

**BANGLADESH UNIVERSITY OF PROFESSIONALS**  
**Military Institute of Science and Technology**  
**B.Sc. in Computer Science and Engineering, Term Final (Fall) Examination 2024:**  
**April 2025**

**Student Group: 72<Earned Credit Hours ≤ 108**

**Subject: CSE 309, Computer Network**

**Time: 3.00 hours**

**Full Marks: 180**

**INSTRUCTIONS:**

- a. Use **SEPARATE** answer scripts for each section.
- b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
- c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
- d. Figures in the margin indicate full **marks**.
- e. Assume reasonable data if necessary.
- f. **Symbols** and **abbreviations** used have their usual meanings.

**SECTION-A**

**Question 1 (Compulsory)**

- a. Why do we need layering in designing computer network models? What considerations should be taken into consideration for choosing number of layers? How does the layer depend on each other? 7
- b. Compare using timing diagrams the connection setup, data transfer and teardown times in circuit switching, packet switching and virtual circuit switching techniques. Explain the pros and cons of each method. 15
- c. A router has an average packet arrival rate of  $L$  packets/sec with an average packet length of  $a$  bits. The link transmission rate is  $R$  bits/sec. If the traffic intensity is  $La/R$ , what happens to the queuing delay as  $La/R$  approaches to 1? Explain this phenomenon with a figure. 8

**Question 2**

- a. It is required to implement a reliable data transfer mechanism utilizing an underlining unreliable channel where bit error or even packet loss may happen. Draw FSMs for sender and receiver to address those problems and explain them clearly. 20
- b. Compare relative challenges in implementing sliding window protocol at transport layer rather than at data link layer in terms of connection management, RTT estimation and handling flow and congestion control. 10

**Question 3**

- a. What is the 'Two Army Problem' and why does it pose a challenge in achieving perfect communication between two parties over an unreliable communication channel? Explain how TCP overcomes the changes of the 'Two Army Problem' during the connection tear-down process. 10
- b. What are the different approaches to congestion control? Explain each of them briefly. How does congestion control differ from flow control? 10
- c. What is AIMD principle? How does TCP's AIMD algorithm ensure both fairness and efficiency in congestion control? Explain with a figure. 10

**Question 4**

- (i)
- What are the goals of a routing algorithm? Why are fairness and efficiency often conflicting requirements in routing? Explain. 8
  - Differentiate between Link State and Distance Vector routing protocols. List the steps through which a node obtains the information of the topology of the network in Link State routing protocol. 10
  - Given a network represented by the weighted graph shown in figure 4(c), Use Dijkstra's algorithm to determine the shortest path from node u to z. Show your steps. 12

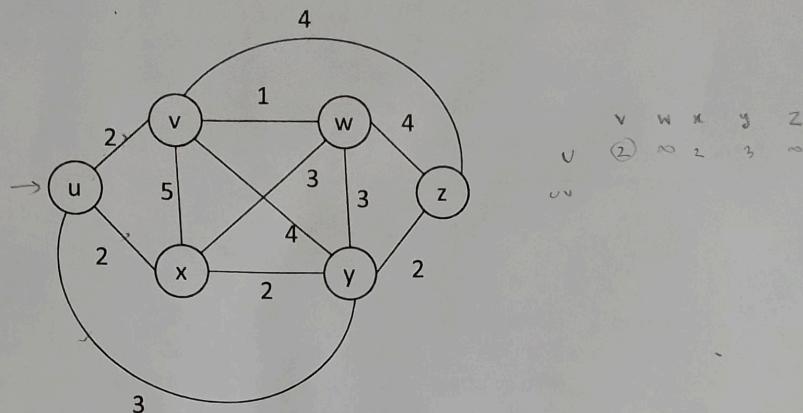


Figure: 4(c)

