

L-3/T-2/CSE

Date : 07/10/2023

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2021-2022

Sub : **CSE 325** (Information System Design)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) A company is very much reputed in completing their IT projects in time with desired quality which meets functional and non-functional requirements correctly. They have pool of experienced and qualified programmers who are key to this success. If a project does not get that much progress then those qualified programmers are assigned to solve the problem. The programmers are low paid and generally without experience. The software development company were awarded so many S/W development projects in the past. Recently the company did not win a bid where there was a requirement to have a process to deliver quality software. Assess the company in terms of CMMI level. What are the necessary steps to be done to upgrade the company in the next CMMI level? **(10)**
- (b) Compare different versioning models with examples focusing the following: **(10)**
- (i) Locking
  - (ii) Conflict resolution
  - (iii) Practical use
  - (iv) Merging
- (c) How are Push and Pull operations performed in Distributed Version Control? Consider a scenario in a Distributed Version Control system when three users work locally on a file A at the same time. Show the steps of committing their changes. **(15)**
2. (a) Explain the following rules with suitable examples in designing user interfaces. **(12)**
- (i) Offer informative feedback
  - (ii) Design dialogue to yield closure
  - (iii) Permit easy reversal of action
  - (iv) Reduce short term memory load to the user
- (b) What are the basic principles to make the effort estimation of software projects accurate? **(5)**
- (c) It is difficult to estimate the effort when you start a project. In the subsequent steps of S/W development, the scope and complexity of the project becomes clear and we get chance to do better estimation. Explain how COCOMO II model addresses this during estimation. **(6)**
- (d) Titas Gas Transmission and Distribution Company is trying to have a new billing software. There are several alternatives to implement that. The first one is to acquire a ready made billing software from a software development company with the cost of Tk 1 crore.

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### Contd ... Q. No. 2(d)

It might require 20 additional changes/reports to customize the software for the use of the company. The cost of each easy, moderately difficult or extremely difficult change/report is Tk 50K, Tk 75K or Tk 100K, respectively. The probability of the changes/reports are easy and moderately difficult are 0.30 or 0.25, respectively. The second option is to reuse an open source billing software by an in-house team of 10 members. There are actually two steps in using such a software. In the first step, the in-house team must understand the open source code and install it for proper understanding. The average salary of the in-house team members is Tk 75K. It will take 6 months to understand the open source system if it is straight forward with the probability of 0.60. Otherwise it will take 9 months if the open source system is complex. In the next step it may require another 10, 20 or 40 additional screens or reports with the probability of 0.25, 0.50 and 0.25, respectively to fulfill the need of the client. The cost of developing one screen/report is 1 man-month by the recruited employees. The third option is to purchase a generalized billing software and customize it for the use of the client. The cost of the generalized billing software is Tk 50 lacs. But the cost of consultants for necessary configuration is Tk 20 lacs. It might require 30 additional changes/reports to customize the software for the use of the company. The cost of each easy or extremely difficult change/report is Tk 100K or Tk 150K. The probability of the changes/reports are easy is 0.30. Which one would be best strategy for developing the billing software?

(12)

3. (a) Consider an Automated Teller Machine (ATM) of a Bank. You can have the following banking operations using the ATM card:

(8)

- (i) Withdrawing money
- (ii) Checking Balance from Core Banking System
- (iii) Changing PIN (Personal Identification Number)
- (iv) Depositing money
- (v) Transferring money to another account
- (vi) Recharging your mobile phone

Draw a use case diagram showing the actors and use cases.

- (b) Write down the use case for withdrawing money and changing PIN.

(8)

- (c) Draw collaboration diagram for the use case for withdrawing money using ATM Card. Show the steps of deriving class diagram from the collaboration diagram.

(19)

4. (a) As project manager how do you form your team for the following software projects:

(9)

- (i) A project for solving complex scientific problem
- (ii) Development of ERP with many modules
- (iii) A software which must be ready at the beginning of the next year.

- (b) What is Software Failure? What are the components failure cost? How can you prevent the failure in software development?

(8)

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### Contd ... Q. No. 4

- (c) Explain the term measure and metric with examples in the discipline of software measurement. Explain two measurement principles with necessary examples. (7)
- (d) Your goal is to evaluate the performance of the programmers. Define the metrics to achieve this goal using goal oriented software measurement. (11)

## SECTION – B

There are **FOUR** questions in this section. **Answer Question 5 (compulsory) and any other two (2) questions.**

5. (a) In Bangladesh, every school teacher is appointed based on MPO regulation. According to this regulation, each candidate has to meet certain qualification criteria defined for each post (of a particular subject) of a certain salary grade. The qualifications are stated in terms of age, subject of graduation, and result at different levels. Example of such requirement is shown below. This is for a particular type of institution, e.g., school, college, etc. (13)

Table for Q 5(a)

১৩	সহকারী শিক্ষক (সামাজিক বিজ্ঞান)	<p>১) শীকৃত বিষ্঵বিদ্যালয় হতে সংশ্লিষ্ট বিষয়সহ মাত্রক ডিপ্রি /সময়মান ও বিএড ডিপ্রি /সময়মান। অথবা</p> <p>২) শীকৃত বিষ্঵বিদ্যালয় হতে সংশ্লিষ্ট বিষয়সহ মাত্রক ডিপ্রি /সময়মান। সম্প্রতি শিক্ষাজীবনে ০১ (এক) টির বেশি ৩য় বিভাগ/প্রেমি/সময়মান প্রাপ্তিযোগ্য হবে না।</p>	<p>অনুর্ধ্ব ৩৫ বছর (সম্পদের ইনডেক্সধারীদের জন্য বয়সসীমা শিখিলযোগ্য)</p>	<p>(১) প্রেড-১০ (১৬০০০-৩৮৬৪০/-)</p> <p>(২) প্রেড-১১ (১২৫০০-৩০২৩০/-)</p>
১৪	সহকারী শিক্ষক (গণিত)	<p>১) শীকৃত বিষ্঵বিদ্যালয় হতে পরিষিদ্ধ বিজ্ঞান বিভাগে মাত্রক ডিপ্রি /সময়মান ও বিএড ডিপ্রি /সময়মান। অথবা</p> <p>২) শীকৃত বিষ্঵বিদ্যালয় হতে পরিষিদ্ধ বিজ্ঞান বিভাগে মাত্রক ডিপ্রি /সময়মান। সম্প্রতি শিক্ষাজীবনে ০১ (এক) টির বেশি ৩য় বিভাগ/প্রেমি/সময়মান প্রাপ্তিযোগ্য হবে না।</p>	<p>অনুর্ধ্ব ৩৫ বছর (সম্পদের ইনডেক্সধারীদের জন্য বয়সসীমা শিখিলযোগ্য)</p>	<p>(১) প্রেড-১০ (১৬০০০-৩৮৬৪০/-)</p> <p>(২) প্রেড-১১ (১২৫০০-৩০২৩০/-)</p>

When a candidate applies for a post, his/her qualifications are matched against such requirements. If the qualification criteria satisfy, he/she is eligible to sit for a recruitment test. Design a BPMN diagram to design the scenario discussed above.

