University of Dhaka
Department of Computer Science and Engineering
3rd Year 1st Semester Final Examination, 2022
CSE-3102: Software Engineering (3 Credits)

Time: 3 hours **Total Marks: 70**

Answer any five (5) out of the following seven (7) questions. Marks are given in the right margin.

1 (a) There are two major views of software development lifecycle: activity-oriented view and entity-oriented view. Give the combined view and show how the activities are related with the deliverables. [5]

(b) Briefly describe the fundamental distinctions between the spiral model and the waterfall model. [4]

(c) When is evolutionary model preferred to waterfall model? Explain. [5]

2 (a) Justify the statement with proper reasoning "*The requirement analysis document serves as a contract between development team and the customer*". [4]

(b) Give two reasons of why it is a good idea to classify and separate functional requirements and non-functional requirements in a requirements specification document. [3]

(c) For the following description of a system, identify functional and non-functional requirements of the system: [7]

Suppose you want to develop software for an alarm clock. The clock shows the time of day. Using buttons, the user can set the hours and minutes fields individually, and choose between 12 and 24-hour display. It is possible to set one or two alarms. When an alarm fires, it will sound some noise. The user can turn it off, or choose to 'snooze'. If the user does not respond at all, the alarm will turn off itself after 2 minutes. 'Snoozing' means to turn off the sound, but the alarm will fire again after some minutes of delay. This 'snoozing time' is pre-adjustable.

3 (a) Assume, you are going to implement an application that will handle the process of assigning the driving license to the people. Two types of people will use this application, the admins and the general people. The features from the general people's side will require logging credentials, account authentication, a basic information-providing panel with an update feature, the ability to give online exams, a panel to apply for the license, a panel to receive important notifications, and many more. [5+5]

Similarly, the admins will have features to verify an account with his/her national id, will have features to set questionnaires for an online exam alongside marking assistance. The admins will also be able to send notifications regarding many aspects to the people who applied for the license and finally a panel to update different attributes of the database.

(i) You need to draw a use-case diagram of the above-assumed application.

(ii) You also need to draw two state chart diagrams representing various states of the general people and the admins.

The listed features are only a bare minimum of the expected features of the application. You are welcome to incorporate other features as well.

(b) Suggest two different readers of a requirements specification. Explain what they will look for in the specification. [4]

4 (a) Coupling is a measure of the interdependence among components in software. Explain content coupling, control coupling and data coupling with examples. [5]

(b) Partitioning and layering are techniques to achieve low coupling. Explain how low coupling is achieved through partitioning and layering. [5]

(c) Which one of functional cohesion and procedural cohesion is more desirable and why? [4]

5 (a) A group of diary and time management system is intended to support the timetabling of meetings and appointments across a group of co-workers. When an appointment is to be made that involves a number of people, the system finds a common slot in each of their diaries and arranges the appointment for that time. If no common slots are available, it interacts with the user to rearrange his or her personal diary to make room for the appointment. [8]

Identify possible entity, boundary and control objects including attributes and operations in the above system.

(b) A book is composed of a number of parts, which in turn are composed of a number of chapters. Chapters are composed of sections. A book includes a publisher, publication date, and an ISB number. A part includes a title and a number. A chapter includes a title, a number, and an abstract. A section includes a title and a number. [6]

Draw a class diagram representing a book defined by the above statements.

6 (a) The essence of software testing is to determine a set of test cases for the item to be tested. Identify all the components of a test case. [4]

(b) In white box testing, correct working of code is tested. Explain branch coverage and path coverage with respect to white box testing with an example. [6]

(c) Differentiate between white box testing, grey box testing, and black box testing. [4]

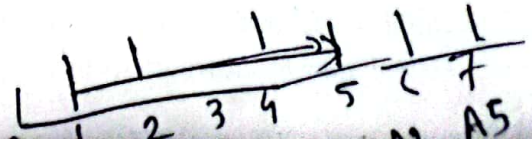
7 (a) A project organization defines the relationships among resources, in particular the participants. Give communication structure among participants of a project. [3]

(b) Show associations between tasks, activities, roles, work products, and work packages. [3]

(c) A project consists of 5 activities. Let us consider the following table for starting finishing week for each activity of the project: [8]

Activity	Latest Start (LS)	Latest Finish (LF)	Earliest Start (ES)	Earliest Finish (EF)
A1	Start of week 1	End of week 5	Start of week 1	End of week 5
A2	Start of week 7	End of week 7	Start of week 6	End of week 6
A3	Start of week 2	End of week 2	Start of week 1	End of week 1
A4	Start of week 3	End of week 5	Start of week 2	End of week 4
A5	Start of week 6	End of week 7	Start of week 6	End of week 7

Find the critical path of the project and slack time of each activity.