**SECTION-B****Question 5 (Compulsory)**

- (i)
- How does a wireless network function in infrastructure mode? If it is not in infrastructure mode, what is the alternative mode, and how does it differ from infrastructure mode? 05
  - A network switch is deployed in a small office with four computers: PC1, PC2, PC3 and PC4. The switch initially has an empty switch table. The following frames are received by the switch in order:
    - PC1 sends a frame to PC3
    - PC3 sends a frame to PC2
    - PC2 sends a frame to PC4
    - PC4 sends a frame to PC1
 After all four frames are processed, draw the final switch table showing MAC addresses and ports learned by the switch. Explain how the switch processes the first frame when it has an empty switch table. 15
  - What is the role of the Home Subscribe Service (HSS) in 4g/5g cellular architecture? Which network elements (such as mobile devices, MME, Serving Gateway Router, PDN Gateway Router) does the HSS directly communicate within the control plane? Does it communicate with any elements in the data plane? Support your answer with a suitable figure. 10

**Question 6**

- (i)
- Why would the token-ring protocol be inefficient if a LAN had a very large perimeter? 5

- b. Consider the scenario as shown in figure 3.1 and suppose that packets from R6 destined for D are switched via R6-R4-R3, while packets from R5 destined to D are switched via R4-R2-R1-R3. Show the MPLS tables in all routers.

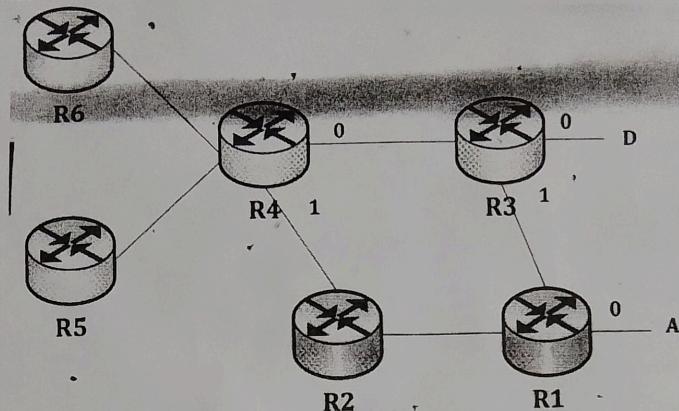


Figure: 3.1

- c. Why is an ARP query sent within a broadcast frame, while the corresponding ARP response is sent within a specific destination address? Discuss the potential challenges if ARP responses were also broadcasted instead of unicasted. 10

#### **Question 7**

- a. What are the differences between a master device in a Bluetooth network and a Base Station in an 802.11 network? 05
- b. Discuss the differences between the following types of wireless channel impairments:  
path loss, multipath propagation, interference from other sources? 15
- c. In IEEE 802.11 wireless networks, frames include multiple MAC addresses. Explain the role of the four different MAC addresses that can appear in a frame. Under what circumstances are all four addresses used? 10

#### **Question 8**

- 2 a. Suppose you wanted to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why? 5
- b. Describe how Web Caching can reduce the delay in receiving a requested object. Will Web Caching reduce the delay for all objects requested by a user or only some of the objects? Why? 15
- c. What is the HOL blocking issue in HTTP/1.1? How does HTTP/2 attempt to solve it? 10

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**B.Sc. in Computer Science and Engineering, Term Final (Fall) Examination 2024: April**  
**2025**

**Student Group: 72 < Earned Credit Hours ≤ 108**

**Subject: CSE 315, Digital System Design**

**Time: 3.00 hours**

**Full Marks: 120**

**INSTRUCTIONS:**

- a. Use **SEPARATE** answer scripts for each section.
- b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
- c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
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**SECTION-A**

**Question 1 (Compulsory)**

- a. You are to design a 4-bit Arithmetic Logic Unit (ALU) which can perform the following operations on 2 inputs A and B: 15
- i) Transfer B
  - ii) Increment B
  - iii) Add A & B
  - iv) Add A & B with input carry
  - v) Subtract A from B
  - vi) Subtract A from B with borrow
  - vii) Decrement B
  - viii) Perform NAND operation between A & B
  - ix) Perform XNOR operation between A & B
  - x) Perform NOT operation on B
- b. Performing A-B operation with the above ALU gives a Carry Out,  $C_{out}$ . 05  
Justify the conclusion that can be drawn from this result.

