

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engineering Part-III, Odd Semester Examination-2024
Course: **CSE3111 (Software Engineering)**
Full Marks: **52.5**, Time: **Three (03) Hours**

[Answer Six (06) questions taking any Three (03) from each of the sections]

Section-A

- | | | |
|----|--|------|
| 1. | a) Define the term software engineering and highlight its scope and necessity. | 3.75 |
| | b) What do you mean by functional and non-functional requirements? Give examples. | 2.00 |
| | c) State five symptoms of the present software crisis. | 3.00 |
| 2. | a) In the context of SDLC models, how can early defect detection reduce cost? How does the Spiral model integrate risk analysis in each phase? Give a real-life example where this was beneficial. | 3.75 |
| | b) How does stakeholder involvement differ between Waterfall, Iterative, and Agile models? Which model provides the most client feedback opportunities? | 2.50 |
| | c) In the Spiral model , how would you technically assess and document risks during each spiral loop? | 2.50 |
| 3. | a) Define cohesion and coupling. Why is high cohesion and low coupling desirable in software design? In a system where Module A directly accesses and modifies variables of Module B , what type of coupling is present? | 4.00 |
| | b) What are the properties of a good SRS document? Describe them. | 1.75 |
| | c) What is a decision table? Given the following conditions, construct a decision table:

Condition 1: <i>Payment mode is credit card.</i>
Condition 2: <i>Shipping address is verified.</i>
Action A: <i>Accept order.</i>
Action B: <i>Put order on hold.</i>
Action C: <i>Reject order.</i> | 3.00 |
| 4. | a) What is software design? How is it different from software architecture? What is the role of software design in the Software Development Life Cycle (SDLC) ? | 3.00 |
| | b) ' <i>Functional Independence is a key to any good design</i> '-explain it with the advantages it offers. | 2.50 |
| | c) Explain how a data dictionary helps maintain consistency and reduce ambiguity in large software projects. Define a data dictionary entry for each of the following items in a Library Management System : <ul style="list-style-type: none">• Book• Member• IssueDate• ReturnDate | 3.25 |

Section-B

5. a) Unified Modeling Language (**UML**) provides multiple views to describe a software system from different perspectives. Analyze the importance of using multiple views in UML modeling. What are the key views defined in UML, and how do they help stakeholders (such as developers, designers, and clients) in understanding, designing, and maintaining a software system? 4.75
- b) In an online **food delivery system**; customers can **search restaurants, place orders, and make payments**. Delivery agents can view assigned orders and update delivery status. Admin can manage restaurants and users. Identify all **actors** and **use cases**. Design a complete use-case diagram for the system. 4.00
6. a) What do you mean by software review? Describe the process of software review. 3.00
- b) Define **test suite** and **test case**. '*It would be incorrect to say that a larger test suite would always detect more errors than a smaller one*'-explain with suitable examples. 3.00
- c) Draw the steps to carry out the path coverage-based testing. 2.75
7. a) What is **system testing**, and when is it initiated? Differentiate between alpha testing, beta testing, and acceptance testing. 3.00
- b) What is **smoke testing**? When is smoke testing typically performed during the software testing life cycle? List some basic test cases that could be used in a smoke test for a **library automation system**. 4.00
- c) Differentiate **validation** and **verification**. Explain with an example. 1.75
8. a) What is software quality? Write about the software quality management activities. 3.25
- b) A software engineer has been given the responsibility for improving the quality of software across an organization. What is the first thing that an engineer should do? What is next? 3.00
- c) Assume that your testing team reports a high number of defects. How do you analyze and respond to this situation? 2.50

University of Rajshahi
Dept. of Computer Science and Engineering
B. Sc. Engineering. Part-III (Odd Semester) Examination 2024
Course: CSE3131 (Web Engineering)
Full Mark: 52.5 Duration: 3 hours

(Answer 3 questions from each Section)