- (b) Draw an ERD to design database for storing the qualification criteria depicted in Q 5(a) for each type of institution. (12)
- (c) Draw a Mock dashboard (considering scenario of Q 5(a)) to show the list of candidates who are found not eligible to appear at the recruitment test for not satisfying one or more criteria. You have to clearly demonstrate the criteria not matched so that the viewer can easily understand the reason for disqualify. (10)

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6. (a) To purchase books, the sites like Amazon.com or Rokomari.com are widely used. Draw a software architecture to implement such a system following Microservice architecture. (15)  
 (b) The web portal of stock market experiences frequent write operation and also updated data is expected by viewers. Which cache write strategy is most appropriate for such application and why? (11)  
 (c) Give three example scenarios where Data-Centered software architecture is appropriate. (9)
  
  7. (a) There is a common printing service for printing secured official documents in an office which is used by different departments. Sometimes, multiple departments send lots of printing request simultaneously and want to get assured of their request is being addressed. What technology should be recommended by the designer of such a system? Draw a block diagram for the required design. (9)  
 (b) What do you understand by Second Order SQLinjection? Give an example. What is the primary (most recommended) way of preventing SQLinjection? (12)  
 (c) You have developed an application for different clients. You need to deploy that quickly in different types of servers of the clients. What DevOps technology will serve your purpose? (8)  
 (d) In your hardware infrastructure, servers of different capacity are being used. Which load balancing algorithm is best suited for your case? (6)
  
  8. (a) A university department organizes seminars on a number of research topics. These seminars take place in September each year. There is a computer program to help with the administration of these seminars. In the program there is an object representing a seminar, and this Seminar Class has a number of possible states. (13)  
 A seminar is first proposed by a professor. Once dates, times and rooms for the seminar have been arranged, it is considered as scheduled. On the second Monday in August the seminar is advertised and it becomes open for enrolment to the students. When all places are taken, the seminar is full and cannot allow any more enrolment. If a student drops out (cancels his/her application) the seminar reverts to the Open For Enrolment position. Two days before the start of the seminar, enrolment will be closed (no more applicants will be considered).  
 Design a State diagram to show different states of a Seminar in the context discussed above.  
 (b) What is the difference between Reflected and DOM-based XSS attack? Draw the flow of a Reflected XSS attack? (12)  
 (c) Discuss Interactor, Indirect and Domain viewpoints for the requirement analysis of a Stock Price Prediction system. Mention three non-functional requirements for such a system. (10)
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**SECTION – A**

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) You are designing software for a Life Insurance company. The requirements are as follows. If the client has a stable job with salary more than 50,000/= and his/her age is below 40 years, s/he is considered a safe customer and offered a Gold rate for premium payment. If any of these conditions are not made, the premium is 20% higher than the Gold rate. Clients may opt to pay premium installment monthly or yearly and via cheque or mobile banking. If a client fails to make a payment, a penalty of 10% of original premium is applied on the next premium. Before due date of premium, the client receives SMS mentioning the amount to pay. If s/he fails to pay two successive premiums, his/her policy is cancelled. (14)

Draw a BPMN diagram to design the premium calculation scenario discussed above.

- (b) What do you understand by Feature Envy, Refused Bequest and Cyclomatic Complexity type of Code Smell. Give an example of Inappropriate Intimacy in the context of Code Smell. (16)

- (c) What do you need to check about requirements collected for a software application? (5)

2. (a) In an educational institution, the teachers offer different course in different semesters. Some courses are jointly offered by multiple teachers. Students enroll in multiple offerings and receive grades at the end of the course. The grades are computed following some grading rule from the marks of different test items. Draw a Class Diagram to reflect the scenario discussed above. Apart from model classes, show the classes that would implement business logic and store computed values. You are not required to show any Boundary or Controller class. (13)

- (b) Draw Collaboration diagram for the scenario described in Q 2(a) to show the computation of grade. You are required to show relevant Boundary and Controller classes. (14)

- (c) Give examples of 4 types of Non-Functional requirements for the example of the application to be developed for the scenario discussed in Q 2(a). (8)

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3. (a) If you want to make a tour with a tourism operator, you have to select a package from their website. Each package presents a combination of site visit, hotels, food, activities. Depending on these components and number of days to spend, the price of the packages varies. A package can be customized for a group of tourists with size larger than 10 and price adjustment is made accordingly. The customer has to book a package with partial advance payment. The remaining payment is made prior to the tour to confirm all the components of the tour. If any activity is not available, the refund is made later. Draw a Sequence diagram to model the scenario discussed above. (15)
- (b) What do you understand by Second Order SQL injection? Give an example. What is the primary (most recommended) way of prevention SQL injection? (12)
- (c) Show an example of "extends" in a Use Case diagram. (8)
4. (a) In an automatic Inventory Management System, an office stocks different products that are expected to be used by the users. When a user needs something, s/he makes a Requisition. If that is in the stock, the requisition is approved by the management and becomes ready to Issue. If the stock-level of a product reaches below a threshold, a re-order request is generated. If the product is not consumable, it has to be returned when the employee is retired or transferred. (12)
- Design a State diagram to show different status of a product in the context discussed above.
- (b) What is the difference between Reflected and DOM-based XSS attack? Draw the flow of a DOM-based XSS attack? (11)
- (c) What do you understand by relative importance of usability dimensions in the context of User Interface design? Discuss in the context of a Sales Management software. (12)

### SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Class A has a public method which is needed by class B. If class B inherits class A, class B gets access to that method. On the other hand, passing an instance of class A to class B also enables class B to access that method. How do you decide which technique to use? Explain your reasoning. (15)
- (b) Give an example of "Evil switch" anti-pattern. Incorporation of which design principle is most likely to avoid "Evil switch"? (10)
- (c) Both KISS and YAGNI encourage simpler code. Explain their differences with a code example. (10)

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6. (a) State the basic idea of each of five SOLID principles. Explain them with appropriate code examples. (25)
- (b) What is the difference between dependency inversion and dependency injection? Explain with an appropriate code example where we need to separate an object's creation from its use. (10)
7. (a) Assume you are a scrum master and you are in the beginning of a sprint after which you need to deliver an additional database search feature along with UI. Plan a sprint which will last for 4 weeks. Include all the scrum events. (15)
- (b) What are the differences between message-driven architecture and event-driven architecture? Explain with an example. (10)
- (c) What is containerization? Why do we need containerization even though we have virtual machines? (10)
8. (a) Among all the components of a simple three-tier web application expecting to process large number of requests per second, which component is most likely to become initial bottleneck? What are the solutions? (15)
- (b) What is the difference between vertical and horizontal scaling? (10)
- (c) Discuss different production deployment strategies for web applications. (10)
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2019-2020

Sub: **CSE 325** (Information System Design)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

**SECTION – A**There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Describe briefly how Unified Modeling Language is used for visualizing, specifying, constructing and documenting. **(10)**  
(b) Consider a microwave oven that uses microwave technology for the purpose of heating foods. If you want to heat food items you must enter the food item in the heating chamber and then set the timer using the key pad in the front panel located on the door of micro wave oven. You have to press the start button to start heating. The oven will give a beep signal when the heating is complete. You can stop heating by pressing the Stop button any time. Do the following for the micro wave oven system: **(6+12+7=25)**
  - (i) Draw the use case diagram by identifying the actors and use cases for this micro wave oven system.
  - (ii) Write down the detailed use case scenarios related to setting the timer and heating.
  - (iii) Write down the acceptance test cases for these use cases as well.
2. (a) Explain the concept for Class and Instance with necessary examples. **(7)**  
(b) An account holder of Sonali Bank can withdraw an amount from his or her account through debit card with the help of ATM (Automatic Teller Machine) booth. The account holder must insert the card into the machine and then after authorization through PIN (Personal Identification Number) the amount of money to be withdrawn will be entered through keypad of the ATM machine. The requested amount will be checked against the balance of the bank account and the amount will be dispensed from the machine if there is available balance to satisfy the request. There must be a notification to the registered phone number to the account holder from central server of the bank. Finally, the ATM machine ejects the card after the transactions. Show the steps of identifying the classes from this use case scenario. **(20)**  
(c) What do you mean by Software Process and Software Process Model? How do you describe a process? Why is Software Process so important for software development? **(8)**

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3. (a) Define Waterfall Model for Software Engineering Process. Explain the problems of Waterfall Model with necessary examples. (6)
- (b) Compare the concept of incremental delivery in the process model with the Boehm's spiral model. (7)
- (c) "Rational Unified Process can be configured to Waterfall Model" – Justify. (7)
- (d) Prescribe appropriate process model for the following cases with proper reasoning: (15)
- (i) Development of an POS (Point of Sale) ERP for computer accessories shops of Bangladesh.
  - (ii) A war Simulator for Bangladesh Army.
  - (iii) Development of Insulin Injection System for Intensive Care Unit as an outsourcing project of an US based biomedical engineering company.
4. (a) Write short notes on the following in the context of Extreme Programming: Pair Programming, Testing, Change Adoption. (12)
- (b) What are the advantages of Distributed Version Control model of source control over Copy Modify Merge Model? Consider a scenario where Andy, Bobby, Cally clone the remote repository locally. They work locally on a certain File F and commit locally to their repositories. What will happen if Cally wants to Push their change first, then Andy tries to push his change and finally Bobby tries to Push her change. Show the steps for conflict resolution in this scenario. (15)
- (c) Define 5 levels of CMMI with process characteristics, behaviors and process areas. (8)

### **SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) If you want to make a tour with a tourism operator, you have to select a package from their website. Each package presents a combination of site visit, hotels, food, activities. Depending on these components and number of days to spend, the price of the packages varies. A package can be customized for a group of tourists with size larger than 10 and price adjustment is made accordingly. The customer has to book a package with partial advance payment. The remaining payment is made prior to the tour to confirm all the components of the tour. If any activity is not available, the refund is made later.
- Draw a BPMN diagram to design the portal of the tourism operator. (15)
- (b) Draw state diagram for a customer booking considering the scenario described for Q. 5a. (12)
- (c) How will you define Message Queue used while deploying software application? What are the benefits of using it? (8)

## CSE 325

6. In a Payroll Management System, the salary of every company is managed. The salary comprises several components such as basic, house rent (a certain percentage of basic), medical allowance, etc. and deductible components like PF contribution, insurance subscription, etc. If an employee takes loan, the repayment is adjusted. At the beginning of a financial year, basic of all employees are incremented following a rule which defines the percentage of increment. However, each salary grade has a maximum bound. The increment will be applicable within this bound.

Based on the scenario discussed above, answer to the following questions a) and b):

- (a) Draw the ER diagram of this system. (15)  
(b) Draw Sequence diagram for the bulk salary increment usecase. (12)  
(c) Why Indexes are used in Database? When should we avoid them? (8)

7.  (a) Create a Collaboration diagram for the following scenario descriptions for a Gym Center's customer management system.

