BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2018-2019

Sub : **CSE 307** (Software Engineering)

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) Bangladesh Shipping Management (BSM) prides itself on having up-to-date information on the processing and current locations of each shipped item. To do this, BSM relies on a company-wide information system. Shipped items are the heart of the BSM product tracking information system. Shipped items may be of two types, goods and food. They can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the BSM system at a single retail center. Shipped items make their way to their destination via one or more standard BSM transportation events (i.e. flights, truck deliveries). These transportation events are characterized by a unique schedule Number, a type (e.g., flight, truck), and a delivery Route. **(14)**

   Design a Class diagram to implement the scenario described above.

   (b) What do you understand by Equivalence Partitioning? Create test input set considering standard practices to test different user roles of BIIS. **(12)**

   (c) What do you understand by defect rate and defect density in Software Engineering? Why are checklists used in code review? **(9)**

2. (a) An application needs to be developed to simulate and study robots' interaction. You have the following classes: **(20)**

   IBehaviour -an interface that defines the behavior of a robot

   AggressiveBehaviour, DefensiveBehaviour, NormalBehaviour - each of them defines a specific behavior.

   Robot - It keeps or gets information such as position, close obstacles, etc., and passes necessary information to the appropriate class.

   In order to select an action, the Behaviour classes need information that is passed from robot sensors like position, close obstacles, etc.

   In the main section of the application the several robots are created and several different behaviors are created. Each robot has a different behavior assigned: 'Big Robot' is an aggressive one and attacks any other robot found, 'George v.2.1' is really scared and run away in the opposite direction when it encounter another robot and 'R2' is pretty calm and ignore any other robot. At some point the behaviors are changed for each robot.

   Draw a class diagram to present appropriate design pattern and write necessary codes so that your code fulfils all the requirements.

Contd P/2

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Contd..... Q. No. 2

(b) Give an example of test execution ensuring method, branch and condition coverage. What are the characteristics of good unit testing? **(15)**

3. (a) A general manager of an office is entitled to have a laptop per year. The laptop requisition process is implemented in a software application. Give examples of positive and negative testing in the context of testing the software process. **(7)**

(b) There is a software application that can be used by the students of a University to provide them with the list of their grades for their exams. This application needs to run in different ways depending on the users that are using it. For example, the admin needs to have some buttons enabled whereas those buttons need to be disabled for the student. The Builder provides the interface for building forms depending on the user login information. The ConcreteBuilders are the specific forms for each type of user. The product is the final form that the application will use in the given case and the Director is the application that, based on the login information, needs a specific form. Draw a class diagram to present Builder design pattern and write necessary codes so that your code fulfills all the requirements. **(20)**

(c) Discuss cohesion and coupling in brief in the context of software engineering. **(8)**

4. (a) Discuss Integration, Beta, and Usability testing in brief. **(9)**

(b) Suppose you have a Bird class with fly() and makeSound() methods. And also a ToyDuck class with squeak() method. Let's assume that you are short on ToyDuck objects and you would like to use Bird objects in their place. Birds have some similar functionality but implement a different interface, so we can't use them directly. Draw a class diagram to present Adapter design pattern for the scenario above and write necessary codes so that your code fulfills all the requirements. **(18)**

(c) Show example class diagram of Aggregation and Composition in the context of a video rental store. **(8)**

SECTION – B

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

5. (a) (i) Write down the formula for calculation risk exposure/risk impact and define the variables used.

(ii) Spectrum Electronics Ltd. produces 10,000 ICs every month, and each of those ICs cost $5. The probability of an IC being faulty is 10%. However, Spectrum Electronics Ltd. replaces every faulty IC with a new one, completely free of charge. Calculate the overall risk exposure for this situation. **(4+8=12)**

Contd P/3

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Contd..... Q. No. 5

(b) Draw the graph of Development cost vs. Development schedule progress in the context of Agile Development. **(10)**

(c) What does framework activity mean in the context of software processes? Name five framework activities encouraged in Personal Software Process (PSP). **(3+10=13)**

6. (a) Name the four P's of Project Management. **(4)**

(b) From the Fig. for Question 6(b) compute the expected cost for each path and suggest the best possible course of action. **(20)**

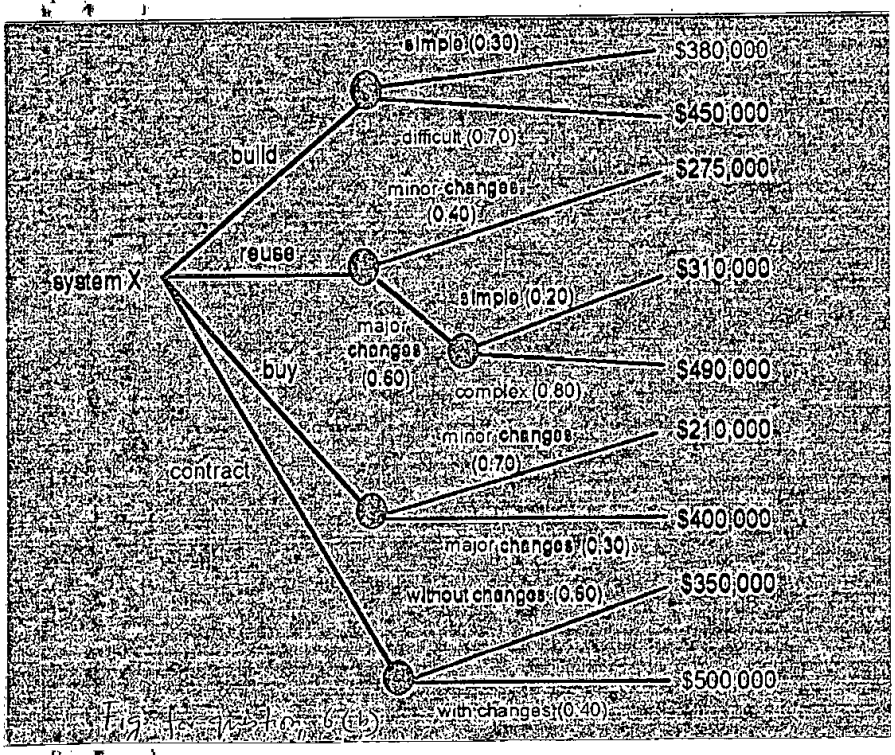

Fig. for Question 6(b)

(c) ABC Software Ltd. has been hired to deliver a business application within a year. The software engineers and developers at ABC Software Ltd. have estimated that the software will probably require 71 KLOCs of code. Using the software equation, compute the estimated effort in person-months. **(11)**

7. (a) Name of three phases of Adaptive Software Development (ASD). Draw a diagram showing the phases of the Extreme Programming (XP) method. **(6+10=16)**

(b) Define Scope Creep. Compute the overall Defect Removal Efficiency of a software team if 300 defects were found and rectified before the delivery and 50 more defects surfaced after the delivery. **(2+5=7)**

(c) X Software Ltd. has budgeted a total of $200,000 to buy, setup, test, and maintain a new system. The planed values for each task are: Buy-$60,000, Setup-$75,000, Test-$40,000, Maintain-$25,000. Among these phases, only the first phase has been completed and the actual cost of buying was $70,000.

Contd P/4

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Using the above information, compute the following- **(6×2=12)**

(i) Schedule performance index (SPI)

(ii) Cost performance index (CPI)

(iii) Budgeted cost at completion (BAC)

(iv) Estimated cost at completion (EAC)

(v) Schedule Variance (SV)

(vi) Cost Variance (CV)

8. (a) Draw the V Model in the context of Prescriptive Process Models. **(7)**

(b) (i) When will you use the Incremental model?

(ii) List four problems associated with Evolutionary Process Models. **(2+8=10)**

(c) Using the information given in the Table for Q 8(c) do the following **(4+10+4=18)**

(i) Draw a network diagram.

(ii) Compute the Early Start (ES) and Late Start (LS) for each node.

(iii) Clearly mention the critical path/paths.

Note that, you have to show the computation steps required for determining ES and LS for all nodes.

Table for Q. 8(c)

Activity	Predecessor	Duration
A	(None)	5
B	(None)	1
C	A	2
D	A,B	3
E	A	2
F	C,E	3
G	D,H	4
H	B,E	2
I	H	1
J	F,G,I	1

L-3/T-1/CSE **Date : 29/09/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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Sub : **CSE 307** (Software Engineering)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

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SECTION – A

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

1. (a) There are several options of ERP implementation for organization which has 250 users. These are described as follows: **(10)**

SAP Customization:

ERP for any organization can be implemented by customizing modules of SAP. The cost for per user licensing fee of the SAP is USD 2000.00. It might require complex customization with the effort of 30 Man Month by the highly experienced SAP consultants and programmers. It might require easy customization with the effort of 20 Man Month by the moderately experienced SAP consultants and programmers. The probability of requiring complex customization would be half of the probability of requiring easy customization. The cost of Man Month for highly and moderately experienced SAP consultants or programmers are USD 20000.00 and USD 10000.00 respectively.

Customized ERP Development by own development team:

It might require 5 analysts, 20 developers, 19 testers and 5 system engineers to develop and implement ERP in 20 months. The estimated monthly salary of analyst, developer, tester and system engineer are USD 4000.00, USD 3000.00, USD 2500.00 and USD 3500.00 respectively. There is a 60% chance to reuse the previously developed components to reduce the development time by 6 months.

Customized ERP Development through outsourcing:

The cost ERP developed by the vendor id USD 400000.00. It might require 2 analysts, 2 developers, 5 testers and 2 system engineers to supervise and monitor ERP development for 8 months. The estimated monthly salary of analyst, developer, tester and system engineer are USD 5000.00, USD 2500.00, USD 2500.00 and USD 3500.00 respectively.

Analyze all the options mentioned above and find the optimal decision.

(b) Discuss the pricing decisions in the following situations with proper reasoning: **(8)**

(i) The software development company is trying to get a contract for automation of an organization where the maximum job duration of the employees in the client's organization is 2 years.

(ii) The software development company is in the process of getting a new contract which will continue for the next 5 years.

Contd P/2

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Contd... Q. No. 1(b)

(iii) The software development company has just started.

(iv) The new VAT rule may require new software and a multinational company wants to develop that software by the software development company.