**Question 2**

- a. Design a 3 bit shifter that can transfer or rotate depending on an external signal. The type of transfer or rotate operation depends on another external signal. The data can be transferred or complement transferred, while rotation can be leftward or rightward. 10
- b. Suppose, A and B are two sign 2's complement binary number inputs of an ALU which can perform A-B (subtraction) operation. 06

Design a Comparator using ALU status registers which will be having the following comparison operations:

- |                |            |            |
|----------------|------------|------------|
| i) $A=B$       | $A=B$      | $Z$        |
| ii) $A \neq B$ | $A \neq B$ | $Z'$       |
| iii) $A > B$   | $A > B$    | $Z^*$      |
| iv) $A \geq B$ | $A \geq B$ | $SQ^*$     |
| v) $A < B$     | $A < B$    | $SQ^*$     |
| vi) $A \leq B$ | $A \leq B$ | $Z^* SQ^*$ |
- Above results are obtained by using the formula:  
$$A \leq B \quad Z^* + (SQ^*)$$
- c. Briefly explain the reasons for using a 2-port memory instead of a scratchpad memory in a processor design. 04

**Question 3**

- a. Using JK flip flop, design an accumulator that can perform the following list of micro operations:
- Set the accumulator
  - Subtract the input from the accumulator
  - Perform XOR operation with the input
- b. Suppose, you are instructed to design a processor with 4 registers (R0-R3), a 4-bit ALU which can do the following operations shown in Table 1, and a 4-bit shifter which can perform the following operations shown in Table 2. The system will send input from the registers R0-R3 to ALU followed by the shifter and store the output to any of the four registers as per instruction. 10

Table 1

S1	S0	C <sub>in</sub>	Operation
0	0	0	A-B-1
0	0	1	A
0	1	0	A+B
0	1	1	Transfer A with carry
1	0	X	A XNOR B
1	1	X	A AND B

Table 2

H1	H0	Operation
0	0	F $\leftarrow$ CLC P
0	1	F $\leftarrow$ All 1's
1	0	F $\leftarrow$ P'
1	1	F $\leftarrow$ P

Draw the Block diagram of the above-mentioned processor and write a micro-program for its control memory for the following instructions:

- R1  $\leftarrow$  CLC R3
- Carry  $\leftarrow$  1
- R2  $\leftarrow$  R3 + R0'
- R3  $\leftarrow$  0

**Question 4**

Design a control unit for the sign-magnitude addition and subtraction of 4-bit two binary numbers A and B by showing:

- a. Figure for flowchart/algorithm 04
- b. State Diagram 03
- c. Data Processor and Control logic diagram along with the control signals required 03
- d. Implement the control unit by:  
 One flip-flop per state method (Show the logic diagram for the flip-flop inputs only. Logic diagram for the output control signals is not necessary).  
 The ALU selection pins S<sub>2</sub>S<sub>1</sub>S<sub>0</sub>C<sub>in</sub> for the operations A+B, A+B'+1, A', A+1 are 0010, 0101, 1110, 0001 respectively. 10

## SECTION-B

**Question 5 (Compulsory)**

- a. Assume you are designing a SAP-1 system for the execution of  
following instructions:  
a. ADD a,b , b. OUT

14

Note: Describe correlating all steps with simple pin diagrams and  
Timing diagrams with their transitions from fetch to execution.

- b. Discuss the requirements of MAR, RAM and Instruction registers  
on different Timing states.

06

**Question 6**

- a. For two mnemonics of instructions, such as ADD and SUB, state  
the total requirement of memory and timing states for a simple as  
possible computer with diagrammatic details.
- b. Compare the performances between Program Counter and  
Instruction Register during both Fetch and Execution Cycle.