Section -A

- | | | |
|----|--|------|
| 1. | a) Define the term "web engineering" and explain its significance in the context of modern software development. | 3.50 |
| b) | What are the unique characteristics that separates web applications from other software applications? | 4.00 |
| c) | What are the key differences between static and dynamic web applications? | 1.25 |
| 2. | a) Changes are inevitable during different stages of web app development. How would you address those changes in a systematic way? | 2.75 |
| b) | Why modeling is necessary? | 1.00 |
| c) | Suppose you are developing a web-based system for A company named "SafeHome" that sales security products and surveillance service. Using their web app user will be able to access cameras installed in their home from internet and check for any possible break-in. Draw a UML sequence diagram for the use-case – 'Access camera surveillance via the Internet.' | 5.00 |
| 3. | a) "To utilize full scalability and redundancy, we can try to balance the load at each layer of the system"- What are those systems? Draw block diagram the system. | 3.50 |
| b) | How does IP Hash load balancing algorithm work. List its pros and cons. | 4.00 |
| c) | What is Sharding? | 1.25 |
| 4. | a) A banking site allows users to transfer funds using the following POST form: | 3.00 |

```

<form action="/transfer" method="POST">
  <input name="to" value="123456">
  <input name="amount" value="1000">
  <button type="submit">Transfer</button>
</form>

```

This form has no CSRF token. What risk does this pose, and how can it be mitigated?

- | | | |
|----|---|------|
| b) | User authentication is a critical part of any web application and a common target for attackers. Describe the best practices developers should follow when implementing user authentication in a modern web application. Support your answer with examples. | 4.00 |
| c) | What is the principle of least privilege, and how does it contribute to the mitigation of injection attacks in web applications? | 1.75 |

Section -B

- | | | |
|----|--|------|
| 5. | a) What potential risks must be identified during the planning activity? How do we use 'risk table' to prioritize them? | 3.50 |
| | b) Discuss various umbrella activities within WebE process framework. | 3.50 |
| | c) What tasks are performed during elicitation session? | 1.75 |
| 6. | a) Model-View-Controller (MVC) is a common architectural pattern used in web application development to separate concerns and organize code more efficiently. What are the three components of the MVC architecture, and what is the role of each component? | 6.00 |
| | b) How does class autoloading is performed in PHP? | 2.75 |
| 7. | a) What is a trait in PHP, and how is it different from a class or interface? | 4.00 |
| | b) Discuss various categories of risks that can delay or hamper the Web App development. | 3.00 |
| | c) What do you understand by REST API? | 1.75 |
| 8. | a) How does caching improve the performance of a web application? Provide examples of where caching can be applied. | 3.00 |
| | b) In software development, choosing the right type of test is essential for maintaining reliable applications. Describe the differences between unit tests, integration tests, and acceptance tests. | 4.00 |
| | c) Briefly describe the 'Microservices Architecture' of web application | 1.75 |

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. Engineering Part-III Odd Semester Examination-2024
Course: CSE3121 (Database Management Systems)

Full Marks: 52.5

Time: 3 Hours

[Answer six questions taking **three** from each section]

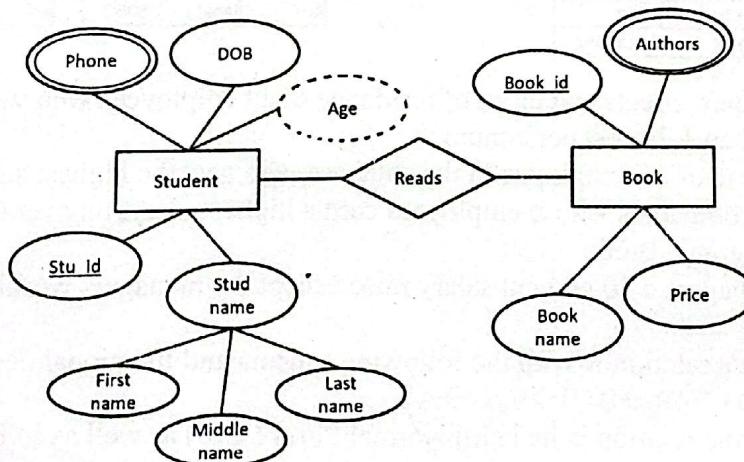
Section-A

1. (a) What is database and DBMS? Name some area where the Government can use DBMS. 2.75
 (b) Define the terms domain constraints, referential integrity, assertions and authorization. 3.00
 (c) Different types of users use the database ranging from sophisticated to unsophisticated. Briefly discuss each type of database users. 3.00