(c) What is algorithmic cost model? What are the factors of accuracy in software cost estimation? **(5)**

(d) After requirement analysis, the experienced system analyst estimated that the size of the code for a training simulator for fertilizer factory might be 230 KLOC. The software development company is a 5 year old company with CMMI level 3. The top management is committed to do formal risk management for smooth software development. Estimate the effort in person month, development time and team size using COCOMO 2 model. **(12)**

2. (a) What are the problems of waterfall model? Describe how other models solve the problem. **(7)**

(b) Consider a software development of a government organization which is using the paper based system by the employees for the last 40 years. The average age of the employees is more than 50 years. Describe how prototyping helps writing SRS in this situation. Show all the phases of prototyping with respect to this development scenario. **(7)**

(c) Why is refactoring important in agile development? Give some example of refactoring in software development life cycle. **(7)**

(d) "A pair of programmers working together is more efficient than two programmers working separately" – Justify. **(7)**

(e) Write down a typical scrum meeting minutes (description of the meeting) for the software development of a digital research library. **(7)**

3. (a) What do you mean by *configuration* in Software Configuration Management? What are the activities of Software Configuration Management? Explain with brief description. **(7)**

(b) Explain baseline, codeline and mainline with proper examples. **(7)**

(c) Consider a university records management system. The university will allow the students of any department to take audit courses from other departments. In this case the grades will not be reflected in the cumulative grade point average. Show the content of the change request form after approving the change. **(7)**

(d) Why is merging required after branching of the codelines. Explain with necessary figures after defining branching and merging. **(7)**

(e) Explain how the source code checksum helps minimize recompilation in system building. **(7)**

Contd P/3

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4. (a) How can you define software architecture? Show the architecture of a residential student hall management system with the following features: **(10)**

(i) Seat allocation, change and cancellation

(ii) Food charge receiving through credit card and bank payment with automatic interfacing

(iii) Issuing and returning books from hall library

(iv) Clearance certificate issuing

(v) Loan issue and repayment of the loan.

(b) Represent a library management system using layered architectural pattern and client server architectural pattern with necessary justifications. **(10)**

(c) A software development schedule is fixed from Oct 2018 to March 2019 in an offshore development center in the Gulshan area of Dhaka city. The top management is thinking of health risks of the software development team during the development period. Identify, analyze and plan mitigation strategies for health related risks in the above mentioned context. **(10)**

(d) "Increasing reliability does not necessarily mean increasing safety" – Justify mentioning two different scenarios of using software. **(5)**

SECTION-B

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

5. (a) Ward is division of a hospital or a suite of rooms shared by patients who need a similar kind of care. In a hospital, there are a number of wards, each of which may be empty or have one or more patients. Each ward has a unique name. Wards are differentiated by gender of its patients, i.e. male wards and female wards. A ward can only have patients of the gender admitted to it. Every ward has a fixed capacity, which is the maximum number of patients that can be on it at one time (i.e. the capacity is the number of beds in the ward). Different wards may have different capacities. The doctors in the hospital are organized into **teams**. Each team has a unique name or code (e.g. Orthopaedics or Pediatrics) and is headed by a **consultant doctor** or **attending physician**. Consultant doctor or attending physician is the senior doctor who has completed all of his or her specialist training, residency and practices medicine in a clinic or hospital, in the specialty learned during residency. She or he can supervise fellows, residents, and medical students. The rest of the team members are all junior doctors. Each doctor could be a member of no more than one team. Everyday each consultant doctor visits the patients admitted under him/her. During this visit, s/he prescribes treatment or modifies previous prescription. When a patient is ready to released, s/he advises the release. Design a Class diagram to implement the scenario described above. **(14)**

Contd P/4

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Contd... Q. No. 5

(b) What do you understand by the usability of software application? How is it measured? Discuss two dimensions of usability with example. **(12)**

(c) What indirect benefits are offered by Code Review practice in a software development company? Discuss in brief with examples. **(9)**

6. (a) In the food shop at Lalbagh many BUET students visit to have dinners. There, they have option to choose different types of set-meals. Each has a main item like rice or bread. Along with rice, gravy curries are added. For bread, chicken or beef kebabs are there. Drinks/juices need to be ordered additionally out of the set-meal if the customer desires to have. Along with the meal, the bill is served and need to be paid before the start of consumption. Draw a class diagram to present appropriate design pattern and write necessary codes so that your code fulfills all the requirements. **(7+15)**

(b) What do you understand by "Parameterization" in the context of software design? Design a user interface to parameterize the price of product that may vary for different brands, sizes, etc. for a point-of-sales software. **(3+10)**

7. (a) The requirement specification of a web-based software application stated that maximum 100 users may access simultaneously. After deployment, the application failed to response properly when 90 users accessed at a time. It was recovered later and then on a certain occasion 150 users tried to access and again it crashed. Which two software testing methods could prevent those two failures respectively? **(6)**

(b) "Uber" and "Pathao" are the popular car based ride sharing applications. They calculate cost based on number of passengers and distance using the following formula: **(6+15)**

Uber:

Cost = n*d*18*time_factor; where n = number of passengers and d = distance

if it is extremely peak hour, then time_factor = 1.8

if it is moderately peak hour, then time_factor = 1.2

if it is off peak hour, then time_factor = 0.9

Pathao:

Cost = n*d*20*time_factor;

if it is extremely peak hour, then time_factor = 1.5

if it is moderately peak hour, then time_factor = 1.15

if it is off peak hour, then time_factor = 0.9

"Uber Moto" and "Pathao Moto" are the popular bike based ride sharing app. They calculate cost based on the distance to destination using of following formula:

Uber: Cost = 25 + d*12

pathao: Cost = 30 + d*11

Contd P/5

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Contd... Q. No. 7(b)

The user will input the destination distance, number of passengers and an input t. (t = 1, 2, 3 for extremely peak, moderately peak and off peak hour respectively.) You need to output the cost for each app. Draw a class diagram to present appropriate design pattern and write necessary codes so that your code fulfils all the requirements.

(c) What is *tight cohesion* and *loose coupling*? How does it influence software design? **(8)**

8. (a) What are the advantages and disadvantages of black-box testing? Discuss performance and regression testing in brief. **(4+8)**

(b) Assume that there is a blog and users register to that blog for update. When a new article is posted in the blog, it will send update to the registered users saying a new article is posted. Then the user will access the blog and read the new article posted. Draw a class diagram to present appropriate design pattern and write necessary codes so that your code fulfils all the requirements. **(5+12)**

(c) Show example diagrams of real-world scenario to present Aggregation and Composition in the context of Class Diagram. **(6)**

L-3/T-1/CSE **Date : 15/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **CSE 307** (Software Engineering and Information System Design)

Full Marks : 280 Time : 3 Hours

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USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Discuss some extensibility mechanisms of UML diagram. **(12)**

   (b) What are the different types of output document of a system? Explain with examples. **(12)**

   (c) Let's assume that, your company developed a system for which the development cost is $50,000. Your system analyst tells you that the operating cost for the next year is $5,000 and in each year the operating cost will increase by $1000. The expected cash inflow is given in the following table: **(15)**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Cash inflow	$18,000	$22,000	$26,000	$33,000	$41,000	$50,000

   Considering discount rate of 11% calculate the payback period. Also calculate its ROI (Return on Investment) for these 6 years.

   (d) Write short note on "Ishikawa Diagram". **(7 2/3)**

2. The following is a narrative description of the business process of a bank:

   There are two types of uses 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.

   The use cases of this scenario are:

   (i) Create account

   (ii) Deposit money

   (iii) Withdraw money

   (iv) Update balance

   (v) Calculate bonus

   (vi) Calculate interest and

   (vii) Convert to foreign currency.

Contd P/2

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Contd ... Q. No. 2

Now answer the following questions based on the above scenario.

(a) Draw the use case diagram of this system. **(13)**

(b) Write use case narrative for the use case "withdraw money". **(7 2/3)**

(c) Draw sequence diagram for the use case "withdraw money". **(13)**

(d) List all the entity classes of this system. Draw state chart diagram of the most important entity class in your consideration. **(13)**

3. (a) Write short notes on the following software vulnerabilities. Also provide example and way around on these vulnerabilities. **(15)**

(i) Buffer Overflow Attack

(ii) SQL Injection

(b) What are the checklists for a code reviewer to review the Non-Functional requirements of a project? Explain in short. **(15)**

(c) The following code takes a user choice from the user. If the choice is I, it increments the value of x which is initialized as 5. If the choice is anything else, value for x is decremented. Now rewrite this code so that the code follows the MVC principle. **(16 2/3)**

```
package withoutmvc;
import java.util.Scanner;

public class WithoutMVC {

    public static void main(String[] args) {
        int choice;
        int x=5;
        System.out.println("Enter your choice: ");
        Scanner sc=new Scanner(System.in);
        choice=sc.nextInt();
        if(choice==1) x = incx(x);
        else x = decx(x);
        System.out.println("New value: "+x);
    }
    public static int incx(int x) {
        x++;
        return x;
    }
    public static int decx(int x) {
        x--;
        return x;
    }
}
```

