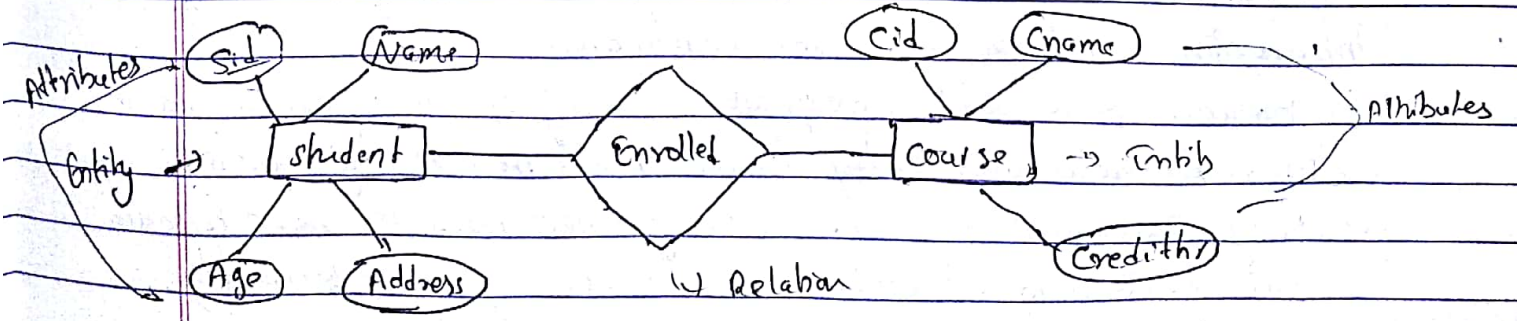
An ERD entity is a definable thing or concept within a system, such as a person/role (e.g. Student), object (eg. Invoice), concept (e.g. Profile) or event (e.g. Transaction). When determining entities, think of them as nouns. An Entities is shown as a rounded rectangle, with its name on top and its attributes listed in the body of the entity shape.

↳ Attributes

Also known as a column, an attribute is a property or characteristic of the entity that holds it. An attribute has a name that describes the property & a type that describes the kind of attribute it is, such as varchar for a string, and int for integer.

↳ Relationships.

A relationship between two entities signifies that the two entities are associated with each other somehow.



9. How do you format forms and reports? Explain general guidelines for formatting forms and reports? (2+3)

ans: Designing forms & reports is a user-focused activity that typically follows a prototyping approach. First, you must gain an understanding of the intended user and task objectives by collecting initial requirement during requirements determination determination. During this process, several questions must be answered. These questions attempt to answer the "who, what, when, where, and how". related to the creation of all forms & reports as given below.

1. Who will use the form or report?
2. What is the purpose of the form or report?
3. When is the form or report needed or used?
4. Where does the form or report need to be delivered and used?
5. How many people used need to use or view the form or report?

Over the past several years, industry and academic researchers have spent considerable effort investigating how information formatting influences individual task, performance, and perceptions of usability. Through this work, several guidlines for formatting information have emerged as given below:

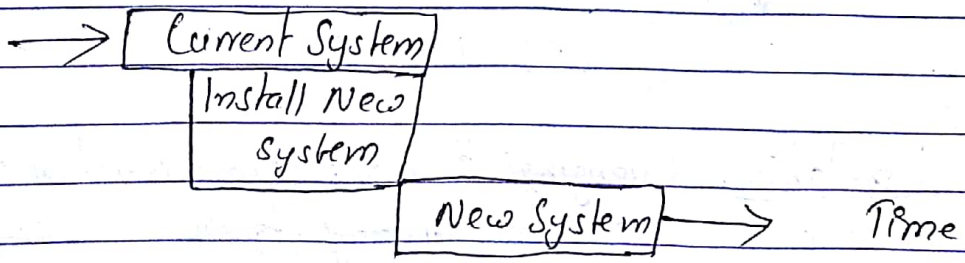
1. Meaningful titles: Titles should be clear and specific describing content and use. They should include version information and current date.
2. Meaningful information: forms should include only necessary information with no need to modification.
3. Balance of layout: Adequate spacing and margins should be used. All data and entry fields should be clearly labeled.
4. Easy navigation system: Clearly show how to move forward and backward. Clearly show where you are currently.

Notify the user when on the last page of a multi- paged sequence.