When members join the Gym Center, they pay a fee for a certain length of time (in months). The club wants to send SMS to members, asking them to renew their memberships one week before their memberships expire. About one-third of the members do not renew their memberships. These members are sent follow-up surveys to complete about why they decided not to renew so that the Center can learn how to increase retention. If the member did not renew because of cost, a special discount is offered to that customer. Typically, 12% of accounts are reactivated because of this offer. (15)

- (b) What are the questions to be considered about a caching technology to be used in your software deployment? Discuss Write-back caching mechanism. (12)  
(c) How should the requirements be validated? (8)

8. (a) What are the limitations of monolithic architecture? Discuss the features of microservice and explain how they overcome the limitations. Draw an ideal deployment architecture for BIIS system if it is developed using microservice architecture. (16)  
(b) Write down one nonfunctional requirement of each type for the website of a stock exchange in Bangladesh. There are 6 types of requirements. (9)  
(c) Briefly discuss 5 types of load balancing algorithms. (10)
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## BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2018-2019

Sub: **CSE 325** (Information System Design)

Full Marks: 180 Section Marks: 90 Time: 2 Hours (Sections A + B)

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

**SECTION – A**There are **FOUR** questions in this section. Answer any **THREE**.

1. a) In an office XYZ, the employees can apply for loans which are approved by the management if all the requirements are met. The requirements include age, certain years of experience, clean disciplinary record, etc. The loans can be created in the system by the user specifying relevant parameters such as interest rate, years to repay, maximum allowed amount based on salary of the applicant, etc. These conditions may change over time. 22
- Design a Class diagram to implement the scenario described above.
- b) Show an example of “extends” in a Use Case diagram. 8
2. a) The following is a narrative description of the business process of a bank: 20  
There are two types of users in a Bank: Normal user and Foreign User. Both users can create account, deposit money and withdraw money. For money withdrawal there are certain rules. A user can make a withdrawal of maximum 3, 00,000 taka per day. At each transaction the highest limit of withdrawal is 1,00,000 taka. A user can make a maximum of 5 withdrawals per day. After every three months, interest is added to the account balance. If an account balance reaches 20,00,000 taka, for every deposit to that account 2% bonus is applied. The foreign user has one extra capability. He can convert his taka to foreign currency.  
Design a BPMN diagram to implement the scenario described above.
- b) Write down examples of 5 types of non-functional requirements for the BIIS application running in BUET. 10
3. a) Design a Sequence diagram for the scenario of a bank described in Question 2(a) 21  
b) What do you understand by Confidentiality, Integrity, and Non-repudiation in the context of a software application? 9
4. a) In an automatic Inventory Management System, an office stocks different products that are expected to be used by the users. When a user needs something, s/he makes a *Requisition*. If that is in the stock, the requisition is approved by the management and 22

becomes ready to *Issue*. If the stock-level of a product reaches below a threshold, a re-order request is generated. If the product is not consumable, it has to be returned when the employee is retired or transferred.

Design a State diagram to show different status of a product in the context discussed above.

- b) Briefly write down Schneiderman's Eight Golden Rules for the design of user interface. 8

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations (January 2020 Semester)

Sub: **CSE 325** (Information System Design)

Full Marks: 180 Section Marks: 90 Time: 2 Hours (Sections A + B)

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE**.

- 5 Consider the following scenario and draw a Level-0 DFD (data flow diagram): (30)

ABC food delivery system takes food and grocery orders from customers and delivers the ordered items to their doorsteps. At first, the customer has to either sign up or sign in. If he is a new customer, he has to provide his name, address and other necessary information to sign up. After the sign up is complete, he has to sign in. For signing in, the customer only needs to provide his phone number and password.

After signing in, the customer is shown a list of restaurants and grocery stores according to his location (checked using GPS). He can select one from this list, or search for other restaurants/grocery stores in the search bar. The customer is allowed to change the location of delivery if he wants. In that case, he will be shown an updated list of restaurants/grocery stores according to the new location.

The customer can also search for specific food/grocery items, and he will be shown a list of restaurants/grocery stores which stock/prepare this particular item.

After the customer selects a restaurant/grocery store, he has to select the items he wants to purchase. He also needs to specify the quantity of each item. After he is done selecting, he can press the checkout button to visit his cart. He can delete/update any item from his cart.

The customer can only order from one restaurant/grocery store at a time. He can reorder only after his current order has been processed. If the customer chooses to check out, he needs to confirm his address and mention any specific requests (if applicable) and press the confirm button.

At this point, the order is sent to all nearby delivery men. If no nearby delivery men are found within 5 minutes, the order is cancelled and the customer is notified.

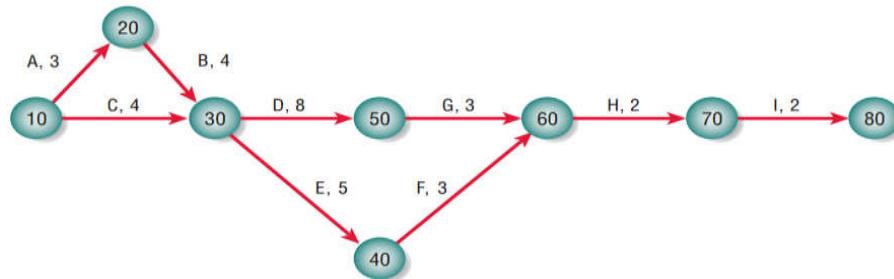
If a delivery man accepts the order, the customer can view the location of the delivery man on a map and is notified during each step of the process (order accepted, order placed at restaurant, food received by delivery man, etc.).

After the delivery man reaches the customer's location, both the customer and the delivery man receive a notification mentioning the total bill. After the delivery man receives payment, he needs to provide a confirmation to close the order.

Once the order processing is complete, the customer can rate the restaurant/grocery shop and the delivery man.

- 6 (a) Write down the differences between client/server architectures with distributed data and client/server architectures with distributed presentation. (5)
- (b) Draw a block diagram of a client/server system with distributed data and application. (10)
- (c) What do you understand by 'partitioning a data flow diagram'? (15)  
Explain four cases where partitioning may be required. Give examples.