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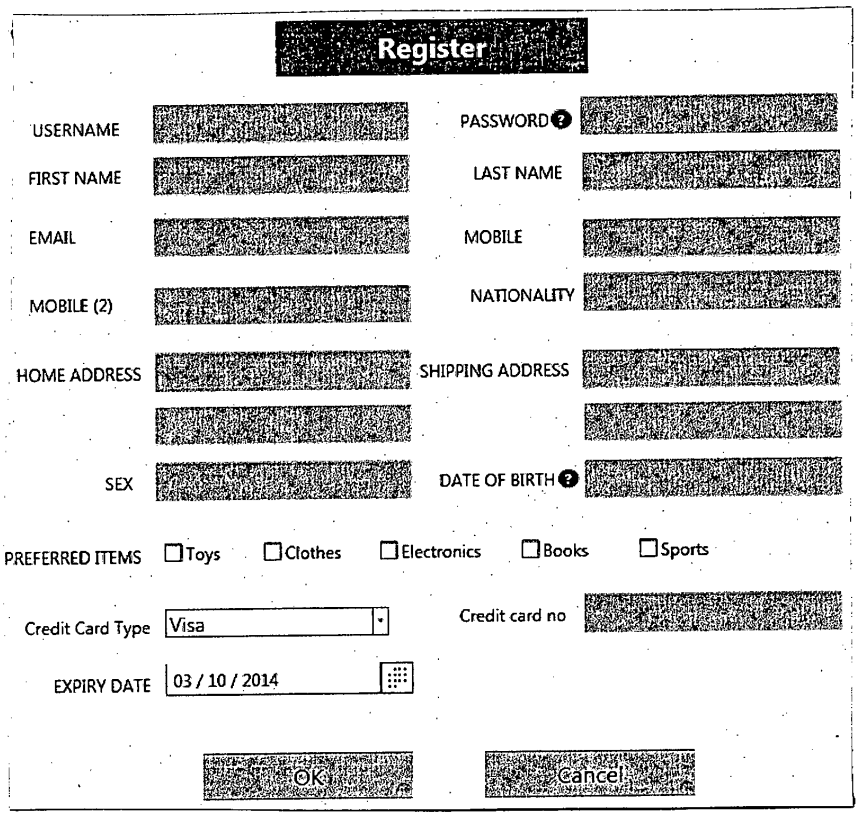
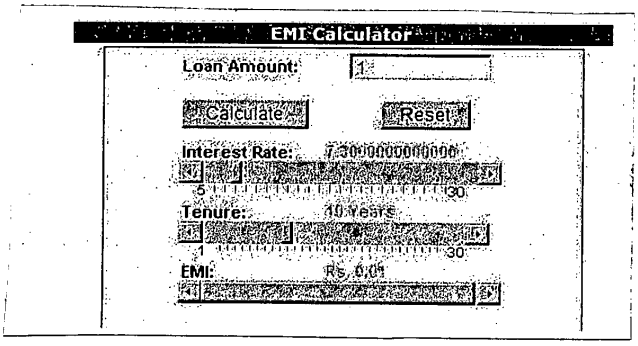
4. (a) Donald Trump is a rookie UI designer. He designed the following registration page of an e-commerce site (e.g. amazon.com) where the user can browse though various items and buy items. Point out all the problems associated with this page in details. **(16)**



(b) What are the steps of system construction and implementation? Mention only the steps. You do not need to explain them. **(8 2/3)**

(c) Write down Sehneiderman's 8 Golden Rules for UI design in short. **(12)**

(d) Consider the following design of an EMI Calculator. In this system, the user inputs his loan amount, interest rate and tenure. The system calculates the EMI. Point out the problems associated with this design and draw a paper prototype of this page to solve these problems.



Contd P/4

SECTION – B

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

5. (a) Describe eager and lazy initialization of singleton class. : **(5+5+5 = 15)**

Give an example where lazy initialization should be preferred over eager initialization.

(b) Briefly describe Spiral process model. **(10+5=15)**

Write down the arguments in favor of and in opposition to Spiral process model.

(c) Assume that you are trying to implement syntax highlighting in a programming language editor. To perform this, you need to be able to parse different kinds of files such as .c,.cpp, .java, .html etc. All the parsers implement an interface named Parser which contains all the functions required to parse a file. When a file is selected, you will decide which parser to use based on the extension of the file. Now which design pattern should be followed to implement the selection process? Write appropriate java implementation of your solution. **(3+7=10)**

[Hint: You don't need to write the parsers. Clearly mention the assumptions you have made.]

(d) Draw the UML class diagram of "Class Adapter Pattern". Write down the pros and cons of Object Adapter Pattern and Class Adapter Pattern. **(3+3 2/3 =6 2/3)**

6. (a) Write short notes on the following: **(3×5=15)**

i. Sprint

ii. Backlog

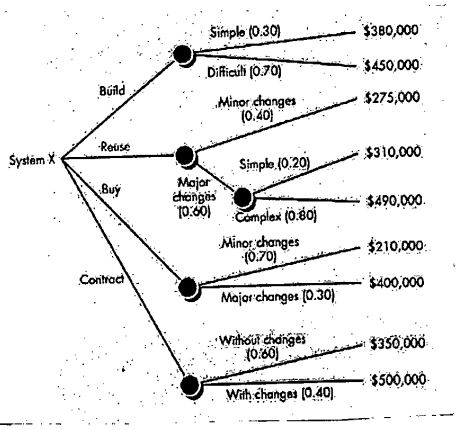
iii. Pair Programming

iv. Code Refactoring

v. Spike Solution

(b) Explain how "Extreme Programming (XP)' follows the agility principles. **(15)**

(c) Using the following decision tree find out the decision that a project manager should take in order to complete "System X". **(10)**



(d) Describe Pareto Principle. **(6 2/3)**

Contd P/5

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7. (a) Write down the five steps of test-driven development. **(5+10=15)**

Dernonstrate all the steps sequentially with the help of an example.

(b) Draw a PERT chart using the durations and dependencies of the tasks shown in the following table. Report the critical path and estimated project completion time. **(15)**

Task	Dependency	Duration
A	-	1
B	-	3
C	A	3
D	B,C	5
E	C	1
F	D	4
G	E, F	3
H	G	2
I	G	2
J	H, I	5
K	J	6

(c) Describe how distributed VCS and centralized VCS store all the different versions of a repository? Draw necessary diagrams to describe your answer. **(10)**

(d) Team A found 342 errors during the software engineering process prior to release. Whereas team B found 184 errors. What additional measures would have to be made for projects A and B to determine which of the teams eliminated errors more efficiently? What metrics would you propose to help in making the determination? **(3+3⅔=6⅔)**

8. (a) Differentiate between the following pairs: **(3×5=15)**

i. fork vs git clone

ii. git pull vs git fetch

iii. git branch vs git checkout

iv. master vs HEAD

v. Centralized VCS vs Distributed VCS

(b) Draw two diagrams depicting the monolithitic and microservice architectural design of a taxi-hailing application project. (Make appropriate assumptions about the functionalities and features of the applications.) **(4+4+7=15)**

Describe which drawbacks of the monolithic architecture are solved by the microservice architecture.

Contd P/6

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(c) Perform function-point analysis using the data in the table given below and estimate the total cost of the project. Assuming that the project adjustment factor is 17, programmers in the organization can complete 18 function point per month, and each programmer charges $5,200 per month for this service. **(10)**

Functions	Count per Complexity			Weight By Complexity		
	Simple	Average	Complex	Simple	Average	Complex
Inputs	3	4	1	2	4	6
Outputs	0	6	2	4	5	7
Files	0	0	5	2	5	7
Inquires	0	8	0	10	15	20
Interfaces	0	3	4	4	7	10

(d) Which class design principle does the code in figure 8(d) violates? Re-write the code to remove the violation of the principle. **(6⅔)**

```
class GraphicEditor{
     public float getArea(Shape s){
          if(s.m_type == 1)return s.width*s.width;
          else if(s.m_type == 2)return 3.1416*s.r*s.r;
     }
}
class Shape{
     int m_type;
}
class Rectangle extends Shape{
     int width;
     Rectangle(int width){
          super.m_type = 1;
          this.width = width;
     }
}
class Circle extends Shape{
     int r;
     Circle(int radius){
          super.m_type = 1;
          this.r = radius;
     }
}
```

figure for question 8(d)

L-3/T-1/CSE **Date : 04/02/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2014-2015

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USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What are the quality attributes for software product revision? Define three metrics to measure one of these attributes. **(6⅔)**

   (b) Your goal is to reduce the number of errors in coding. Define three matrices for this goal using goal oriented software measurement. **(8)**

   (c) Describe the significance of token, glue token and super glue token to define cohesion and coupling. **(7)**

   (d) Describe a scenario of reviewing the code for a method implementing quick-sort. Mention the participants and sample of the queries made by the reviewers in the review process. **(10)**

   (e) A software development is being done in seven phases. Each of the first four phases generate 25 errors. In the 2nd, 3rd and 4th phase, 40% errors of the previous phase are paused through without amplification and 60% errors of the previous phases are passed with an amplification by the phase number. The final three phases are testing phases without generating any error. The DRE of these three phases are 60% each. In the first four phases, the DRE of the review is defined by 20%×x, where x is the phase number. Find the remaining errors at the end of software development. **(15)**

2. (a) Demonstrate an example showing that exhaustive testing is nearly impossible. **(6⅔)**

   (b) Consider a module that finds the maximum number in an array of n numbers. Identify the test cases for loop testing. **(12)**

   (c) Consider a module which sorts several floating point data in descending order. Write down the code for automated tester that tests the order as well as originality of the data. Here originality means the unsorted input and sorted output are the same set of data. **(13)**

   (d) What are the components of unit test environment? Explain each of them. **(7)**

   (e) Explain different types of integration testing strategies. **(8)**

3. (a) In estimating a software development effort in function point method the following data are collected: **(10)**

	Counts			
	Pessimistic	Most likely	Optimistic	Weight
Number of user inputs	40	30	20	5
Number of user outputs	10	8	7	5
Number of use inquiries	30	20	15	4
Number of files	8	5	4	6
Number external Interfaces	10	8	6	8
Algorithms	20	15	10	6

Contd P/2

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Contd ... Q. No. 3(a)

In the complexity multiplier is 0.75 and a person can implement eight function points in a week, find the estimated budget. Average salary of a developer is Tk. 50,000 per month.

(b) Write down the guide lines for estimating the software project. **(7)**

(c) Write down the reasons behind the failure of software projects. **(6⅔)**

(d) What do you mean by project risk? Explain with example. **(8)**

(e) Consider the following risks shown below for a Banking software development project: **(15)**

Risk	Probability
Employee turnover	30%
Discontinuation of Development platform support	50%
Change of customer requirement	20%
Reduction number of customers in the market	40%
Missing delivery deadline	60%
Regulatory Constraints	70%
Change of technology	55%

Write down the impact of these risks with proper reasoning. Do formal risk analysis and show mitigation plan for the first five risks.

4. (a) Why are framework activities not applicable for any software development project? **(6⅔)**

(b) Compare incremental and spiral model for software development process. **(10)**

(c) Describe unified process for software development. How does the concept of concurrency and evolution applied in unified process? **(10)**

(d) Describe the distinguishing features of scrum model. **(10)**

(e) You are the architect for the software system that controls operation of a microwave oven. Which type of architecture will be most suitable? Explain with proper reasoning. **(10)**

SECTION – B

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

5. (a) A magazine company's customer sends an order coupon to the company's order entry department. The order entry clerk approves the order and prepares a four-part sales order form. The clerk then enters the order into the sales journal and accounts receivable subsidiary ledger. The first three copies of the sale orders are forwarded to the fulfillment department; the fourth is filed by date along with the order coupon. The fulfillment department determines which reward will be offered to the customer and updates the other to add reward information. The first copy of the order is mailed to the customer, the second is sent to the company's distribution center, and the third is filed numerically. **(20)**

Draw a prototype of the information system of the magazine company.