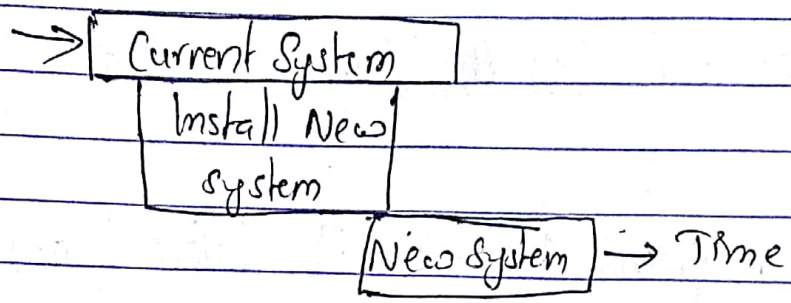
Q.10. What is installation? What are the different approaches to installation? (1+4)

ans: Installation is the organizational process of changing over from the current information system to a new one. All employes who use a system, whether they ~~are~~ were consulted during the development process or not, must give up their reliance on the current system and begin to to rely on the new system. Four different approaches to installation have emerged over the years: direct, parallel, sigle- location & paphased. The approach an organization decides to use will depend on the scope and complexity of the change associated with the new system and the organization's risk ~~aversion~~ aversion.

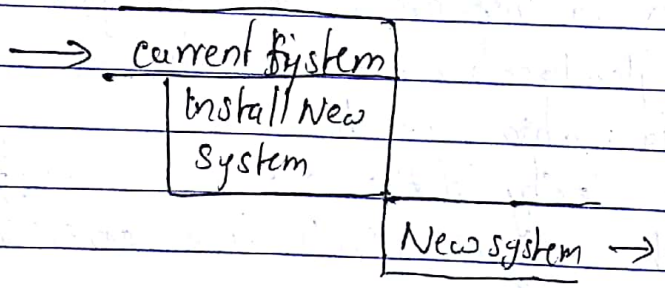
Direct installation: Changing over form the old system to a new one by turning off the old system when the new system is turned on.

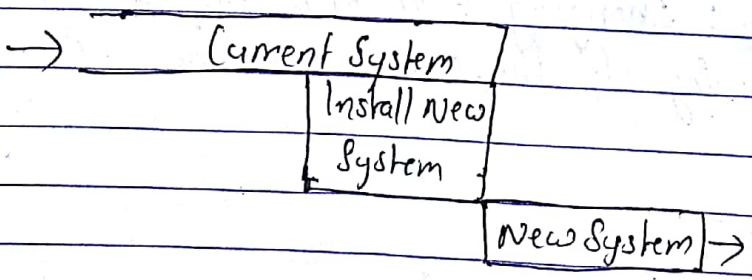


Parallel Installation:- Running the old information system and the new one at the same time until management decides the old system can be turned off.



Single-location installation: Trying out an new information system at one site and using the experience to decide if and how the new system should be deployed throughout the organization. Also known as location or pilot installation.





Phased Installation: Changing from the old information system to the new one incrementally, ~~starting to the new one incrementally~~, starting with one or a few functional components and then gradually extending the installation to cover the whole new system

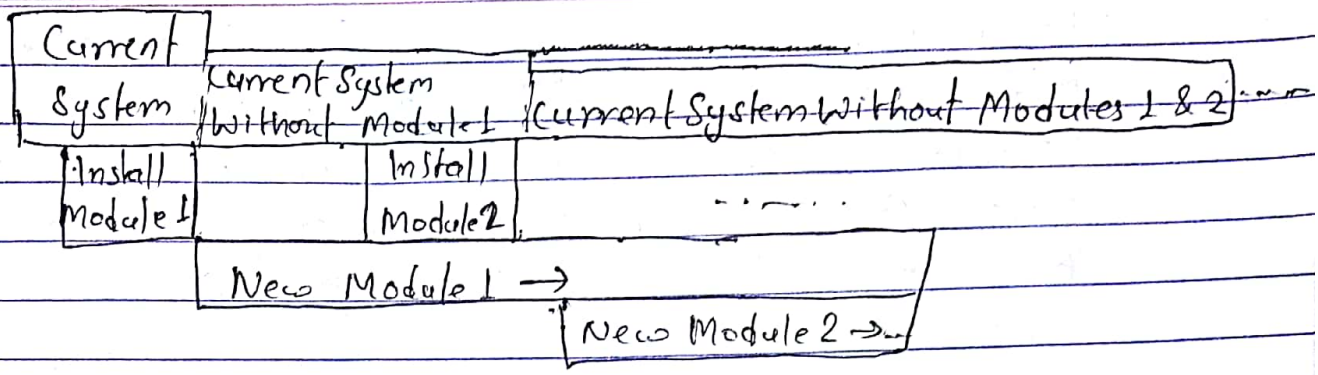


fig: Phased installation.

