Kishoreganj University

3rd Year 1st Semester B. Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

CSE 3101: Data Communication (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1	a.	What are the three criteria necessary for an effective and efficient network? Explain in details.	4
	b.	What is the relationship between protocols and standards in networking? Describe the key elements of protocol with examples.	2.5+2.5=5
	c.	Explain in detail the different types of transmission impairments that affect data communication over a network.	5
2	a.	What is frequency domain representation? Why it is used in analyzing signals?	1.5x2=3
	b.	State and explain Shannon channel capacity. Consider a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate and signal level?	6
	c.	The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with -0.3 dB/km has a power of 2 mW, what is the power of the signal at 5 km?	5
3	a.	List down the characteristics of different line coding schemes. Differentiate multiline and multi-level encoding techniques with suitable examples.	4
	b.	State the Nyquist theorem. Illustrate the components of PCM encoder and briefly explain the steps of PCM.	1+3=4
	c.	Draw the signal representation of data 01001110 in NRZ-L, NRZ-I, Polar RZ, Manchester, Differential Manchester and AMI encoding scheme. Assume the signal level at t(0) is positive. [Hint: Draw the clock pulse of master clock and draw the signals with respect to the clock pulse.]	6
4	a.	What is modulation? Why analog to analog conversion is needed in data communication?	3
	b.	Which of the four digital-to-analog conversion techniques (ASK, FSK, PSK or QAM) is the most susceptible to noise? Defend your answer.	3
	c.	Find the bandwidth for the following situations if we need to modulate a 5-KHz voice. i. AM ii. PM (set $\beta = 5$) iii. PM (set $\beta = 1$)	3
	d.	Why PM is preferred over AM and FM? Describe how PM can be implemented with proper diagram.	5
5	a.	What strategies are followed when the data rates of the input sources in a time-division multiplexing (TDM) system are not the same? Explain.	4
	b.	We have four sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame, find: (i) the duration of each character in each source, (ii) the frame rate, (iii) the duration of each frame, (iv) the number of bits in each frame, and (v) the data rate of the link.	5
	c.	Describe the concept of frequency hopping spread spectrum (FHSS). How it achieves antijamming facility in data communication?	5

6 a. For CRC, given data word is 1010011010 and the divisor is 1011. 04
   i. Using binary division, show the generation of the codeword at the sender site.
   ii. Using polynomials, show the checking of the codeword at the receiver site.

b. Show the complete process of checksum if a sender needs to send four data items 0x3456, 0xABCC, 0x02BC and 0xEEEE. Find the followings: 05
   i. Checksum at the sender site
   ii. Checksum at the receiver site if second data item is changed to 0xABCE.

c. Hamming code is used to detect and correct error. Using Hamming code technique, find the codeword for the dataword 1011001. 05

7 a. Why microwave cannot penetrate wall while radio wave can? 2

b. Why optical fiber is the backbone is today's network? Briefly describe the different classes of optical fiber including single mode, multimode step index, and multimode graded index, explaining their core structure, light propagation, and common applications. 1+6=7

c. What is the significance of the twisting in twisted-pair cable? 3

d. How does sky propagation differ from line-of-sight propagation? 2

Kishoreganj University

3rd Year 1st Semester B.Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

CSE 3103: Operating System (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1. There are many computer systems (Batch to Handheld). Every computer system has its own functionalities, which is completely different or relates to each other's. User is one of the most vital parts of these systems. According to the system properties and user requirements we need different operating system to operate a computer.
   - (a) Define operating system with example. Is it necessary for all systems? **3**
   - (b) Which types of system is most user friendly among all systems? Explain briefly. **4**
   - (c) Differentiate between a trap and an interrupt. **3**
   - (d) Suppose you have four processes with length 48, 64, 120, and 28 bytes respectively. The memory available for user space is 300 bytes. Discuss a way by which you can run all the four processes parallely in your system minimizing number of memory accesses. **4**

2. (a) Explain the Convoy Effect of FCFS algorithm. Suggest one or more scheduling strategies that can reduce or eliminate the Convoy Effect, and briefly explain how they help. **2+2**

   (b) Consider the following dataset: **3+1**

Process	Arrival Time (s)	Burst Time (s)
P4	3	10
P2	0	5
P3	6	9
P5	7	12
P1	5	7

   Draw the Gantt Chart and calculate the Response Time, Waiting Time and Turn Around Time of the Processes using Round Robin Algorithm by considering Time Quantum = 2s. In case the above scenario, if the context switch time is 3s, will there be any problem?