University of Dhaka
Department of Computer Science and Engineering
3rd Year 1st Semester Final Examination, 2021
CSE-3102: Software Engineering (3 Credits)

Time: 3 hours **Total Marks: 70**

Answer any five (5) out of the following seven (7) questions. Marks are given in the right margin.

1 (a) Describe briefly the function of each tasks of requirement engineering. [5]

(b) Consider normal operation of an ATM for withdrawing cash. The scenarios are like: a customer inserts the card, enters his/her PIN, enters the amount, takes the card, and takes the money. [4]

Identify the main actors and give the use-cases.

(c) The paragraph given below describes the functionality of an auction web-market with the following features: [5]
Sellers publish offerings with product descriptions and sales conditions. Buyers search with a hierarchy of categories or with free-text keywords. Buyers can bid on offerings. Sellers can sell to highest bid or at fixed price. Sellers can sell to highest bid or at fixed price. Sellers can be business sellers or private persons. Buyers can rate sellers.

Identify functional and non-functional requirements of the system.

2 (a) Consider the operation of a vending machine: [7]
The main function of a vending machine is to allow a customer to buy product(s) from the machine (candy, chocolate, soda, juice, etc.). When the customer wants to buy some of the products offered by the vending machine, he/she inserts money into the machine, selects one or more products, and the machine dispenses the selected product(s) to the customer. If the products cost less than the amount of money the customer put in the machine, the vending machine shall dispense change. Also, the vending machine needs to be restocked when it runs out of certain products. In addition, there must be a provision for a person (say, a collector) to collect money from the vending machine.
(i) Identify the main actors.
(ii) Draw the Use Case Diagram for the above scenario.

(b) Create an UML activity diagram modeling a student applying for a job describing the following scenario: [7]
The student is writing a letter that is sent to the company. The company registers the application and a manager takes a decision if the student should be interviewed or not. If the student should be interviewed, the manager books a meeting time. In both cases, the student gets an e-mail with a response to the application. If the student is called to the interview, he will get the response if he got the job at this meeting. At the same time as the company manages the application, the student is taking a course at the university. If the student accepts the job he will start at the company after the course is finished. Divide the diagram into suitable swimlanes and give proper names.

3 (a) A group of diary and time management system in intended to support the timetabling of meetings and appointments across a group of co-workers. When an appointment is to be made that involves a number of people, the system finds a common slot in each of their diaries and arranges the appointment for that time. If no common slots are available, it interacts with the user to rearrange his or her personal diary to make room for the appointment. [7]

Identify possible objects (including attributes and operations) in the above system and develop an object-oriented design for them.

(h) Consider the following scenario: [7]

A Blood Bank collects blood and tests all blood for blood type and potential viral agents. The results of these tests are sent to a processing officer. For each tested blood unit, he fills out a form that lists the blood unit number, the blood type, the date and the results of the test and this information is stored in a database. 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.

A number of hospitals make request for blood to the bank. A processing officer prepares a listing for each hospital and the specific types of blood to supply to the hospital. If the blood for specific type is available, the bank prepares refrigerated containers of these units and distributes them to the hospital vans when they arrive to pick up their supply. When the order is filled, the lab technician signs the order and returns a copy to the processing officer. 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 the context level DFD and Level-1 DFD.

4 (a) Discuss various types of coupling. What are the problems if coupling between two modules is high? [5]

(b) Give two arguments of why it is good to have high cohesion and low coupling amongst software modules. [5]

(c) A system architecture is often described using multiple views. Why is this beneficial? [4]

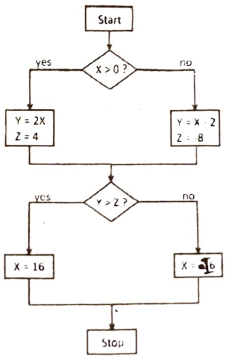
5 (a) Software testing activities boils down to selecting and executing test cases. Identify five key elements of a test case. [5]

(b) Design black box test suits for a function that checks whether a character or string upto ten characters is a palindrome. [6]

(c) Differentiate between white-box and black-box testing. [3]