- 7 Consider the following PERT chart and the crash times for each activity mentioned in the PERT chart: (30)



Activity	Estimated Duration	Crash Time	Cost/Week
A	3	1	400
B	4	2	600
C	4	2	500
D	8	6	700
E	5	5	1000
F	3	3	1000
G	3	3	300
H	2	2	800
I	2	1	900

Answer the following questions:

- How many paths are present in the existing PERT chart? Mention each path along with its duration.
  - Write down the critical path(s) in the existing PERT chart with duration(s).
  - Using the information given in the above table, show the required steps for expediting in another table. For each step, show the updated paths (with duration). Mention the final critical path(s) (with duration).
  - If the budget for expediting is \$2000, up to how many steps can the project be expedited?
  - If \$650 can be saved when the project is expedited by one week, up to how many steps can the project be expedited?
- 8 (a) When should we choose Agile approach over SDLC (Systems Development Life Cycle)? Also, explain why SDLC is sometimes chosen over Agile approach. (15)
- (b) Explain data partitioning and data replication. When should you use data partitioning and/or data replication? Give examples. (15)

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

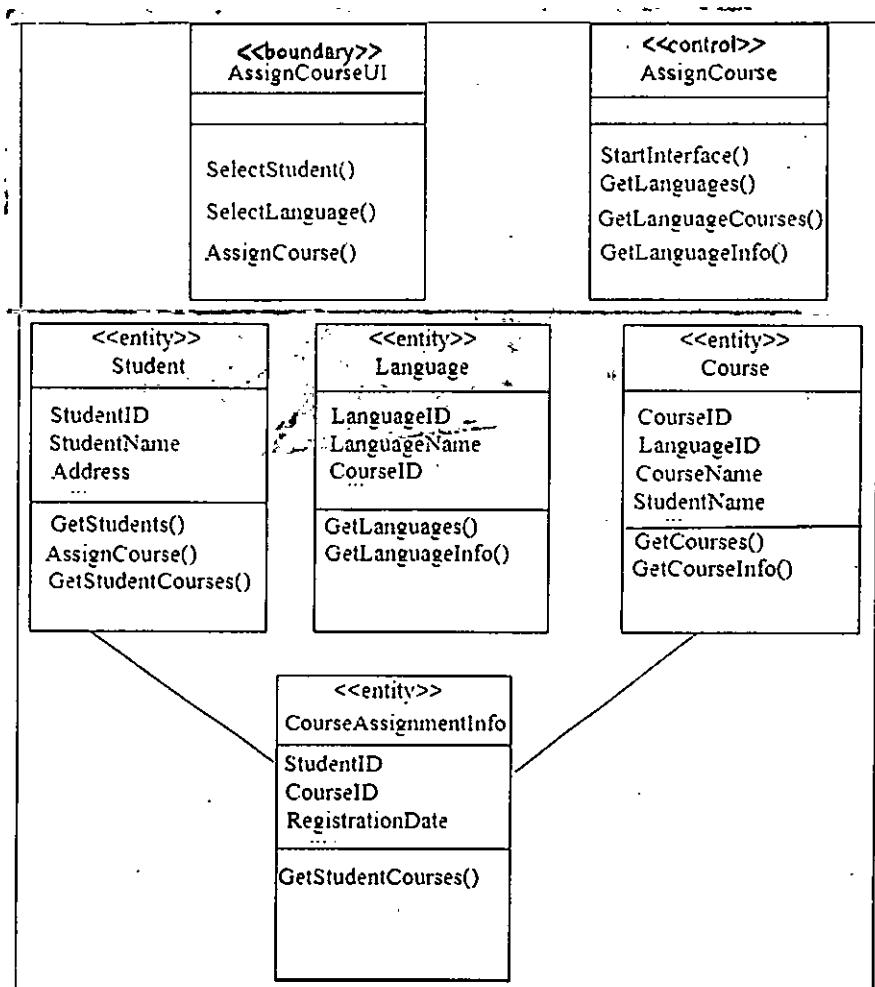
There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Consider the following scenario:

A language teacher wants to register a particular student for an online French course. After he logs in, he is shown a list of students. When he selects a particular student, a list of languages is displayed. After he selects a language (say, French), he is shown a list of courses on French that the selected student has not taken yet. When he selects a course, the course assignment is complete.

Make a list of the inconsistencies in the class diagram given below. Don't redraw the diagram.

(20)



- (b) Graphically show the variation of resource consumption during the lifetime of a system.

(8)

- (c) Name three types of questions to avoid during an interview. Give one example of each.

(3)

- (d) Name two sampling techniques in the context of requirement analysis.

(4)

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2. (a) Refer to the scenario mentioned in 1(a). Now, draw a collaboration diagram which accurately represents the scenario. (13)

Note that, solving 1(a) is not mandatory for this step. However, make sure that the function names accurately represent the tasks they perform.

- (b) Mention the five stages of the Agile Development life cycle. Draw the Systems Development Life Cycle. (5+7=12)

- (c) Write one/two word answers to the following questions on Sequence Diagrams. (2×5=10)

(i) The execution of an operation in a sequence diagram is shown by \_\_\_\_\_.

(ii) An asynchronous message is drawn with \_\_\_\_\_.

(iii) Returns are drawn with \_\_\_\_\_.

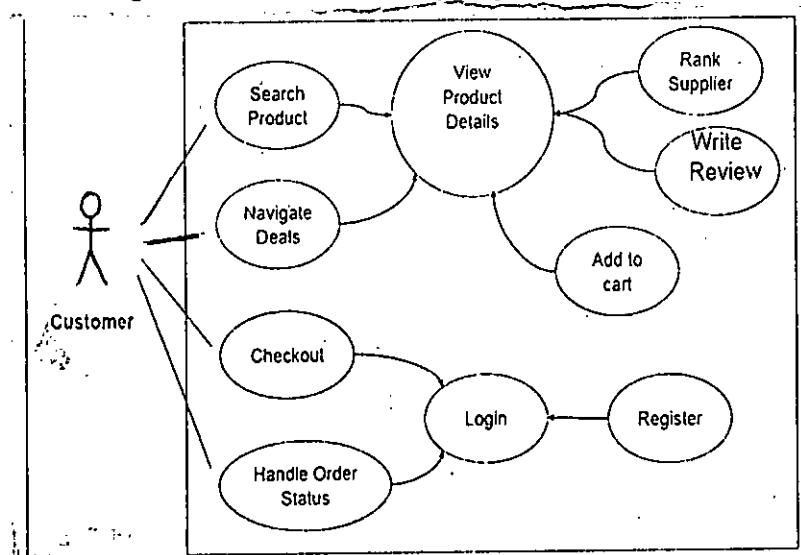
(iv) Is focus of control the same as activation?

(v) What is the one major difference between sequence diagrams and collaboration diagrams?