Contd P/3

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Contd ... Q. No. 5

(b) Discuss the disadvantages of the prototyping technique. **(10)**

(c) What types of UML diagrams do exits? Name each diagram type and describe its main purpose. Classify each of the UML diagram types as static or dynamic. **(10)**

(d) What is the value of the money after 5 years whose present value is $100, assuming a 5% discount rate? **(6⅔)**

6. (a) What is the difference between Structural and Behavioral patterns? Provide criteria for determining if a new pattern should be considered Structural or Behavioral. The criteria must also explain why the current patterns are classified as they are. **(10)**

(b) Give one design pattern that can be reduce dependence on hardware and/or software platforms. Explain how the pattern reduces a program's dependence on hardware and/or software platforms. **(12)**

(c) A company has decided to open a training school, which will deal with trainees employed in several departments. It is also intended that the training school will accept students of the local university who will pay a small fee. A new system is required to deal with registration, assigning trainees/students to one of the available classes, allocation of resources, (such as classrooms and tutors from the local university) and attendance. A class is always held in the same classroom. The university tutors will be paid for each hour they teach. They always teach in the same classroom but may teach different classes; however the classroom can be used by different tutors at different times. Briefly describe a fact-finding approach for this system. **(15)**

(d) A book is written by an author, published by a publisher, sold by a book store, and read by a reader. Moreover, for a reader to read a book, she must buy it from a book store that is selling it. Draw a use case diagram for this scenario, showing relationships between different use cases. **(9⅔)**

7. (a) Explain different kinds of feasibility analyses used in information system design. **(15)**

(b) In a Video Rental System a *Customer* makes a *Video request* to the *Rent Video* process. The Rent *Video* process also receives *Video info.* from the *Video Library* data store. The process produces a *Bill* to the *Customer*, and stores the *Rental info.* into the *Rental* data store. **(10+12)**

A *Customer* can *Return Video* by providing *Video* and *Rental info.* The process stores the *Video info.* into the *Video Library* data store and *Rental info.* into the *Rental* data store. As a result, *Return receipt* is delivered to the *Customer*. Note that Data Flow Diagram does not answer in what way and in what order the information is being used throughout a system. If this information is important and worth mentioning, consider to model it with diagrams. Finally, a *Manager* can receive *Rental report* from the *Generate Rental Report* process and the information involved is provided by the Rental data store.

Draw a context diagram and data flow diagram of the Video Rental System.

(c) Explain two different types of interaction diagrams with example. **(9⅔)**

Contd P/4

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8. (a) Describe different types of classes used in a class diagram with example. **(12 2/3)**

(b) Consider, you have a collection of several hundred music CDs. Your friends love to borrow them, often borrowing several at the same time. You don't mind lending the CDs, but it is becoming difficult for you to keep track of which friend borrowed which CD. The difficulty is increased by the fact that you have more than one copy of some CDs. Also you are thinking of introducing a daily fee per CD loaned. For these reasons you would like to build a database, which you could query to find out how many CDs a given friend has; how long the friend has had them and how much he or she owes; who has a particular CD and so on. Draw class and sequence diagram for the above scenario. **(12+10)**

(c) ABC Advertising specializes in using large helium balloons to help business with their marketing. They rely on computer processing and databases to manage the distribution of balloons around the country. Customers can hire their advertising balloon by phoning the state branch of ABC Advertising. **(6+6)**

Whoever answers the telephone, checks the booking file to see if the requested time by the customer is available. The customer contact details, advertising text, balloon type and install instructions are taken down and entered into the customer file. A total price is negotiated and 10% deposit is requested from the customer. This is written into the accounts file.

When the deposit has been received a receipt is sent to the customer and the accounts file is updated. A designer then uses the advertising details to create a number of design and these are sent to the customer. The customer selects the appropriate design and adds comments for any alteration and returns the design to ABC Advertising. The changes are made and the customer file is updated with the design details that will be used.

The balloon is created and an account is produced and sent to the customer. Installation is then completed at the prearranged time. When the full payment has been received from the customer the account file is updated and a statement showing all payment details is sent to the customer.

At the end of the week business transaction report is produced from the customer and account files and this is sent to the head office.

(i) Suggest whether a centralized or distributed information system would be used in the above situation. Give two reasons for your answer.

(ii) ABC Advertising is also developing a web site for online booking. They are also considering adding an online payment section for deposits. Describe a fact finding strategy a System Analyst could use to gather information about the sites requirements.

L-3/T-1/CSE Date : 08/08/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CSE 307** (Software Engineering and Information System Design)

Full Marks : 280 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) You are to analyze the requirements for a government office to automate the filing system. Describe how fact finding, questionnaire and interviews play different roles to elicit requirements. **(12)**

   (b) Design a typical room JRP (Joint Requirement Planning) session. Mention the roles and responsibilities of different participants. **(12)**

   (c) Define *extends* and *uses* relationship in *use case diagrams* with proper real life examples. **(7⅔)**

   (d) Consider a teller of a bank serving clients to deposit examination fees in a queue. Show the extended version of *use case* for depositing examination fees by a student. **(15)**

2. (a) Why are the following factors considered in selecting software teams: **(8)**

   (i) Degree of modularization of the problem

   (ii) Rigidity of the delivery date

   (iii) Size of the system to be developed

   (iv) Quality of the programmers

   (b) Write down the general form of empirical estimation model. How are the equations developed? **(8)**

   (c) You are a CTO of a bank. Your management has asked you to establish mobile banking for the customers of the bank. You have studied the mobile banking solution market and found the following alternatives: **(10⅔)**

   (i) Building the system by the in house programmer might require 100 Man-Month if it is simple and it might require 150 Man-Month if it is difficult. It is assumed that the probability that the system is different to build is 0.65.

   (ii) Reusing the previously developed system in another good option. The estimated effort for minor and major change requirements to modify the system for mobile banking are 80 Man-Month and 120 Man-Month respectively.

   (iii) Purchasing an off the shelf mobile banking system Tk. 50 lacs only. But the estimated effort for major and minor customizations are 40 Man-Month and 60 Man-Month respectively with equal probability.

   If the cost of average Man Month is Tk. 80 thousand then which alternate should be the wisest decision for the CTO?

   (d) "Reactive Risk Management is not a Risk Management" – Justify with appropriate example and reasoning. **(6)**

Contd P/2

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Contd ... Q. No. 2

(e) Explain the risks associated with the following factors: **(6)**

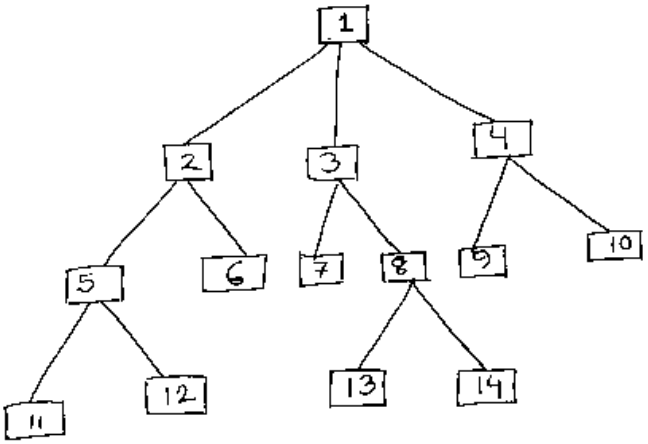
(i) Reasonableness of delivery date

(ii) Sophistication of the customer

(iii) Deviation of the product size.

(f) Explain risk mitigation technique using the risk table. **(8)**

3. (a) Consider the following call and return architecture of a subsystem: **(10)**



Show the sequence of tests done in top down integration mentioning the stubs and drivers

(b) Explain the debugging process with a diagram describing its process. **(8)**

(c) Consider a module which shorts a number of floating point data in ascending order. Write down the driver code for generating different sizes of data set. Write down the code for this module. **(12)**

(d) Consider a module that sums up n numbers. Identify the test cases for loop testing. **(10)**

(e) Demonstrate equivalence portioning for reducing the number of test cases with an example. **(6⅔)**

4. (a) Consider an aircraft controller with the provision of automatic and manual control. These could be switched whenever pilot wants. There are temperature, pressure and humidity sensors in the aircraft and these information are displayed in the cockpit. The automatic controller decides movement based on the sensor data and GPS system output. But whenever the aircraft is under manual control the system moves based on the pilots input. Write a DFD of the system and generate the architecture of the aircraft controller system. **(17⅔)**

(b) Explain the architecture of software system for the following case: **(12)**

(i) A billing software for Titas Gas Transmission and Distribution Company Ltd

(ii) An embedded system software that controls a microwave woven.

(iii) Software for Network Interface Card

(iv) MATLAB software.

Contd P/3

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Contd ... Q. No. 4

(c) Discuss framework and umbrella activities for software development. **(8)**

(d) Find a suitable software development process for the following case: **(9)**

(i) A scientific software development that require lots of innovation and there are unknown issues.

(ii) A quick development of stock brokerage solution for a new instrument.

(iii) A large software development with very unstable users.

Show proper reasoning for each case.

SECTION – B

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

5 (a) What is a model in the context of information system design? **(5)**

(b) What are the four kinds of things used in UML? **(12)**

(c) What is discovery prototyping? **(5)**

(d) Briefly describe the fact finding methods. **(14)**

(e) What is meant by JRP? Describe its advantages and disadvantages. **(10⅔)**

6. (a) What is meant by agile method? **(6⅔)**

(b) Briefly describe different computing layers with respect to application architecture. **(10)**

(c) Briefly describe human engineering guidelines for user interface design. **(8)**

(d) Consider the following problem description: **(22)**

Consider an online reservation system for a bus company. The bus company includes several buses and realizes trips to different cities. Each bus is identified by its plate number and a separately assigned bus number. The trips are based on a predefined schedule and stop at predefined bus stations. Each bus can have only one trip per day. Each bus includes a driver and one hostess. For long trips, the bus will have a breaks at service and rest areas. There are two types of trips: normal trips and express trips. Express trips do not stop at intermediate stations and get faster at the destination.