2. (a) Define schema and instance with example. 2.00
 (b) What is data abstraction? Discuss different levels of data abstraction. 3.75
 (c) What do you mean by data model? Explain network data model and hierarchical data model. 3.00

3. (a) Distinguish between weak entity set and strong entity set with example. 2.00
 (b) Discuss the Specialization and Aggregation features of E-R model with example. 4.00
 (c) Draw an E-R diagram for a relationship set named *loan-payment* with the following entity sets: 2.75
 loan(loan-number, amount)
 payment(payment-number, payment-date, payment-amount)
 Write the participation and cardinalities between the entity sets. Also determine the primary key of the entity set *payment*.

4. (a) Shortly discuss DCL and TCL as the database languages. 2.00
 (b) Draw a complete E-R diagram for a highway police database with the following entity sets and relationship sets: 2.75
Entity Sets:
 Person(PId, PName, Address)
 Car(EngineNo, Model, Year)
 Accident(ReportNo, Location, AccidentDate)
Relationship Sets:
 Own: between Person and Car (a many-to-many relationship)
 Participated: among Person, Car, and Accident (a many-to-many relationship)
 N.B. Accident has a descriptive attribute named as DamageAmount
 (c) Derive the tables to convert the following E-R diagram into relational model. 4.00



Section-B

5. (a) Explain why intersection operation of relational model is not a fundamental operation. 1.75
 (b) Write the relational algebra from the tables mentioned below from Figure-1 to Figure-4 for the 4.00
 following queries:
 (i) Find out the student names who have a desktop but not a laptop.
 (ii) Find out the player names who plays all sports.

student name	total pc
Karim	2
Rahim	1
Kamal	2
Jamal	1
Rafiq	2

Figure-1: desktop

student name	total laptop
Karim	1
Rahim	2
Salam	1
Jamal	2
Shafiq	1

Figure-2: laptop

player name	sport name
Karim	Football
Rahim	Cricket
Kamal	Football
Jamal	Cricket
Rahim	Football

Figure-3: player

sport name
Football
Cricket

Figure-4: sport

- (c) Briefly discuss with example the inner join and full outer join operations in relational algebra. 3.00

6. (a) What is aggregate function? Write three different SQL query using the function 2.75
 (i) *avg* (ii) *max* and (iii) *count*
 (b) Consider the relations given below, and answer the following questions. 6.00

Employee		
eName	Street	City
Arif	51 west	Rajshahi
Sumon	52 east	Moynamati
Sagor	Neemgachhi	Sirajgong
Abdul	Binodpur	Rajshahi
Himesh	Nazrul ave	Dhaka
Amirul	Chawk bazar	Sylhet
Sajib	99 north	Chittagong

Company	
cName	city
Agrani	Rajshahi
Sonali	Sylhet
Janata	Dhaka

Works		
eName	cName	salary
Sumon	Agrani	12000
Abdul	Sonali	13000
Himesh	Agrani	6000
Amirul	Sonali	20000
Sagor	Sonali	8000
Arif	Janata	18000

Manages	
eName	mName
Amirul	Amirul
Abdul	Amirul
Sagor	Amirul
Sumon	Sumon
Himesh	Sumon
Arif	Arif

- (i) Find the names, streets and cities of residence of all employees who work for "Sonali" and earn more than 1,20,000 per annum.
 (ii) Find the name of the employee in the database who gets the highest salary?
 (iii) Find those companies whose employees earn a higher salary, on average, than the average salary at "Agrani" Bank.
 (iv) Give all managers a 30 percent salary raise except the managers working in Janata Bank.