3. (a) Consider the following scenario: (24)

Suppose, you want to design an information system for a multi-seller online shopping site. Anyone can search for products, or view some exciting sale offers. In both cases, you will be shown a product list. After you click on a product from the list, you can view the details. Also, in that page, there has to be options for adding the product to the cart (provided that it is available), ranking the supplier of that particular product, and writing a review. After a user has added something to his cart, he can proceed to checkout. In this phase, the system needs to check whether the user is logged in. If the user is an unregistered one, he needs to be requested to sign in. When the user has successfully ordered his product, and is logged into the system, he can view or handle his order status. Now, complete the Use-case Diagram given below. In case of any extends use-case, clearly mention the extension point. In addition to labeling the existing relationships, you can also add new ones.

However, you must not rename the existing use cases. Note that, you can add new use-cases to the diagram, but it is not strictly required.



Contd ..... P/3

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### Contd .. Q. No. 3

(b) (i) Name the types of structural things in UML.

(7+4=11)

(ii) Name four types of relationships in UML class diagram.

4. (a) Define data partitioning and data replication.

Consider a shoe manufacturing company called ABC Limited. The company has numerous branches in 21 countries, and maintains digital records of all purchases made in all branches using a relational database. Among many tables, there is a Customer table, which contains the names, addresses and contact information of all the customers of all branches. There is also a Shoe table, which contains the names and details of all shoes manufactured by the company.

Will you apply data partitioning and/or data replication? Why?

(2+8=10)

(b) (i) Name the five layers of computing in the context of application architecture.

(ii) Depending on the placement of these layers, application architecture can be divided into four groups. Name them.

(5+4+3+3+3+3=21)

(iii) For each group in (ii), mention where the computing layers are placed by filling the table given below. In place of Layer n/Group n, write the actual name of the layer/group.

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5
Group A					
Group B					
Group C					
Group D					

(c) Define Openness and Closedness in the context of organizational environments.

(4)

### SECTION – B

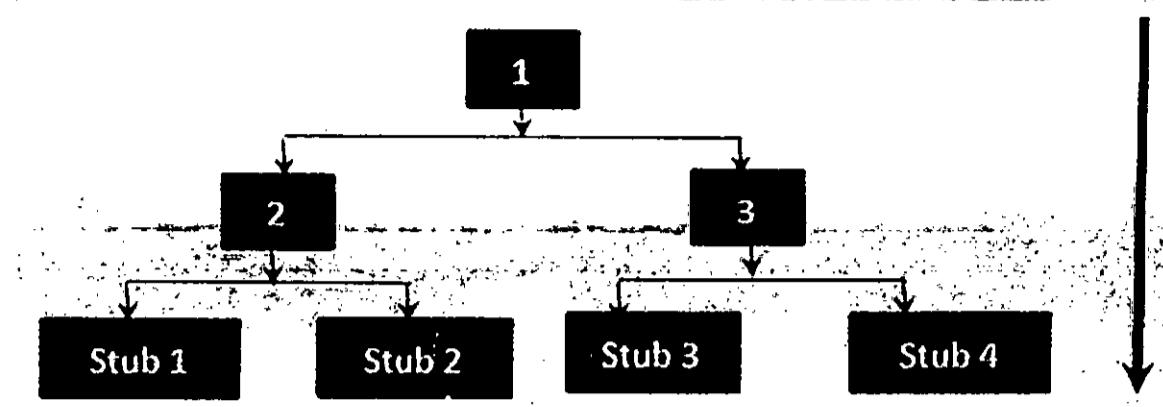
There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) The following diagram states that Modules 1, 2 and 3 are available for integration, whereas, below modules are still under development that cannot be integrated at this point of time. Hence, Stubs are used to test the modules. Write down the order of integration testing if BFS used.

(4)

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Contd .. Q. No. 5(a)



- (b) Consider the following C code (contains goto statements). Draw a flow graph from the code (give node name same as the equivalent label name in the code). Find the cyclomatic complexity of the graph. Find out the independent paths. **(6+4+4=14)**

```
void function() {
    A: statement A;
    if (condition 0){
        if (condition 1){
            B: statement B;
            if (condition 2){
                C: statement C;
                if (condition 3) goto B;
            }
            else{
                E: statement E;
                goto F;
            }
        }
        else{
            D: statement D;
            if (condition 4) goto E;
            else{ F: statement F; }
        }
        G: statement G;
        goto A;
    }
    H: statement H;
}
```

Figure for Question 5(b)

- (c) Consider the following diagram. List all the errors present in this diagram. You do not need to consider any naming convention error like process should be named as *verb-adj-noun*.

(In this diagram, E1, E2 ... are external entities; P1, P2 ... are processes; D1, D2 ... are data stores and df1, df2 ... are data flows.)

**(12)**

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Contd .. Q. No. 5(c)