6 (a) When and how often in the lifecycle does *verification* and *validation* activities take place? Which members of the team are typically in charge of each one? Explain briefly. [5]

(b) Consider the flowgraph below describing a function with an input variable X and output variables X, Y and Z. Write down two sets of test cases. The first set of test cases shall guarantee that all statements are executed at least once, using a minimum number of test cases. The second set of test cases shall guarantee that all paths1 of the flowgraph are traversed at least once. [5]



(c) Create a short risk management plan for a software development project. The plan should include one technology risk, one business risk, and one project risk. There are two strategies for accepting a risk. For each of the 3 risks, write down one example for each strategy. [4]

7 (a) Define role, task, work package and explain different communication strategies. [5]

(b) Give the basic principle for project scheduling. Why critical path and slack time is important in project scheduling. [5]

(c) A problem estimates unadjusted function point as 18, value added factor as 0.87, and performance factor as 2. Find the effort in person days. [4]

University of Dhaka
Department of Computer Science and Engineering
3rd Year 1st Semester Final Examination, 2020
Course Code: CSE-3102
Course Title: Software Engineering (3 Credits)

Time: 2 hours **Total Marks: 70**

Answer any three (3) out of the following five (5) questions. Marks are given in the right margin.

1 (a) Explain the terms *actor*, *use-case* and *system boundary*. **[4]**

(b) Consider the normal operation of an ATM. The scenarios are like; a customer inserts the card, enters his/her PIN, enters the amount, takes the card, and takes/deposits/transfers the money. Identify the main actors and give the use-cases. **[12]**

(c) Draw one use-case diagram of a web-based bookstore, for instance Amazon, with two different actors and two different use-cases. Both actors shall be humans and have an association to at least one use-case. **[7.33]**

2 (a) (i) What aspects lead to the success of Agile methods? Explain with the basis of its principles. **[8+4+4]**
(ii) What are the problems with Agile methods?
(iii) How does Extreme Programming relate to Agile methods?

(b) Discuss the five categories of the stakeholders with respect to effective software project management. **[7.33]**

3 (a) Give two reasons why it is a good idea to classify and separate functional requirements and non-functional requirements in a requirements specification. **[4]**

(b) For the following description of a system, identify functional and non-functional requirement of the system: **[12]**

A user can request a quiz in the system. The system picks a set of questions from its database and composes them together to make a quiz. It rates the user's answers, and gives hints if the user requests it. In addition to users, we also have tutors who provide questions and hints. And also examiners who must certify questions to make sure they are not too trivial, and that they are sensible.

(c) Suggest two different readers of a Requirement Analysis document. Explain what they will look for in the specification. **[7.33]**

4 (a) Draw a class diagram that represents a book which is defined by the following statement: "A book is composed of a number of parts, which in turn are composed of a number of chapters. Chapters are composed of sections." Draw the class diagram focusing only on classes and relationships. **[4]**

(b) Create a UML *activity* diagram modeling a student applying for a job that is described by the following scenario: **[12]**

The student is writing a letter that is sent to a company. The company registers the application and a manager takes a decision if the student should be interviewed or not. If the student should be interviewed, the manager books a meeting time. In both cases, the student gets an email with a response to the application. When the student is called for an interview, he may or may not get the job based on the interview. If he gets the job at this meeting, he will get a response after the meeting. At the same time as the company manages the application, the student is taking a course at the university. If the student accepts the job he will start at the company after the course is finished.

Divide the diagram into suitable swim-lanes and give proper names.

(c) Draw a context diagram for the following system: **[7.33]**

A store is doing business by selling paints and hardware items. A number of reputed companies supply items to the store. New suppliers can also register with the store after providing necessary details. The customer can place an order with the shop telephonically or physically. In case items are not available, customers are informed. The details of every new customer is stored in the company's database for future reference. Regular customers are offered discounts. Additional details of daily transactions are also maintained.

5 (a) Software testing activities boil down to selecting and executing test cases. Identify three key elements of a test case. **[6]**

(b) Explain briefly the purpose of Black-Box and White-Box testing techniques. Why do we need a separate operational environment and a test environment? **[5.33]**

(c) Consider the following program segment: **[12]**

```
a = b;
if (c > 0){ a++; }
else {
      a=2*a;
      if (d <= 10){ b = 5*d; }
      else        { b = 3*d+5; }
}
e = a + b;
```

Give a control flow graph for this program fragment and give branch coverage and path coverage with node numbering of your choice.