7. (a) Suppose there is a relation R with the following schema and functional dependency: 3.00
 $R(A,B,C)$ and $FD = \{A \rightarrow B, B \rightarrow C, C \rightarrow A\}$
 Now prove that the relation is in Third Normal Form (3NF) as well as in Boyce-Codd Normal Form (BCNF).

- (b) Suppose the following relation $R(A,B,C)$ is decomposed into two relations $R_1(A,B)$ and $R_2(B,C)$. 3.00

A	B	C
1	2	1
2	2	2
3	3	2

Now prove that the decomposition is a Lossy Join Decomposition.

- (c) Suppose there is a relation R with the following schema and functional dependency: 2.75
 $R(A,B,C,D)$ and $FD = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow B\}$
- Now if the relation is decomposed into three relations $R_1(A,B)$, $R_2(B,C)$, and $R_3(B,D)$. Then, prove that the decomposition is a Dependency Preserving Decomposition.
8. (a) What is meant by Redundant Arrays of Independent Disks (RAIDs)? Write the difference between RAID 10 and RAID 01. 3.00
- (b) What do you understand by transaction in database? Discuss different states of transaction with diagram. 4.00
- (c) Does the following schedule preserve the consistency between transaction T_1 and T_2 ? Explain your answer. 1.75

T_1	T_2
read(A) $A := A - 100$	read(A) $temp := A * 0.1$ $A := A - temp$ write(A) read(B)
write(A) read(B) $B := B + 100$ write(B)	$B := B + temp$ write(B)

University of Rajshahi

Department of Computer Science and Engineering
B.Sc. Engineering Part-III, Odd Semester, Examination-2024
Course: CSE3141 (Compiler Design)
Full Marks: 52.5 Time: 3 hours

[N.B. Answer any SIX questions taking THREE from each of the sections]

Section-A

1. a) What is a compiler and an interpreter? What are the differences between them? 2.00
b) Suppose a source program contains the assignment statement:
 $position = initial + rate * 60$
Explain how this statement is processed and finally translated at different phases of a traditional compiler. 5.00
c) Distinguish between single-pass and multi-pass compiler. 1.75
2. a) What is a parser? Classify parsers. 2.00
b) What is handled in bottom-up parsing? 2.00
c) Explain operator precedence parsing with stack implementation for an expression $a+b*c$ with the following grammar: $E \rightarrow EAE|a|b|c, A \rightarrow +|*$. 4.75
3. a) Explain top-down and bottom-up parsing style with the following CFG with a sentence, '*abbcde*':
 $S \rightarrow aABe, A \rightarrow Abc|b, B \rightarrow d.$ 3.50
b) Construct a parsing table for LL(1) parser with the following CFG grammar:
 $S \rightarrow Aa \mid b, A \rightarrow bdC \mid C, C \rightarrow abC \mid cC \mid \epsilon$ 5.25
4. a) Check whether the given grammar is LR(0) or not:
 $E \rightarrow T+E|T, T \rightarrow id$ 4.25
b) Construct SLR (1) parsing table for the above grammar. Parse the string "id+id+id" with the parsing table. 4.50

Section-B

5. a) What is a translator? Classify translators based on level of programming language. 2.75
b) What is bootstrapping in compiler design? How it helps in self-compilation of a compiler. 3.00
c) Given that there is a Pascal translator written in C language which translates any Pascal program to a corresponding C program. Using the concept of bootstrapping how to create that translator written in C++? 3.00
6. a) Discuss the role of lexical analyzer. Construct lexical analyzers for the following languages: 5.75
i) $\{ 1^m 0^n 2^l \mid m, n, l \geq 0 \}$
ii) $\{ w \in \{0, 1\}^* \mid w \text{ is a binary number whose decimal equivalent is divisible by } 4 \}$
b) Differentiate between parser and scanner. Why is scanner generation automated but parser generator is not fully automated? Explain. 3.00
7. a) Explain the difficulties of top-down parsing. 2.00
b) What is semantic checking of a compiler? Write down some semantic errors of a computer program. 2.00
c) Why is intermediate code necessary for designing a compiler? Discuss various type intermediate codes often used in compilers. 3.00
d) Write down a syntax tree for the statement "if $a=b$ then $a:=c+d$ else $b:=c-d$ ". 1.75
8. a) Explain syntax-directed translation (SDT) scheme. Write down SDT for following CFG: 5.00
 $E \rightarrow E*T \mid T, T \rightarrow F-T \mid F, F \rightarrow 2|4$
What is the value of the string $w=4-2-4*2$ if you carry out the SDT on that particular string?
b) Construct a syntax tree using the above SDT of the CFG for the string "4-2-4*2". 3.75