Seats can be reserved by customers on the web site of the bus company. The customer has the option to directly pay for the seat through the website. In that case, the seat cannot be cancelled (neither by the customer nor by the company). If the customer has not paid for the seat, the bus company can cancel the seat if the customer does not show up one hour before the trip. When the reservation is cancelled, the seat will become free and can be sold to another customer. Both the customer and the company staff must authenticate themselves for performing operations with the system

Draw a use case diagram for describing the functional requirements of the above system.

Contd P/4

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7. (a) To take CSE 308, a student must go through the following process. When the instructor posts assignment 1, each student must form a team, do the assignment and hand it in. When assignment 2 is posted, each student works on it with her term. When the midterm assignment is made available, each student writes it. After both assignment 2 and the midterm are done with, each student waits for assignment 3, and when it is available, does it with her team. Draw a class diagram (with attributes, where appropriate) that describes entities and relationship relevant to the process. In particular, students are members of teams. Each team has 2 or 3 members. Each team completes 0 to 3 assignments. Each student takes exactly one midterm test. Each assignment and midterm is assigned a mark. **(20)**

   (b) Draw a sequence diagram to represent the following scenario: **(16⅔)**

   A patient arrives at a Magnetic Resonance Imaging (MRI) center carrying a doctor's referral form. A clerk in the Intake Department reviews the referral form for completeness, checks the Active Doctor file to verify that the doctor is in good standing with the department, and signs the doctor's referral form. The intake department clerk then prepares a 3-part MRI assignment form, which identifies the MRI machine and technician. The third copy of the MRI assignment is mailed to the doctor, the second copy is recorded by date with the referral, and the first copy is forwarded to the Imaging Department. A technician is the imaging department performs the imaging procedure, updates the assignment form to include information about when the procedure was performed.

   (c) Distinguish between distributed and centralized architecture. What are the advantages of distributed architecture? **(10)**

8. (a) What is the present value of $ 1.000 one year from now, assuming a 10% discount rate? **(5)**

   (b) What is payback analysis? Explain briefly how it works. **(10)**

   (c) Draw context and data flow diagram for the case described below. Data flow diagrams which are impossible to interpret because of all the scratching out and changes are less likely to be treated generously. **(31⅔)**

   The Blood Bank Testing Unit. This is one unit within the College Street Red Cross Blood Donor Centre. On the day following a blood donation, the Blood Bank unit tests all blood for blood type and potential viral agents. They send the results of these tests to the Processing Office (another unit of the Centre). For each tested blood unit, they fill out a form which lists the blood unit number, the blood type, the date and the results of the test. If the tests indicate that the blood may be contaminated with a viral agent, the blood unit is destroyed. This is indicated on the test form. Blood units have a limited shelf life.

Contd P/5

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Contd ... Q. No. 8(c)

The Blood Bank receives a list every day of those units which have exceeded their shelf life. These are discarded and the list sent back to the Processing Office with a signed indication of the disposal of the units. The Blood also distributes blood to various hospitals requesting blood. Requests usually come in for specific blood types. The Blood Bank prepares refrigerated containers of these unit and distributes them to the hospital vans when they arrive to pick up their supply. The Blood Bank receives a listing for each hospital and the specific units of blood to supply to the hospital from the Processing Office. The order is printed in triplicate. When the order is filled, the lab technician signs the order and returns a copy to the Processing Office. A copy of it travels with the blood to the requesting hospital. The final copy is kept in the Blood Bank records but discarded after one year.

L-3/T-1/CSE **Date : 17/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **CSE 307** (Software Engineering and Information System Design)

Full Marks : 280 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) Differentiate between "Generic" and "Bespoke" software products with suitable examples. **(5⅔)**

   (b) "Waterfall Model may lead to blocking state" – Do you agree with the statement? Why or why not? **(7)**

   (c) Suppose you have to develop an application that takes a string of the format **A operator1 B operator2 C** as input and provides the result of the corresponding operation. Here, A, B and C are number string and the operator1 and operator2 are any one of +, –, *, / operators. Which design pattern will you chose to design a solution to the problem and why? Draw the appropriate class diagram for your proposed solution approach. **(4+10=14)**

   (d) Describe the phases of "Unified Process" in brief. **(15)**

   (e) At the conclusion of a project that used the Unified Process, it has been determined that 30 errors were found during the elaboration phase and 12 errors were found during construction phase. The error found in the construction phase were traceable to errors that were not discovered in the elaboration phase. But no errors were found in the transition phased. What is the DRE of the elaboration phase? **(5)**

2. (a) Differentiate between lazy and eager initialization of Singleton pattern. Draw the structure of singleton pattern. **(6+4=10)**

   (b) Draw the corresponding PERT chart of Table-1 and find out the critical path(s). **(14)**

Task	A	B	C	D	E	F	G	H	I	J	K
Dependency	--	--	A	B,C	C	D	E,F	G	G	H,I	J
Duration	1	3	3	5	1	4	3	2	2	5	6

Table-1 for Q. No. 2(b)

   (c) Draw the schematic diagram of RAD model and explain why it is a high speed adaptation of "Waterfall Model". **(7+5=12)**

   (d) Discuss use of "Project Velocity" with respect to Extreme Programming model. Provide a suitable example. **(6⅔)**

   (e) A Web Application and its support environment have not been fully fortified against attack. Web engineers estimate that the likelihood of repelling attack is only 30 percent. The system does not contain sensitive or controversial information, so that threat probability is 25 percent. What is the integrity of the application? **(4)**

Contd P/2

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3. (a) "To use LOC and FP for estimation, a historical baseline of information must be established" – explain. **(6⅔)**

(b) Suppose company A has taken up project S. Table 2 and 3 shoe the frequency and weight of the Function Points of project S respectively. External factors that affect project S are ranked from 0 to 5 and shown in Table 4. From historical data it can be found that the A's average productivity is 24 FP/pm and labor rate is $ 48000 per year. Calculate the estimated project cost and effort. **(15)**

FPs	Simple	Average	Complex
Inputs	2	4	6
Outputs	3	5	7
Files	5	10	15
Inquires	2	4	6
Interfaces	4	7	10

Table- 2 (Weight assignment of Function Points) for question 3(b)

FPs	Simple	Average	Complex
Inputs	-	4	2
Outputs	2	2	4
Files	2	5	1
Inquires	1	-	5
Interfaces	10	3	-

Table- 3 (Frequency of Function Points) for question 3(b)

Factor	Rank
Complex internal processing	4
Distributed processing	5
High performance	4
Multiple sites	5
Code to be reusable	3
Data Communication	5
Online Data Entry	4
Data Backup and Recovery	5

Table- 4 (External Factors) for question 3(b)

Contd P/3

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Contd ... Q. No. 3

(c) Consider the decision tree shown in Figure 1 for project S. Difficult implementation of project S costs the same as deduced in question 3(b). Simple implementation of project S costs 75% of the difficult implementation. Given company A's priority is cost minimization, what will be your decision regarding the implementation of project S? **(12)**

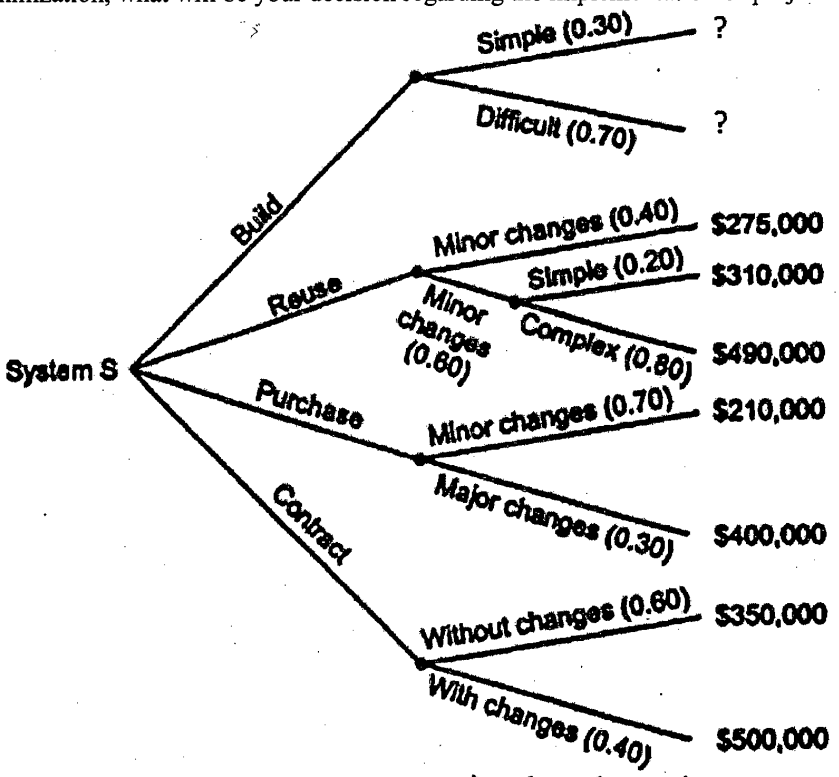

Figure-1 (Decision Tree) for Q. 3(c)

(d) Suppose your ISD lab group has been assigned to develop a "Library Management System" for BUET central library. **(3+10=13)**

(i) State one possible risk that can occur for each of the following risk types: technology, tools, and requirements

(ii) What is the probability and affect of each of the possible risks you identified? Justify your assessment.

4. (a) Suppose a project developed in C programming language. Propose four "Data faults" that should be checked during project inspection. **(6)**

(b) What is the primary motivation behind "Interface Segregation Principle"? With a suitable "bad example" explain the "Interface Segregation Principle". **(14⅔)**

(c) Consider the following code of "Counting Sort" algorithm that sorts an integer array ar, whose elements are drawn from the range [0, k). Here, n is the length of ar (n>0). Now, draw the corresponding flow graph of "Counting Sort" algorithm and identify the independent paths. For each independent path, design suitable test cases.