University of Dhaka

Department of Computer Science and Engineering

3rd Year 1st Semester B. Sc. Final Examination 2019

CSE 3102: Software Engineering

Duration: 3 hours **Credits: 3** **Full Marks: 60**

(Answer any four of the following six questions)

1. a. State the advantages and disadvantages of the evolutionary model of software development. 5

   b. Is it (evolutionary model) more, or less, suitable than the waterfall model for safety-critical projects? Justify your answer. 5

   c. What is the main criterion for deciding whether or not to use the waterfall model in a software development project? Explain whether there would be any difference for a hardware development project. 5

2. a. Suggest one primary, one secondary, and one indirect stakeholder of a university student records system. Make sure to motivate the answer. 5

   b. Give one advantage and one disadvantage of specifying requirements in natural language only. 3

   c. Describe four use-cases and draw a use-case diagram of a self-scanning system in a shop. A self-scanning system allows a user to scan European Article Number (EAN) codes of all articles, and deduct the sum from the customer's shopping account. Special solutions apply to alcohol, tobacco and non-packaged articles, such as, vegetables. 7

3. a. Write down one functional and one non-functional requirement of a mail management client, for instance MS Outlook. Give two reasons of why it is a good idea to classify and separate functional requirements and non-functional requirements in a requirements specification. 4

   b. Verification and Validation are two process areas at CMMI level 3. For both of these areas provide i) a definition; and ii) a description of how you can fulfill the area in your testing activities. 7

   c. Describe two different software metrics which measure the same quality factor. Don't forget the motivation and the description of how to obtain the numerical values. 4

4. a. Decomposing a system into subsystems reduces the complexity developers have to deal with by simplifying the parts and increasing their coherence. Decomposing a system into simpler parts usually results into increasing a different kind of complexity: Simpler parts also mean a larger number of parts and interfaces. If coherence is the guiding principle driving developers to decompose a system into small parts, which competing principle drives them to keep the total number of parts small? 4

   b. Assuming one of your design goals is to enable future developers to substitute the planning algorithm that decides on the next move with a better one, which design pattern would you consider to satisfy the goal? Justify your choice. 4

   c. Consider a system that includes a database client and two redundant database servers. Both database servers are identical: the first acts as a main server, the second acts as a hot back-up in case the main server fails. The database client accesses the servers through a single component called a "gateway," hence 4

hiding from the client which server is currently being used. A separate policy object called a "watchdog" monitors the requests and responses of the main server and, depending on the responses, tells the gateway whether to switch over to the back-up server. What do you call this design pattern? Draw a UML class diagram to justify your choice.

d. What are test data? Design the test data to validate a birth date of a person in the online job application form where age should be less or equal to 30 years as on 30th June, 2019. 3

5. a. Consider the following program segment 6

```
w = x; // node 1
if (m > 0)
 {
   w++; // node 2
 }
else
 {
  w=2*w; // node 3
 }
     // node 4 (no executable statement)
if (y <= 10)
 {
  x = 5*y; // node 5
 }
else
 {
  x = 3*y+5; // node 6
 }
z = w + x; // node 7
```

Draw a control flow graph for this program fragment. Use the node numbers given above.

b. Which nodes have *defs* for variable *w*? Which nodes have *uses* for variable *w*? 3

c. Enumerate all of the du-paths for variables *w* and *x*. 6

6. At Department of Computer Science and Engineering, University of Dhaka (CSEDU), faculties manually take attendance in every class each day. They spend time to do that during class time. As a result, it takes lots of time and sometimes some students come to class late and request for attendance. That's why CSEDU wants to develop a class attendance system to keep tract of the presence of the students in a class. The Automatic Attendance System will help them do this process in an easy way by using fingerprint or face recognition technology. The main scope of this project is to make attendance process more organized in every class. The system will give a report to the department chairman as well as all the students by monthly basis. Besides this, the system will give the late attendance to the students who come after a specific time period and will consider three late attendances as one attendance. As a computer science student, you are asked to further the requirement analysis and prepare a requirement document for software developers so that they can develop the Attendance software using the software requirement analysis document.

Now considering the above requirements, answer the following questions.

a. Identify functional and non-functional requirements of the Attendance system. 5

b. Describe the data flow of the Attendance system with the DFD diagram. 5

c. Draw a class diagram of the Attendance system. 3

d. How the activity diagrams are useful in eliciting the requirements of software system? 2