University of Rajshahi
Department of Computer Science and Engineering
B. Sc. (Eng.) Part III Odd Semester Examination 2024
Course: CSE 3151 (Engineering Ethics and Environment Protection)
Full Marks: 35 Duration: 2 hours
Answer any two questions from each section

Section-A

- | | |
|---|-----------------|
| 1. a) Explain the term 'moral dilemma'. | 1 |
| b) An engineer Sayema, develops a computer program used as a tool in developing other programs assigned to her. She changes jobs and takes the only copy of the first program with her for use in her new job. Suppose the program was not written under the direct assignment, from the first employer, but was undertaken by her to help her regular work assignments at that time and the same was developed on her own time and weekends using the employer's facilities and computer services. | 3 |
| i) Does the employer own or partially own the program? | 3 |
| ii) Does she require previous employer's permission before using it on the new job? | 1 |
| c) Discuss the levels of Kohlberg moral development theory. | 4 $\frac{3}{4}$ |
| 2. a) What is meant by 'intellectual property'? What are the purposes that are served by intellectual property? | 3 $\frac{3}{4}$ |
| b) Differentiate between 'Patent' and 'Trade secret'. | 3 |
| c) What is meant by 'copyright'? | 2 |
| 3. a) When does a conflict of interest occur? Explain. | 2 |
| b) What is the difference between 'bribe' and 'gift'? | 3 |
| c) Henry is in a position to influence the selection of suppliers for the large volume of equipment that his firm purchases each year. At Christmas time, he usually receives small tokens from several salesmen, ranging from inexpensive ballpoint pens to a bottle of liquor. This year, however, one salesman sends an expensive briefcase stamped with Henry's initials. | 3 $\frac{3}{4}$ |
| i) Should Henry accept the gift? | 3 |
| ii) Should he take any further course of action? | 1 |
| d) What is 'moonlighting'? | 1 |

Section-B

- | | |
|---|-----------------|
| 4. a) What is meant by 'occupational crime'? | 1 |
| b) Discuss different types of problems in 'computer ethics'. | 4 $\frac{3}{4}$ |
| c) List the ethical problems with computers in the workplace. | 2 |
| d) What is a white-collared crime? | 1 |
| 5. a) What is sustainable development? | 1 |
| b) What is Cradle-to-Cradle (C2C) Thinking? How does it relate to the idea of biomimicry? | 4 $\frac{3}{4}$ |
| c) Suppose you are an environmental engineer for one of the many local plants. That plant discharges effluents into a lake in a flourishing tourist area. Although all the plants are marginally profitable, they compete for the same customers. | 3 |

Your responsibilities are to monitor the water and air discharges at your plant and the periodic reporting to the Dept. of Anti-pollution. You have just prepared a report that indicates that the level of pollution in the Plant's water discharges slightly exceed the legal limits. Your supervisor says you should regard the excess as a mere 'technicality', and he asks you to 'adjust' the data so that the data appears to be in compliance. He says that slight excess is not going to endanger human or fish life any more than if the plant were actually in compliance. However he says, solving the problem would require a very heavy investment. He explains, "We cannot afford new equipment. It might cost even a few jobs. It will set us behind our competitors. Besides, he says that many of the competitors are doing the same and the bad publicity we would get might scare off some of the tourist industry, making it worse for everybody"

- i) What are your basic responsibilities as an environment engineer in this plant?
- ii) How should you respond to supervisor's request?
- iii) What are the ethical issues in this case?