/** Sort the n elements in ar, drawn from the values [0, k). */ **(20)**

Contd P/4

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Contd ... Q. No. 4(c)

```
int* countingSort (int *ar, int n, int k) {
1. int i, idx = 0
2. If(n > 1){
3.          int *B = calloc (k, sizeof (int));
4.          for (i = 0; i < n; i++) {
5.                  B[ar[i]]++;
            }
6.          for (i = 0; i < k; i++) {
7.                  while (B[i]-- > 0) {
8.                          ar[idx++] = i;
                    }
            }
9.          free(B);
  }
10. return ar;
}
```

(d) Differentiate between: **(6)**

(i) Verification and Validation

(ii) Defect Testing and Debugging

SECTION – B

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

5. (a) The "Sweet Treat" company is a small, independent business that sells sweets and cakes to the public. The proprietor is very keen on baking and specializes in making homemade sweets and cakes for sale in the shop. Besides, making a lot of the confectionary sold in the shop, the proprietor also buys sweets and some cakes from suppliers to increase the range of products for sale. **(18)**

The proprietor keeps records of the quantities of stock he has on hand. The stock includes raw ingredients for his baking, and also the sweets and cakes he buys from suppliers. Once a week proprietor checks the stock to dispose of anything that is past its 'sell by' date. He also checks to see if any raw ingredients or any pre-made sweets and cakes need to be ordered from the suppliers. The proprietor orders supplies on a 'Cash on Delivery' basis, so all deliveries are paid for immediately after they arrive.

At the end of each day, the proprietor checks how many of each homemade item have been sold. He keeps a record of these sales, and uses this to decide how many of each cake or sweet to make for the following day.

Produce a top level data flow diagram of the "Sweet Treat" company.

(b) Consider the following cash flow description for an online auction management system which is ready to develop. Amounts given in dollar value. **(15)**

Assuming an 11% discount rate, what would be the payback period? Calculate annual ROI. Would be a good investment?

Contd P/5

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Contd ... Q. No. 5(b)

Year	Development Cost
0	588,040

Year	Estimated operation and maintenance cost	Estimated benefit
1	15,500	150,500
2	17,880	185,000
3	16,500	200,000
4	19,000	215,000
5	18,140	240,000
6	20,000	270,500

(c) Draw a collaboration diagram to illustrate the following scenario: a word-processor (active object) creates a print file and then asynchronously requests a print spooler (active object) to print the job. The print spooler repeatedly reads a block from the print file and sends the block to the printer (active object) using a procedure call. **(9)**

Also draw an activity diagram of the *print file* operation.

(d) What is JRP? Who are the JRP participants? **(4⅔)**

6. (a) A grocery store has just implemented a new sales system. The system generates invoice for each sale. Consider the following collaboration diagram for *creating invoice*. **(10+2+4)**

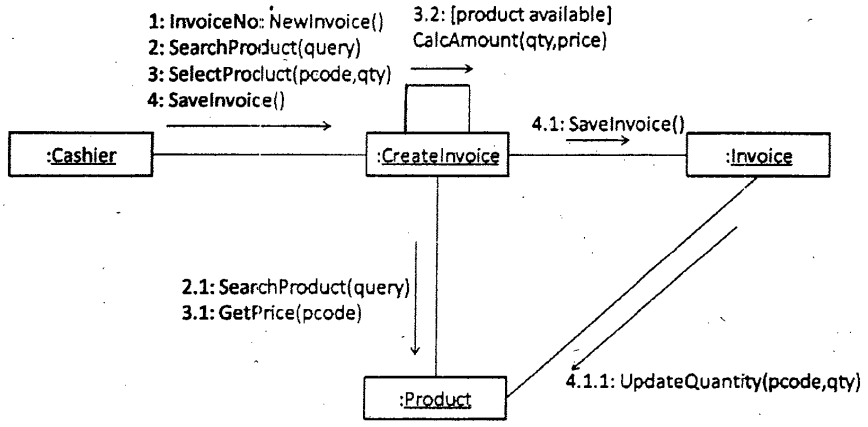

Figure 2: Collaboration diagram for Q. 6(a)

Now answer the following:

(i) Draw the sequence diagram for *creating invoice*.

(ii) Include stereotypes for each classes.

(iii) Find the UML Class for **Invoice**. Include everything that can be determined from the above diagram such as attributes, methods. You do not need to include information which is not contained in the above diagram.

Contd P/6

CSE 307

Contd ... Q. No. 6

(b) Assume that a chain shopping store is going to implement an information system. Every customer is associated with a branch. If a customer purchases products worth more than Tk. 50,000 in a month, he/she becomes a super customer for that month. Super customers get special offer for purchases from any branch in the specified month. Every branch has several employees and one manager. The manager of the branch defines the offer for that branch. So, offer of one branch is not related to the offer of another branch. Now answer the following based on the given scenario. **(4+10)**

(i) What database tables do you need for the store?

(ii) For each database tables, find whether you should replicate or partition the data. Justify your answer.

(c) What are the drawbacks of two-tier client-server architecture? How can the problem be solved? **(10)**

(d) Document management system (DMS) is used to track and store electronic documents. It is usually capable of history tracking i.e., keeping track of the different versions modified by different users. Now discuss the intangible benefits of a DMS. **(6⅔)**

7. (a) Give a state diagram that describes the process of passing a graduate course as a set of concurrent activities. The process works as follows: To pass, a student has to attend all but two lectures, present to the class a paper she read, and complete a course project, due on the last day of the term. To give her presentations, the student is given a date by the instructor, prepares her presentation, and gives it on the assigned day. At any time, the student can drop the course. **(15)**

Define events, conditions and actions for transitions in your diagram, where appropriate.

(b) Assume that you are designing an information system for a health center. Possible users of your system are doctor, nurse, patient, receptionist, pharmacist, attendant and patient. What are the seven fact finding methods? Argue which fact finding method(s) you should select for each user? **(15)**

(c) Different librarians work in different shifts in the university central library. The library contains multiple copies of each book. Each book is written by one or more authors and published by a publisher. A user may borrow up to 10 books at a time. User returns a borrowed book to the librarian working in that shift. Now design a class diagram with attributes and associations based upon the above scenario. You don't have to show any methods. **(12)**

(d) What are the different kinds of *things* in UML? **(4⅔)**

8. (a) The Northeast Hotel's website allows potential guests to make a room reservation, specifying the dates and type of room. If they have registered with the website previously, their stored details are used to speed up the process; otherwise they are required to register as a new customer. Each reservation is given a unique reservation code. Before the date of their stay, they may enter this reservation code into the website to amend or cancel the reservation.

Contd P/7

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Contd ... Q. No. 8(a)

Amendments can include altering the dates, changing the room type or the number of guests in each room. When the guests arrive at the hotel the reservation id is used by the receptionist to quickly find the reservation to check them in. At the end of their stay, the receptionist checks the guests out. At this point, the hotel system validates their payment through the card payment system. A printed invoice may be requested by the guests. The hotel has many room types available, each with a room-type name, number of guests and additional facility information. Each room in the hotel has a room number and is of one specific type. Monthly reports are prepared by the system which may be viewed on request by the Hotel Manager. **(15+5)**

(i) Produce a System Use Case diagram for the above scenario.

(ii) Also give the Use Case Dependency diagram.

(b) What does the abbreviation CRC stand for? Name two benefits derived from the use of CRC when used for class modeling? **(5)**

(c) A fellow designer has asked you to review the dialogue to be used in several screens for a new application. Give your opinion about the following messages based on the guidelines of tone and terminology. **(5)**

(i) **An error message that says** DISCHARGE, DATE MUST BE ON OR AFTER ADMISSION DATE.

(ii) **An instruction that says** ENTER THE CLIENTS NAME NOW.

(iii) **An error message that says** DATA IS SO FAR OUT OF RANGE IT HAS LEFT THE SOLAR SYSTEM.

(iv) **A question that asks** DO YOU WANT TO RDF THE ACR BEFORE "UCI' ING" CMIS?

(v) **An error message that says** DON'T WORRY-NOT EVERONE GETS IT RIGHT THE FIRST TIME.

(d) Define (any three): **(9)**

(i) Stratification of Sampling Method

(ii) Batch Input Processing

(iii) Stub Test

(iv) POS Terminal

(v) Reverse Engineering

(e) Suppose you have applied for a building permit. The authority, after receiving the application, reviews it for completeness. From this stage, the verified application is forwarded for compliance checking. The authority has to review the application for zone compliance and environment compliance. Further permission or registration for towers may be needed from aviation authorities. If all criteria are fulfilled, the authority will issue you the building permit. Now give the decomposition diagram of the "Building Permit Application Process System". **(7⅔)**

Ayon Sen
23-09-13

L-3/T-1/CSE **Date : 23/09/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **CSE 307** (Software Engineering and Information System Design)

Full Marks: 280 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**.

1. (a) Discuss the different implementation issues and consequences of Composite Pattern. **(14)**

   (b) Write a Java code fragment based on Singleton Pattern. There should be class called Base, which can be inherited by other classes. Define two classes called Derived1 and Derived2 that will inherit Base. The maximum number of instances of Derived1 and Derived2 that can be created is 5 and 10 respectively. Write a main function where two arrays of Derived1 and Derived2 are created respectively and show the Singleton implementation. **(18⅔)**

   (c) Discuss the different types of document standards with respect to quality management. **(6)**

   (b) What is process based quality? Describe process based quality briefly. **(8)**

2. (a) Read the following scenario carefully: **(18⅔)**

   A car rental company called "ABC Car Rentals" provides rent-a-car services to its customers. To rent a car from the company a customer must first visit its office. He then provides the time and duration to a company employee at the office. The employee checks the system and shows the customer available car models. The customer chooses a car model. The employee checks if that model is available for the given time. If not then the customer is asked to choose again. After the car model is fixed the employee asks the customer for his national id number and other necessary information. The information is entered into the system by the employee. The specific car is also booked for that particular time given by the customer. The employee then informs the customer about the rental cost and asks him to pay half the cost in advance. If the customer is unable to pay the cost then the booking is cancelled.

   Now give the use case narrative for the use-case "Rent a Car" given this scenario.

   (b) Define resilient and non-resilient systems. **(6)**

   (c) What are the different types of messages in a sequence diagram? Discuss them briefly with examples. **(12)**

   (d) What is a CRC card? Discuss its usages. **(10)**

Contd P/2

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3. (a) What are the different types of events in a state chart diagram? **(8)**

(b) An insurance company provides life insurance policies to its customer. A customer can purchase a policy worth Tk 3,50,000 for the duration of 5 years. After purchasing a policy the customer must pay monthly installments of Tk 5000 to the company. If a customer fails to pay the installment he becomes a defaulter. A defaulter must pay an extra Tk 500 for each month he did not pay to become a regular client again. If a customer fails to pay 6 consecutive installments then his policy is cancelled by the company. If the customer dies within the given time period then the company pays the nominee Tk 3,50,000. If the customer does not die during the period then the customer is paid Tk 3,50,000 by the company.. **(14⅔)**

Now draw the state chart diagram of a customer for this system.