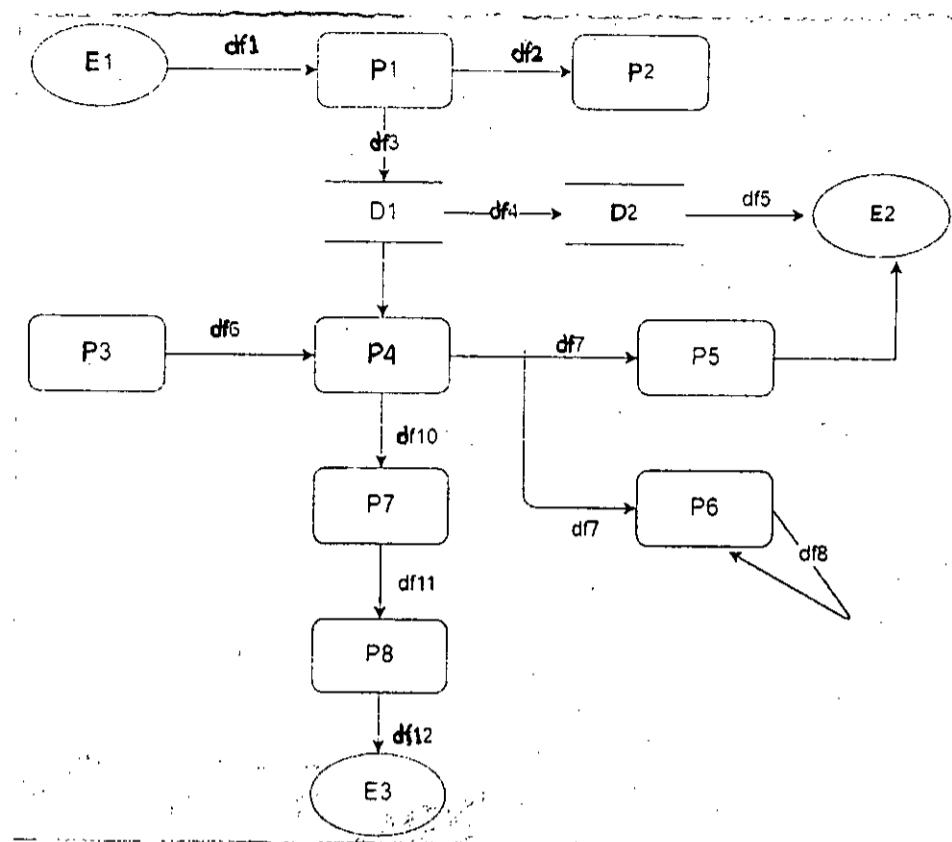


Figure for Question 5(c)

(d) Write down the name of attributes while defining a data store. (5)

6. (a) Consider the following process in Diagram 0 of a system. (6)

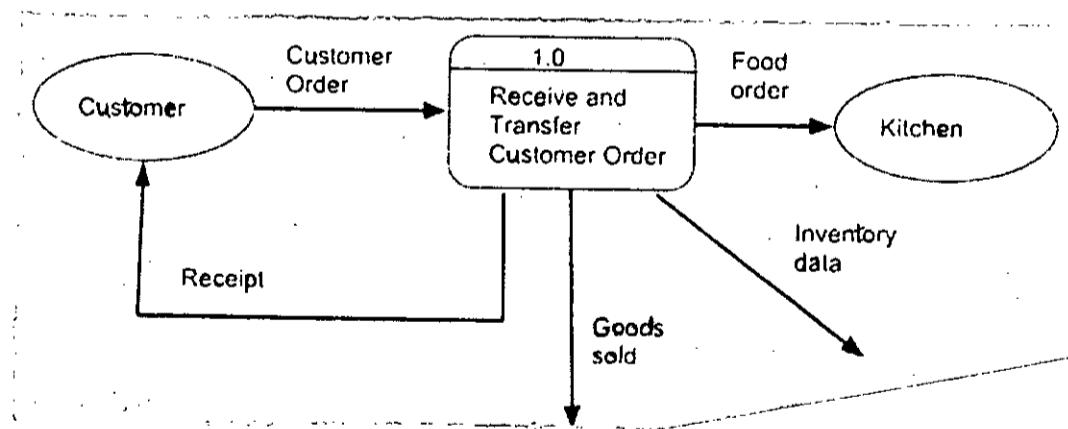


Figure for Question 6(a) [Diagram 0]

A Child diagram is drawn in order to decompose the process 1.0. Now label the data flows in Child diagram correctly according to the parent diagram. Also, mention suitable numbers for processes in Child diagrams.

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### Contd .. Q. No. 6(a)

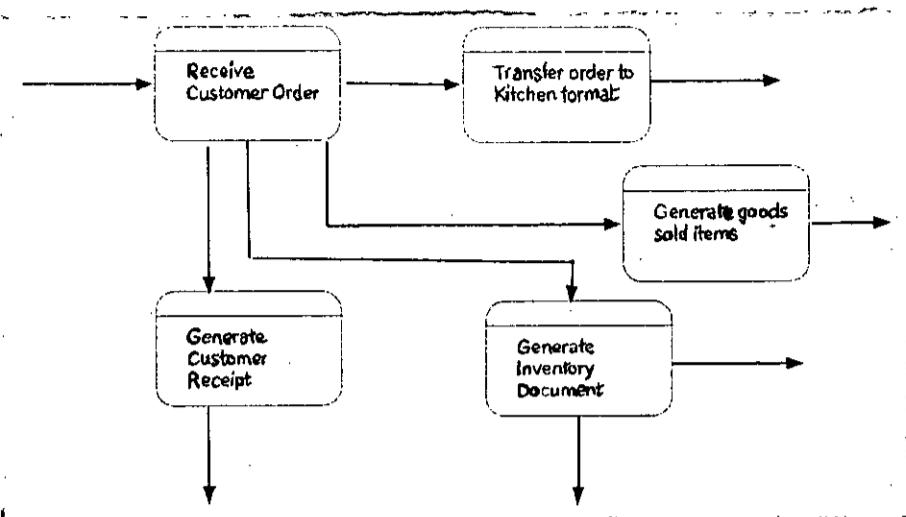


Figure for Question 6(a) [Child diagram]

(b) There are two-system analysts in Markov Company. First analyst wants to quit from the job as early as possible but before he leaves, he wants to show profit for the project in earliest possible time. However, second analyst is loyal to the company and he wants to make more profit considering the total time line of the project. Now the project has two options for development. The revenue and costs of each method is given below (in dollar). (15)

Year	COTS method		SaaS method	
	cost	revenue	cost	revenue
1	10000	5000	5000	3000
2	1000	5000	5000	4000
3	2000	4000	2000	5000
4	500	500	2000	3000
5	1000	1500	200	3000

(Consider discount rate  $i = 10\%$ )

(i) Which method will the First analyst choose? When can he leave the company?

(ii) Which method will the Second analyst choose?

(c) Draw a sample wireframing for YouTube home page. (Assume that you have already logged in gmail) (8)

(d) Explain the following terms in the context of input and output design. (Any three) (6)

(i) Grid structure in website

(ii) Non-responsive design

(iii) Context of data in dashboard

(iv) Auto focus in form design

7. (a) The RELIABLE CONSTRUCTION COMPANY has made the winning bid to construct a new plant for a major manufacturer. The following table lists the necessary activities for the construction. From the table, first draw a Gantt chart. Then convert it to Pert diagram (Edge represented as task).