11. What is class diagram? Explain class diagram with suitable example. (2+3)

ans A class diagram shows the static structure of an object-oriented model: the object classes, their internal structure, and the relationships in the which they participate.

In UML, a class is represented by a rectangle with three compartments separated by horizontal lines. The class name appears in the top compartment, the list of attributes in the middle compartment, and the list of operations in the bottom compartment of the rectangle.

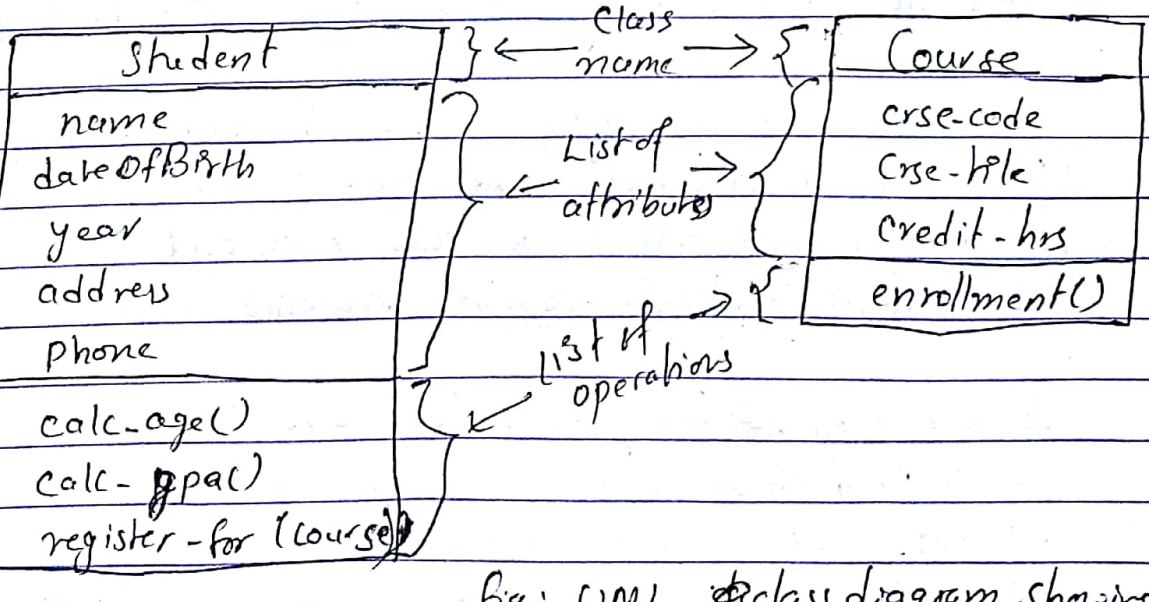


fig: UML class diagram showing two classes

The diagram in the above fig shows two classes, Student and Course, along with their attributes and operations. The student class is a group of Student objects that share a common structure and a common behavior. Each object knows to which class it belongs.

12. Write short notes on:

(a) Agile development

ans: The Agile software development model was mainly intended for helping developers build a project which can adapt to transforming requests quickly. So, the most important endeavor for developing the Agile model is to make easy and rapid project achievement. For attaining this ~~tet~~ task, developers need to preserve the agility during development. Agility can be achieved by correcting the progression to the project by eliminating activities which may not be crucial for that specific project.

It share three key principles (According to Fowler):

(1) a focus on adaptive rather than predictive methodology
(2) a focus on people rather than roles, and
(3) a focus on self-adaptive processes.

It is not for ~~add~~ every project, it is for:

- unpredictable or dynamic requirements
- responsible & motivated developers, and
- customers who understand the process & will get involved

b). Maintenance cost

Information systems maintenance costs are a significant expenditure. For some organizations, as much as 60 to 80 percentage of their information systems budget is allocated to maintenance activities. These huge maintenance costs are due to the fact that many organizations have accumulated more and more older so-called legacy systems that require more and more maintenance

Maintainablity: the ease with which software can be understood, corrected, adapted, and enhanced.

Numerous factors that influence the maintainablity of a system:

- the number of latent defects
- number of customers for a given system.
- Quality of system documentation
- Maintenance personnel.
- Tools
- well-structured programs.