(c) What are the different phases of constructing a new system? Describe them. **(16)**

(d) What are the different installation strategies while implementing a new system? **(8)**

4. (a) What are the different types of System Design Approaches? Describe the different types of Model Driven Approaches. **(18⅔)**

(b) What is three-tiered or n-tiered client/server computing? Discuss its various aspects. **(12)**

(c) What are the four essential elements of a Design Pattern? Discuss them briefly. **(8)**

(d) What are the difference between the usage of bar charts and column charts? When do we use radar charts and scatter charts? **(8)**

SECTION – B

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

5. (a) Classify each of the following statements according to its most appropriate requirement category by indicating 1, 2, 3, 4, 5, 6 or 7, where the numbers denote the following categories: **(10)**

1 - The sentence is a performance requirement.
2 - The sentence is a portability requirement.
3 - The sentence is a security requirement.
4 - The sentence is a usability requirement.
5 - The sentence is an availability requirement.
6 - The sentence is a maintainability requirement.
7 - The sentence is a domain requirement.

Contd P/3

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Contd... Q. No. 5(a)

	Statement	Category
i)	The system must authenticate the user at each new session.	
ii)	On average, no more than 2 failures requiring a system restart shall occur within a month of operation.	
iii)	At most 5% of the source code shall be operating system specific.	
iv)	The methods of the system shall have a maximum cyclomatic complexity of 6.	
v)	The system shall be able to run with all functionality enabled within 250 MB of internal memory and 2 GB of external memory.	
vi)	The rocket shall reach a speed of 11.2 km/s in order to evade earth gravity.	
vii)	The system shall be operational on Windows XP, Windows Vista, and Windows 7.	
viii)	The system shall require less than five mouse clicks to add a weekly meeting to a user's calendar.	
ix)	After a 2 hours training period, a regular user shall be able to add a new customer within 3 minutes.	
x)	The Olympics Ticketing System shall be able to process 100 ticket requests per minute at peak load.	

(b) What is agile software development? Briefly describe different stages of extreme programming. **(18⅔)**

(c) Compare and contrast the Scrum approach to project management with conventional plan-based approaches. The comparisons should be based on the effectiveness of each approach for planning the allocation of people to projects, estimating the cost of projects, maintaining team cohesion, and managing changes in project team membership. **(18)**

6. (a) CSE department of BUET has got a very exciting project of modifying an existing banking solution. The solution is now working in different branches of many banks. But it has one major disadvantage that it does not use any centralized database. Now the task is to do a complete requirement analysis, design and redevelopment of the banking solution so that it can support online (any branch) banking. The project may need a complete technological up gradation. Also, CSE department has the problem of losing skilled personnel as teachers frequently leave for higher studies. Identify the risks associated in this project and describe how you plan to cope up with these. **(16⅔)**

(b) What are the different ways in which software engineers can deal with errors? What are the advantages and disadvantages of these approaches? List and discuss as many ways as you can think of. **(12)**

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Contd... Q. No. 6

(c) The following Table sets out a number of tasks, their durations, and their dependencies. Draw a bar chart showing the project schedule. **(18)**

Task	Duration	Dependencies
T1	10	
T2	15	T1
T3	10	T1,T2
T4	20	
T5	10	
T6	15	T3,T4
T7	20	T3
T8	35	T7
T9	15	T6
T10	5	T5,T9
T11	10	T9
T12	20	T10
T13	35	T3,T4
T14	10	T8,T9
T15	20	T2,T14
T16	10	T15

7 (a) Your company is developing software for an on-line stock-trading service. The software contains the following subsystems: a database of stockholder accounts, a web-based client through which customers place orders and request stock prices, an ordering server which processes stock transactions as requested by clients, and a networking system for communicating with an external stock price server (for up-to-the-minute stock prices).

For each of the following test cases, indicate whether it should be run during unit, integration, or system testing.

If you feel a test should be run in more than one testing phase, state the phases and justify your answer. **(10)**

(i) Assuming the server is up, do stockholders receive price quotes within 3 seconds even if 200 stockholders request quotes simultaneously?

(ii) Does the ordering server accept an order only if the stockholder's account has sufficient funds to cover the order?

(iii) Does the client refuse orders for stocks that do not exist?

(iv) If the server receives an order to purchase stock and the stockholder has sufficient funds, is the stock eventually purchased?

(v) Once stockholder's account has been removed from the account database, is that stockholder prohibited from placing orders through the software?

Contd P/5

CSE 307

Contd... Q. No. 7

(b) Draw the control flow graph for the following function. Then determine the cyclomatic complexity and the basis set of independent paths of the CFG. Finally prepare test cases that force execution of each path in the basis set. **(25)**

```
public double calculate(int amount)
{
    double rushCharge = 0;
    if (nextday.equals("yes"))
    {
        rushCharge = 14.50;
    }
    double tax = amount * .0725;
    if (amount >= 1000)
    {
        shipcharge = amount * .06 + rushCharge;
    }
    else if (amount >= 200)
    {
        shipcharge = amount * .08 + rushCharge;
    }
    else if (amount >= 100)
    {
        shipcharge = 13.25 + rushCharge;
    }
    else if (amount >= 50)
    {
        shipcharge = 9.95 + rushCharge;
    }
    else if (amount >= 25)
    {
        shipcharge = 7.25 + rushCharge;
    }
    else
    {
        shipcharge = 5.25 + rushCharge;
    }
    total = amount + tax + shipcharge;
    return total;
} //end calculate
```

(c) Briefly describe the techniques of estimating different stages of agile development. **(11⅔)**

8. (a) You have an impatient, result-oriented client who keeps on changing requirements. Which process model would you adopt to keep the development under control? Why? **(10)**

(b) Describe the four phases of the Rational Unified Process (RUP). Mention four ways in which the RUP differs from the Waterfall process model. **(12)**

(c) How COCOMO II model for cost estimation can be used at various stages of a project life cycle? **(15)**

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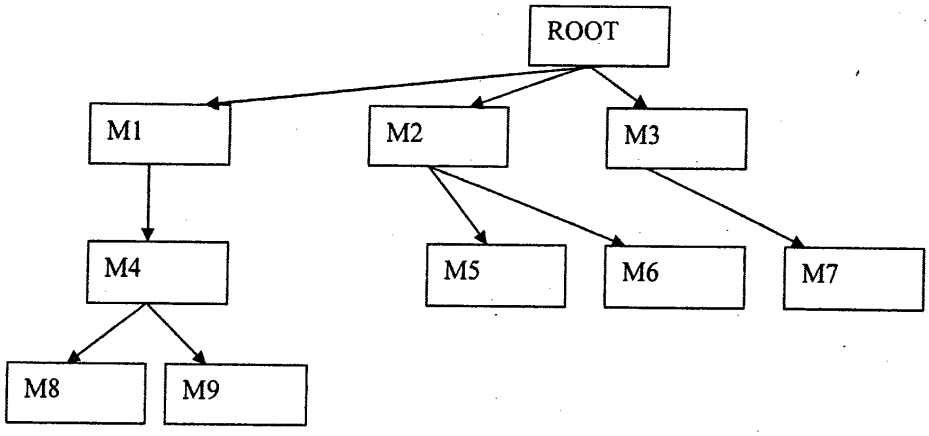
Contd... Q. No. 8

(d) The structure chart below illustrates the hierarchy of modules in a software sub-system: **(9⅔)**



Describe the sequence of module tests for integrating the modules using the depth first top-down approach.

L-3/T-1/CSE Date : 19/03/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 307** (Software Engineering and Information System Design)

Full Marks : 280 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**.

1. (a) Read the following Use Case Carefully. **(24⅔)**

Use Case : Check Out Books

Primary Actor: Worker

Stakeholders and Interests:

-Worker: wants fast, and easy check out of books.

-Patron: wants fast check out, and does not want to be charged for books they did not check out.

-Library: wants fast check out of books, and wants to make sure that all books that leave the library have been checked out. Wants to allocate books fairly.

-Government: wants to protect investment in books and keep costs down.

Wants to promote learning and citizen happiness.

Preconditions: The Worker has been authenticated.

Success Guarantee (Post conditions): The System remembers that the Patron has checked out the books.

Main Success Scenario (or Basic Flow):

1. The Worker tells the System the identity of a patron who wishes to check out books.
2. The System confirms that the patron is allowed to check out books, and remembers the patron's identity.
3. The Worker tells the system the identity of a book this patron is checking out.
4. The System confirms that the book can circulate, calculates the due date based on whether the patron is a faculty member or a student, and records that the patron has checked out this book, which is due on the calculated due date, and makes that information available from the library catalog.
5. The System tells the Worker the due date (which also confirms that the book has been checked out).

The Worker repeats steps 3-5 until indicates done.

Extensions (or Alternative Flows):

2a. if the patron is not allowed to check out books because they have violated some library policy (for example, if the patron has not paid their university bill or library fines):

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Contd ... Q. No. 1(a)

1. The System tells the Worker that the patron is not allowed to check out books and the reason for this prohibition.

2. The use case ends.

4a. If the book that is being checked out is non-circulating;

1. The System tells the Worker why the book is non-circulating.

2. The use case continues from step 3 in the main success scenario.

Special Requirements

-There are different due dates depending on the kind of patron one is dealing with. For example, faculty can take out books for the whole academic year, whereas students can only take them out for a limited time.

-The System must respond to the Worker, at least giving some progress indication, within 3 seconds, 95% of the time.

-Workers are experts, because they use the system continuously, so the interface should have minimal interaction and should minimize the physical effort involved; for example, workers should not have to be prompted.

-Displays for the worker should be visible from one meter away.

-The system should be quiet.

Technology and Data Variations List:

3a. Barcode scanners are normally used to identify books.

3b. Books without barcodes have to be entered manually.

Frequency of Occurrence: nearly continuous.

Open Issues: How to deal with failures and recovery?