6. a) Differentiate between "Kohlberg and Gilligan theory" of moral development.

$\frac{3}{4}$

b) What does it mean for a social problem to exhibit a high degree of coordination complexity?

3

c) How might Artificial Intelligence help to deal with such a problem? —

1

d) A woman who was driving a car was involved in an accident. The vehicle dashed against the divider. She has fallen unconscious. You are passing by in your vehicle, which is driven by a driver engaged by you. You are going to appear for an interview for Air Force recruitment.

2

- i) What should you do? Apply Duty theory.



Time: 02 Hours

Department of Computer Science and Engineering
Rajshahi University

Code: ICE3161 Title: Communication Engineering
B.Sc. Engineering Part-3 (Odd Semester) Exam 2024

Full Marks: 35

ANSWER ANY 04 TAKING 02 FORM EACH SECTION

SECTION A

1. (a) How is the term "data" defined in textbooks? [02]
- (b) "Delivery, Accuracy, Timeliness, and Jitter – are the four fundamental characteristics that control the effectiveness of a data communication." – Do you agree with the statement? If agreed then define the significance of those characteristics. [03]
- (c) What do you know about the term "Performance" as one of the three important criteria of a Network? [1½]
- (d) "Images are represented by bit patterns" - how? [02]
2. (a) Draw two sine waves on the same time-domain plot. The characteristics of each signal are as follows: [02]
- Signal A: amplitude 40, frequency 9, phase 0;
 - Signal B: amplitude 10, frequency 9, phase 90;
- (b) A periodic composite signal with a bandwidth of 2000 Hz is composed of two sine waves. [2] The first one has a frequency of 100 Hz with maximum amplitude of 20 V; the second one has maximum amplitude of 5 V. Draw the frequency spectrum.
- (c) A device is sending out data at the rate of 1000 bps. [03]
- How long does it take to send out 10 bits?
 - How long does it take to send out a single character (8 bits)?
 - How long does it take to send a file of 100,000 characters?
- (d) Write down the difference between a periodic and an aperiodic signal? [1¾]
3. (a) The return-to-zero (RZ) scheme uses three values: positive, negative, and zero. How to use this scheme to represent 01001? [02]
- (b) High-density bipolar 3-zero (HDB3) is a Scrambling technique. Can you explain its mechanism of substituting four consecutive zeros? [03]
- (c) What do you understand by the terms "data rate" and "signal rate"? [1½]
- (d) "A PCM encoder has three processes" – what are they? [02]

SECTION B

4. (a) In the context of analog transmission, what is known as the carrier signal or carrier frequency? There exist three types of Shift keying – what are they? Express your knowledge on the shift keying. [03]
- (b) Illustrate the frequency division multiplexing and de-multiplexing operation. [02]
- (c) The FHSS offers enhanced security over FDM – but how? [02]
- (d) There exists a variant of multiplexing known as Wavelength-division multiplexing. Can you explain it? [1¾]
5. (a) What is known as a Satellite Network? [1¾]
- (b) The Bangladesh Satellite-1 (BS-1) is a GEO category satellite. What do you know about this category of satellite? [02]
- (c) “The period of a satellite, the time required for a satellite to make a complete trip around the Earth, is determined by Kepler’s law.” – Clarify this statement with a necessary example. [03]
- (d) What do you know about Starlink? Will it be worthy for Bangladesh? [02]
6. (a) ‘The correction of errors is more difficult than the detection’ - explain it, please. [2¾]
- (b) Assume that the given dataword is 1001 (*i.e.* $k = 4$), the length of the codeword is 7 (*i.e.* $n = 7$), and the shared divisor is 1011. What would be the codeword if the scheme is CRC? [03]
- (c) Let us assume that a receiver received a 10101001111 codeword encoded with the Hamming code technique. The received data has a single-bit error. Find the error and correct it [03]