14

06

**Question 7**

- a. If you are designing a SAP system, for a real time land navigation  
based system with capabilities of multi-routine processing, explain  
the upgrading features required to transform a SAP-1 computer to  
SAP-2 in terms of utilization of I/O operations, larger memory and  
stack operations.
- b. Compare and contrast between 3-state buffers/ICs and 2-state  
components with this rational applicability for systems design.

14

06

**Question 8**

- a. Recall the necessity of dynamic RAMs as a primary memory for  
designing a digital system.
- b. For a static system, a memory needs to load contents from either  
counters or buffer registers. Justify the necessity of a dynamic  
memory for this system. DRAM
- c. Associate the roles of ROMs in terms of their particular types for  
boot-loading and routine-loading of a system consisting of SAP  
architecture. Are these memories volatile? Justify your answer.

07

07

06

ROM  
EPROM  
Hybrid EEPROM  
FLASH  
NVRAM

fetch  
intra  
Address  
execute

1507	419	1010
3043	237	995
611	967	995

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**B.Sc. in Computer Science and Engineering,**

**Term Final (Fall) Examination 2024: April 2025**

**Student Group: 72 < Earned Credit Hours <= 108**

**Subject: CSE 319 Software Engineering**

**Time: 3.00 hours**

**Full Marks: 180**

**INSTRUCTIONS:**

- a. Use **SEPARATE** answer scripts for each section.
- b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
- c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
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**SECTION-A**

**Question 1 (Compulsory)**

- a. Suppose an online ticket booking system processes ticket requests for a concert. Based on the requested number of tickets and user eligibility, the system follows a simple decision process. If the requested amount of tickets is greater than 6, the request is automatically rejected and the user receives a “booking rejected” message. If the requested number of tickets is 6 or fewer, the system checks the user’s membership status. If the user is a premium member, the booking is automatically confirmed, and a “booking confirmed” message is sent. For regular (non-premium) members, a “booking rejected” message is sent.

**15**

Now, find test data for the “Ticket Booking System” using the Equivalence Partitioning and Boundary value Analysis technique. Show how you partitioned the equivalence classes and set the boundaries for defining the test cases.

- b. A program has the complex expression below:

**15**

Condition 1 AND (Condition 2 OR Condition 3)

Now, draw a truth table for the above expression and identify test cases on the basis of statement coverage, decision condition coverage, condition coverage, decision condition/condition coverage and multiple condition coverage.

**Question 2**

- a. Explain the concept of non-functional requirements in software system. Discuss their significance on how they influence and are interconnected with software architecture design decisions.

**10**

- b. Suppose you are building an online learning management system that allows students to access courses, watch live or recorded lectures, submit assignments, and participate in discussions. The system must efficiently manage user authentication, content delivery, and real-time interactions between students and instructors.

**10**

Which architectural pattern would be the most suitable for designing this system, and why? Justify your choice by considering factors such as scalability, content management etc. Additionally construct an architectural diagram illustrating the system based on your chosen pattern.

- c. Discuss pipe and filter architectural pattern along with its advantages and disadvantages. 10

**Question 3**

- a. Differentiate between static testing and dynamic testing. Briefly explain the procedure of a static testing approach. 10
- b. Change is inevitable in business software which leads to rework and increased expense. However, there are two approaches to deal with these issues and cope up with the change. Discuss the two approaches, explaining how each method helps mitigate the impact of change, reduces/avoids rework, and controls costs. 10
- c. Imagine you are designing a real-time stock trading platform that allows users to buy and sell stocks, track market trends, and receive real-time price updates. The system must support high-frequency trading, provide instant order execution etc. Additionally, traders should be able to interact with financial advisers via real-time chat and notification. 10

Now, suggest which software development process model would be the most suitable for designing this system. Justify your answer by explaining how the chosen model aligns with the system's requirements, including performance, security and compliance with financial regulations.