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### Contd .. Q. No. 7(a)

Finally, find all the paths with their duration and report the critical path. (You may use Edge label to represent a path. For example *start\_node-A-B-C-D-G-H-M-finish\_node* will be a path)

(4+7+4=15)

Activity	Activity Description	Immediate Predecessors	Estimated Duration
A	Excavate		2 weeks
B	Lay the foundation	A	4 weeks
C	Put up the rough wall	B	10 weeks
D	Put up the roof	C	6 weeks
E	Install the exterior plumbing	C	4 weeks
F	Install the interior plumbing	E	5 weeks
G	Put up the exterior siding	D	7 weeks
H	Do the exterior painting	E, G	9 weeks
I	Do the electrical work	C	7 weeks
J	Put up the wallboard	F, I	8 weeks
K	Install the flooring	J	4 weeks
L	Do the interior painting	J	5 weeks
M	Install the exterior fixtures	H	2 weeks
N	Install the interior fixtures	K, L	6 weeks

Table for Question 7(a)

(b) For the previous problem, suppose RELIABLE CONSTRUCTION COMPANY has also a fund of 150,000\$ to speed up the project. Time-cost trade-off data has been shown on the following table. Given the constraint, which activities can be crashed? Also, find the critical path with duration after crashing.

(10)

Activity	Time		Cost		Maximum Reduction In Time	Crash Cost per Week Saved
	Normal	Crash	Normal	Crash		
A	2 weeks	1 week	\$180,000	\$ 280,000	1 week	\$100,000
B	4 weeks	2 weeks	\$320,000	\$ 420,000	2 weeks	\$ 50,000
C	10 weeks	7 weeks	\$620,000	\$ 860,000	3 weeks	\$ 80,000
D	6 weeks	4 weeks	\$260,000	\$ 340,000	2 weeks	\$ 40,000
E	4 weeks	3 weeks	\$410,000	\$ 570,000	1 week	\$160,000
F	5 weeks	3 weeks	\$180,000	\$ 260,000	2 weeks	\$ 40,000
G	7 weeks	4 weeks	\$90,000	\$ 1,020,000	3 weeks	\$ 40,000
H	9 weeks	6 weeks	\$200,000	\$ 380,000	3 weeks	\$ 60,000
I	7 weeks	5 weeks	\$210,000	\$ 270,000	2 weeks	\$ 30,000
J	8 weeks	6 weeks	\$430,000	\$ 490,000	2 weeks	\$ 30,000
K	4 weeks	3 weeks	\$160,000	\$ 200,000	1 week	\$ 40,000
L	5 weeks	3 weeks	\$250,000	\$ 350,000	2 weeks	\$ 50,000
M	2 weeks	1 week	\$100,000	\$ 200,000	1 week	\$100,000
N	6 weeks	3 weeks	\$330,000	\$ 510,000	3 weeks	\$ 60,000

Table for Question 7(b)

(c) (i) In your thesis, you have provided a new method NMT (Neural Machine Translation) for text classification. You compare your method with other techniques and the comparison is given below,

Method	Accuracy
NMT	78%
LSTM	74%
CNN	75%
SVM	68%

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### Contd .. Q. No. 7(c)

It can be seen that the accuracy of each method does not differ much. Draw an appropriate graph to bias the readers so that your method seems to outperform other techniques.

(ii) Moreover, the accuracy of your method does not increase so much if the iteration number increases. For example, accuracy of your method and LSTM is shown below over iteration number.

Iteration	NMT Accuracy	LSTM Accuracy
100	70	60
200	72	65
300	75	70
400	78	74

Present these data in graphs in a biased way so that your method seems to improve better as iteration number increases. (Hints: You need to use separate graph for each method) (5+5=10)

8. (a) Identify the mistakes in the following customer registration form. (12)

The form is titled "Customer Registration Form". It contains fields for First Name, Last Name, Email, Password, Retype Password, Phone Number, Address Line, Zip Code, and two buttons at the bottom: "Submit" and "Clear". Each field is marked with "(required)".

Customer Registration Form	
FirstName	(required)
Email	(required)
Phone Number	(required)
+880	
Address Line	
Zip Code	
<input type="button" value="Submit"/>	<input type="button" value="Clear"/>

Figure for Question 8(a)

(b) Suppose, one sunny morning in 4-1, you woke up at 11am and opened your mail. You found that you have been hired as a part-time developer of a startup company called *Pounopunik App Solution*. You went to the company with great enthusiasm but found out that the office consists of 2 rooms only. The company has one system analyst, two full-time developers and five part-time developers including you. You need to work 20 hours per week and may need to do some round the clock work to meet deadline.

The *Pounopunik App Solution* has the task of developing mobile ERP solution and feedback support for a large multi-national company X. The timeline of the project is 9 months. Now buying license from SAP mobile solution nearly costs 1500\$ and requirement criteria of company X is hardly similar to this SAP mobile version. Assume that developing mobile ERP solution is being done for the first time in Bangladesh.

## CSE 325

### Contd .. Q. No. 8(b)

Currently the office has one desktop and one laptop. Since all the part-time developers are CSE students, they have their own laptops. (3+3=6)

(i) Given the scenario, which hardware alternative should *Pounopunik App Solution* choose? Point out reasons behind your decision.

(ii) Which software alternative should the startup choose to develop the mobile ERP according to the given scenario? State your reasons.

(c) According to the scenario in previous question, *Pounopunik App Solution* has started to develop in full swing. It has bought a printer, a projector and other stationary items. The works have been done in full swing for three months. However, due to the ineffective decision making of the system analyst, the company lost a competitive edge. In the meantime, another software company has brought the mobile ERP solution in the market, which declines the image of your startup.

Identify the tangible and intangible costs associated with *Pounopunik App Solution* according to the above scenario. (5)

(d) Consider the following specifications. (6+6=12)

Input: length of three sides of a triangle: a, b, c

Output: true if each side is a positive number less or equal to 20 and the triangle is Isosceles (2 sides are equal), false otherwise.

Precondition: the sides form a triangle (You do not need to consider cases like  $a+b \leq c$ )

(i) First, write down all valid and invalid equivalence classes for this problem. (For example, V1:  $0 < a, b, c \leq 20$ ; V2:  $a=b$  and  $a \neq c$  are two valid equivalent classes. On the other hand,

X1:  $a > 20$ , X2:  $a=b=c$  are two invalid equivalent classes.)

(ii) Generate test cases covering all classes. Use the following table structure. Try to minimize the number of tests. (First few entries have been shown for your convenience)

Test no	Test data	Expected outcome	Class covered
1	5, 5, 2	T	V1, V2
2	22, 14, 14	F	X1
3	7, 7, 7	F	X2