How to deal with overnight check out of reserve items.

How to deal with library books that are unknown to the circulation system.

Now draw a **Collaboration** and **Class diagram**, which should be relatively complete for the use case given. It should include associations also.

(b) List all behavioral UML diagrams and describe the purpose of each of them. **(8)**

(c) Draw an **Activity diagram** that represents the making of a cup of tea. The initial three activities are Fill kettle with water, Find cup and Find tea bag and they may be performed in parallel. When the Find cup and Find tea bag are completed the activity Place tea bag in cup can start. The kettle must have boiled and the tea bag must have been placed in the cup before the activity Add water to cup can begin. If milk is required then activity Add milk should be performed. **(10)**

(d) Assume that A, B, C and Boolean variables, X, Y, Z are outcomes. Propose a decision table for the following procedure: **(4)**

Contd P/3

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Contd ... Q. No. 1(d)

If A then if B then X
else if C then Y else Z endIf endIf
else if C then X else Z endIf
endIf

Make sure your final table is in simplified form, i.e., does not have redundant rows or columns.

2. (a) To buy a book electronically from chapters.com, a customer needs to select the book from a list provided by Chapter's eCommerce system, provide credit card information to the system, then the system gets authorization from the bank for the payment, and --if positive -- confirms the sale. The order is then sent to the orders department and when the book becomes available, it is shipped to the customer. Also, the order department charges the customer's credit card by informing the bank of the amount.

Draw a **Sequence diagram** that models this process. Make sure to model all relevant actors and the interactions between them. Do show explicitly the time intervals when different actors actively participate in the process you are modeling. **(12)**

(b) Give a **State Chart diagram** that describes the lifetime of a video tape in a video store. You can assume that a video tape is purchased, packaged properly (plastic case with identification information on the outside), put in the video store database, and is then put up for rental. Customer who choose to rent it, check it out and return it in 3 days. If a customer fails to return it, the store calls him/her the next day. The call is repeated a second time after 2 more days, and if the tape is not returned within 2 more days, the store delegates the matter to a collection agency and removes the video tape from its collection. If the tape is damaged on return, it is removed from the collection database also. Finally, if the tape is missing during the annual store inventory, it is removed from the collection database as well. **(12⅔)**

Make sure to define **events, conditions, actions** for transitions in your diagram, where appropriate.

(c) A book is written by an author, published by a publisher, sold by a book store, and read by a reader. Moreover, for a reader to read a book, she must buy it from a book store that is selling it. **(8)**

Draw a **Use Case diagram** for this scenario, showing relationships between different use cases.

(d) (i) What is the present value of $ 1,000 one year from now, assuming a 10% discount rate? **(4+10)**

(ii) Explain the difference between **return on investment** and **payback period**. Why might you need to know both in order to decide which of two different development alternatives represents a better investment for a particular organization?

Contd P/4

CSE 307

3. (a) **The Blood Bank Testing Unit**. This is one unit within the College Street Red Cross Blood Donor Centre. On the day following a blood donation, the Blood Bank unit tests all blood for blood type and potential viral agents. They send the results of these tests to the Processing Office (another unit of the Centre). For each tested blood unit, they fill out a form which lists the blood unit number, the blood type, the date and the results of the test. If the tests indicate that the blood may be contaminated with a viral agent, the blood unit is destroyed. This is indicated on the test form. **(12⅔)**

Blood units have a limited shelf life. The Blood Bank receives a list every day of those units which have exceeded their shelf life. These are discarded and the list sent back to the Processing Office with a signed indication of the disposal of the units.

The Blood Bank also distributes blood to various hospitals requesting blood. Requests usually come in for specific blood types. The Blood Bank prepares refrigerated containers of these units and distributes them to the hospital vans when they arrive to pick up their supply. The Blood Bank receives a listing for each hospital and the specific units of blood to supply to the hospital from the Processing Office. The order is printed in triplicate. When the order is filled, the lab technician signs the order and returns a copy to the Processing Office. A copy of it travels with the blood to the requesting hospital. The final copy is kept in the Blood Bank records but discarded after one year.

Draw a **data flow diagram** for the Blood Bank Testing Unit System.

(b) Define each of the following with suitable examples: **(24)**

(i) Detailed Report
(ii) Summary Report
(iii) Exception Report
(iv) Turnaround Document
(v) Two-Tier Architecture
(vi) Three-Tier Architecture
(vii) File-Server Architecture
(viii) Agile Method

(c) The ordinary way to extend a software system is to find a suitable superclass, and to subclass it, You can also "inherit" behavior from more than one class by copying some of the operations of the second class and delegating calls to an instance of that class. Both of these extension techniques, however, require that you know at compile time what behavior you want to add. Name these two techniques that we just described. Should one of these techniques require a preferential treatment? **(5)**

Contd P/5

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Contd ... Q. No. 3

(d) Does the following code fragment implement the **Factory design pattern**? Explain in brief. **(5)**

```
public class XMLReaderFactory {
// This method returns an instance of a class
// that implements the XMLReader interface.
// the specific class it creates and returns is
// based on a system property.
public static XMLReader createXMLReader ( ) ;
}
public interface XMLReader {
public void setContentHandler (ContentHandler handler) :
public void parse (InputStream is) ;
}
```

4. (a) Which of the following (i) and (ii) is a valid implementation of **Singleton Pattern**? Give specific reason for each of the following implementation. **(5)**

(i)

```
public class Singleton {
private static Singleton s_singleton = new Singleton ( ) ;
    private Singleton ( ) { }
            private static Singleton getInstance( ) {
                    return s_singleton;
    }
}
```

(ii)

```
public class Singleton {
    private Singleton ( ) { }
    private static class SingletonHolder {
    private static final Singleton instance = new Singleton ( ) ;
            }
    public static Singleton getInstance ( ) {
            return SingletonHolder. instance;
    }
}
```

(b) Write down the guideline for input design and output design of a system. **(5+5)**

(c) In principle a social network service focuses on building online communities of people who share interests and/or activities, or who are interested in exploring the interests and activities of others. Facebook support groups that people can join. Each group has a title, administrative members, a group type (open/ closed), and a list of related groups. Otherwise, a group operates just like an ordinary page. If somebody writes on the wall page of the group, the information is broadcasted to all the members and it is visualized in the news feeds of the members.

Contd P/6

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Contd ... Q. No. 4.(c)

Which design pattern is the most appropriate to handle this basic functionality of such a Facebook group? Users should be able to join a group as well as leave a group if they get bored. Once a user has joined a group it will automatically receive any updates that are published on the wall. Give a short explanation. In particular, show a complete class diagram(s) and enough code fragments to illustrate your use of the pattern to solve the problem. **(12)**

(d) Now let's suppose that you would like to extend the functionality of Facebook group that you have created in **Question. 4(c)** by adding the possibility that besides normal users a group page can also be a member of another group. As an example it should be possible that the group page of the "CSE BUET 08" joins the "BUETIANS" group. As a consequence all the members of the "CSE BUET 08" group become automatically members of the "BUETIANS" group. **(12⅔)**

Which design pattern is most appropriate to accommodate this change? How the solution proposed in the previous example shall be extended. Please give a short explanation why. Show a complete class diagram(s) and enough code fragments to illustrate your use of the pattern to solve the problem.

(e) Suppose Alice told you the following story **(7)**

"At the company for which I work we are facing this problem: We have a large amount of application software written using a particular library. Let's call this library LibX. The provider of this library was XIndustries AB. We wanted to extend the functionality of our application and for this reason we tried to contact XIndustries AB to implement the necessary library functionality. To our surprise we found out that XIndustries AB has gone out of business. Fortunately we found out that there is another company called YEnterprise AB is producing LibY that provides the same functionality as LibX but many of the classes have different interfaces. We don't have access to the source code of the old library LibX and neither to the source code of LibY. What should we do?"

Which design pattern is most appropriate to accommodate this change? In particular, show an appropriate class diagram to solve the problem.

SECTION – B

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

5. (a) What do you know about COCOMO model? Describe the basic COCOMO model with its limitations. How COCOMO II model for cost estimation can be used at various stages of a project lifecycle? **(5+10+15)**

(b) How Ishikawa diagram is used to identify, explore and depict problems, and the causes and the effects of those problems? Describe with an appropriate example. **(16⅔)**

Contd P/7

CSE 307

6. (a) Discuss about waterfall model and iterative model of software development. **(3+3)**

   (b) What are the challenges that arise in quality management of a software development process? Suppose your team is developing customized hospital management software. Identify the quality criteria for such a project. **(4+8)**

   (c) What is the difference between verification and validation? What input/output faults you may check while designing a banking transaction module. **(2+5)**

   (d) Describe the communication practices a software engineer should adopt. **(6⅔)**

   (e) Suppose you are writing a 'Queue' class. Design some test cases to verify your code. **(15)**

7. (a) Discuss about professional and ethical responsibilities of a software engineer. **(6⅔)**

   (b) As a part of ensuring eGovernance goal, the Government is going to computerize its land management process that keeps records about land ownership and transfers of ownerships. It is your responsibility to do the requirement analysis for such a project. What fact finding techniques you may use and how? **(25)**

   (c) Your company has previously made the very successful game BUET Premier League 2011 (BPL 2011). But new 3D technology has arrived and the introduction of Kinect sensor requires you to upgrade the game to a newer version. Now, the overall market condition is not good due to economic recession, and this game may be a key to success for your company over the other game developing firms in the market. Identify the associated risks in this project and describe how you plan to cope up with these. **(15)**

8. (a) What is the difference between software engineering and system engineering? **(5)**

   (b) Suppose you are the project manager of a newly founded software firm and you are estimating the cost of a customized VOIP software to quote in a tender process. The market is very competitive, but you have the advantage of having some skilled persons in your firm. What pricing factors you should consider while making that cost estimation and why? **(15⅔)**

   (c) Describe the following software cost estimation techniques: **(3+3)**

   (i) Parkinson's Law.

   (ii) Pricing to win.

   (d) Find the critical path of a project using PERT chart base on the following table describing task dependencies and the expected duration of each task. **(20)**

Task	Prerequisite	Duration
A	-	2
B	-	3

Contd P/8

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Contd ... Q. No. 8(d)

C	A	3
D	B,C	5
E	C	1
F	D	4
G	E,F	3
H	G	2
I	G	3
J	H,I	5
K	J	6