**Question 4**

- a. Briefly describe the planning phase and iterations to release phase of XP software development approach. 10
- b. Differentiate between the following terms: (any 2) 10
- i) System testing vs Acceptance testing
  - ii) Verification vs Validation
  - iii) Scrum vs plan-driven approach .
- c. Create a concept map for a healthcare management system, illustrating how various components such as patients, doctors, appointments, medical records, billing, and pharmacy are interconnected. Additionally, discuss the advantages and disadvantages of using concept maps in analyzing and designing complex systems. 10

## SECTION-B

### Question 5 (Compulsory)

— Software testing ensures that the software behaves as expected and meets quality standards. In view of the same, answer the questions that follow.

- a. Analyze and evaluate the different phases of the software Testing lifecycle, discussing their significance and how they contribute to ensuring software quality. *Rapid & DR TC* 12
- b. Critically access the various "Non-functional Testing" methodologies, explaining how each contributes to the overall software quality and performance. *perf., stress, perf., availability* 8
- c. Evaluate and justify the different testing strategies you would implement to ensure system availability, minimizing downtime and disruptions under various conditions. *failover/test, catastrophic, load balance, cloud service* 10

### Question 6

— You are the head of the quality assurance in a software firm. You know that quality software is user-friendly, dependable and performs optimally. In view of the same, answer the questions that follow.

- a. Analyze and discuss the key attributes that, in your opinion, define the quality of software. *Rel., Accur., Secur., Quality, Dep.* 12
- b. Evaluate and describe the various phases of software quality Assurance (SQA) process, highlighting the purpose and importance of each phase. *Plan, Sta & C, Review & Audit, Test, Defect* 8
- c. Critically analyze and explain the various metrics you would use to measure the following:
  - i) Code Quality *cycle, churn, coverage*
  - ii) Defects *intensity, MTBF, defect ratio*
  - iii) Performance *stress, N1, server utilization, Response time*10

### Question 7

— You have newly been appointed as a software project manager in a reputed firm. In view of this, answer the questions that follow.

- a. Enumerate the various responsibilities that you expect to be entrusted with in term of managing people and project. *PMO, DMCB* 6
- b. Analyze and discuss the various aspects involved in Project Estimation, evaluating how each factor contributes to accurate and effective planning, resource allocation and project execution. *proj. plan, scope mngt, pro. ent.* 14
- c. Evaluate and explain the various activities in Risk Management process that you would undertake.  
*Identify risk, Assess risk, Mitigate risk, Plan mitigation, Monitor risk* 10

### Question 8

Software designing and implementation are very important aspects of Software Engineering. In context of the same, answer the questions that follow,

- a. Analyze and discuss the various steps involved in the software design process. 8

- b. There are primarily two different software design approaches. Clearly explain both the approaches. With the help of an example, explain a scenario where combination of the two approaches may be best suited. 12
- c. With the help of a simple example explain the working of a "Factory Method Design Pattern". 10

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**2025**

**Student Group: 72 < Earned Credit Hours ≤ 108**

**Subject: GES 301, Fundamentals of Sociology**

**Time: 3.00 hours**

**Full Marks: 120**

**INSTRUCTIONS:**

- a. Use **SEPARATE** answer scripts for each section.
- b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
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**SECTION-A**

- Question 1 (Compulsory)**
- a. Deviance varies across different cultures and societies. Discuss. 04
  - b. Distinguish between crime and deviance. Describe the functional roles of deviant behavior. 08
  - c. How does Robert K. Merton's Anomie theory explain the relationship between societal norms, goals, and individual behavior, particularly in the context of deviance, and what implications does this have for understanding societal structures and their impact on crime? Illustrate. 08
- Question 2**
- a. Describe orientalism and occidentalism with relevant examples. 04
  - b. Discuss the causes of poverty in the light of conflict perspective. 08
  - c. Briefly discuss the Malthusian perspective of population growth in the context of Bangladesh. 08
- Question 3**
- a. Discuss push factor and pull factor of migration with relevant examples. 04
  - b. Illustrate the features of pre-industrial and industrial cities with examples. 08
  - c. Distinguish between capitalism and socialism. Which economic system do you consider, to be more acceptable to address poverty and vulnerability of people in contemporary society? Give argument for your answer. 08
- Question 4**
- a. Explain the nature of sacred and profane. 0
  - b. "The universality of religion is not based upon the forms of belief and practice but upon the social function which it universally fulfills." Describe the functions of religion in the light of the statement. 0

- c. Briefly discuss C.H. Cooley's "Looking glass self" theory of socialization and Mead's stages of self.

### SECTION-B

**Question 5 (Compulsory)**

- a. Discuss which of the classical sociologists (Marx, Weber, Durkheim) you relate most in your daily life experiences. 10
- b. Discuss the difference between mechanical and organic solidarity as explained by Durkheim in his work 'The Division of Labor in Society'. 10

**Question 6**

- a. Discuss the significance of the 'iron cage' in Max Weber's analysis of modernity and bureaucratization. 10
- b. Discuss how Durkheim defines social facts, and why they are important in understanding society. 10

**Question 7**

- a. Discuss how Marx defined the relationship between the base and the superstructure in society with relevant information. 10
- b. Discuss the significance of alienation in Marx's theory of labor and capitalism. *PPR seit. m. h. am* 10

**Question 8**

- a. Discuss why Weber argued that social inequality is shaped by class, status, and power rather than just economic factors. 10
- b. Compare and contrast between three perspectives of sociology, (Functionalism, Conflict and Symbolic Interactionism). 10

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**Student Group: 72<Earned Credit Hours ≤ 108**

**Subject: GESL 303, Environment, Sustainability and Law**

**Time: 3.00 hours**

**Full Marks: 120**

**INSTRUCTIONS:**

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**SECTION-A**

**Question 1 (Compulsory)**

- a. Define sustainability. **02**
- b. Define economic, societal and ecological goods and show their relationship using a flowchart. **09**
- c. Describe the case of Easter Islands and its lessons for mankind. **09**

**Question 2**

- a. Discuss the properties of common goods. Briefly explain why it is significant in environmental studies. **06**
- b. Explain using game theory how selfish behavior of human beings may lead to a suboptimal outcome and how it can be resolved. **14**

**Question 3**

- a. Give your opinion on the Stern-Nordhaus debate. **06**
- b. Suppose a significant catastrophe of \$700 billion is predicted 50 years from now because of greenhouse gas emissions. Determine whether spending \$50 billion today to stop such a catastrophe is worth it. You should consider a discount rate of 5% and 6%. **06**
- c. A 47 billion ton of coal reserve has been discovered recently. Graphically depict a three period consumption plan (including the current year) for the resource using a discount rate of 8%. **08**

**Question 4**

- a. Discuss the impact of Aerosol on the climate. **05**
- b. Discuss the steps of eutrophication process. **07**
- c. Graphically describe the phosphorus cycle and its importance. **08**

## SECTION-B

**Question 5 (Compulsory)**

- a. Explain how the Rio Conference (1992) has evolved so far. **08**
- b. Describe the Corfu Channel Case (1949) and its significance in international environmental law. **12**

**Question 6**

- a. Mention the key points of Agenda 21. **08**
- b. Describe the Nuclear Tests Case (1976) and its significance in international environmental law. **12**

**Question 7**

- a. State the key issues addressed in the Environmental Conservation Rule 1997. **05**
- b. Explain the key measures taken in Bangladesh Water Act 2013. **06**
- c. Summarize the high-court directives (2019) to save the rivers and water bodies of Bangladesh. **09**

**Question 8**

- a. Explain how controlling intellectual property rights can help promote environment-friendly technologies. **06**
- b. Briefly discuss the Tuna-Dolphin cases and their significance in environmental law. **14**