   (c) A system uses preemptive priority scheduling, where a lower number means a higher priority. The CPU is allocated to the process with the highest priority, and preemption occurs whenever a new process with a higher priority arrives. The following processes arrive in the system: **3+3**

Process	Arrival Time (ms)	Burst Time (ms)	Priority
P1	0	10	3
P2	2	4	1
P3	4	6	5
P4	6	2	4

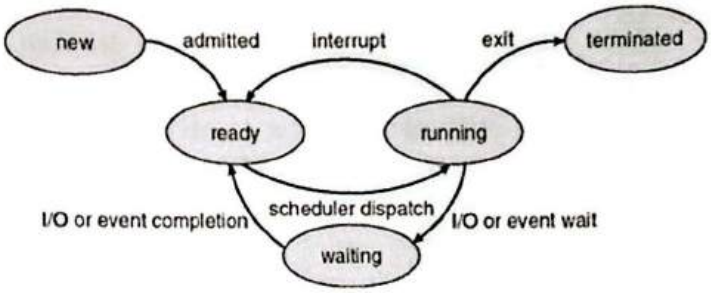
Without Aging:

Draw the Gantt Chart showing process execution order based on preemptive priority scheduling algorithm. Also compute the average turnaround time, and average waiting time for the scenario.

With Aging:

Now assume the system implements aging to reduce the risk of starvation. Each process waiting in the ready queue will have its priority increased by 1 every 2ms of waiting. Redraw the Gantt chart considering the aging mechanism.

3. (a) Consider the following figure: 4



Assume there is a process named P1. Explain the life-cycle of the process P1 and how it transits from one state to another state according to the above figure.

(b) Outline the procedures by which a parent process communicates with a child process. Illustrate the communication procedures with appropriate diagrams. 4

(c) Consider the following semaphore code: 4+2

```
wait(S) {
while (S <= 0)
; // busy wait
S--;
}
signal(S){
S++;
}
```

Assume that initially, S=2 and there are three processes: P1, P2, and P3. Provide a step-by-step example showing how these processes use the semaphore to access the critical section. Determine whether this is a binary semaphore. Justify your answer.

4. (a) Define a safe state in operating systems. Under what circumstances should the Banker's Algorithm be preferred over the Resource Allocation Graph method for deadlock detection? 1+3

(b) Consider the following snapshot of a system: 5+1

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	2	1	1	1	5	2	4	4	4	3	4	2
P2	3	2	2	1	4	2	6	2				
P3	2	1	1	2	2	3	1	7				
P4	1	4	3	1	2	5	3	4				

i) Illustrate that whether the system is in safe state by demonstrating an order in which the process may arrive.

ii) If a request from process P2 arrives for (0, 3, 0, 2) can the request be granted immediately?

(c) Design a security defender software prototype to incorporate within the operating system of your computer to secure and protect your computer resources. 4

5. (a) Consider the following segment table: 4

Segment	Base	Length
0	2400	600
1	2300	50
2	1000	200
3	1270	480
4	1980	90

Draw the flowchart for converting Logical Address to Physical Address and identify the location of the physical addresses in the main memory for the following logical addresses.

(b) Differentiate between internal fragmentation and external fragmentation with proper examples. 4

(c) Given memory partitions of 220K, 55K, 20K, 120K, 75K, and 35K (in order), how would Best Fit and Worst Fit algorithms place each of the processes P1 to P10 given in the table (in order). 6

Process	Size	Turnaround
P1	50K	2
P2	20K	3
P3	35K	2
P4	110K	3
P5	90K	4
P6	200K	1
P7	5K	2
P8	55K	1
P9	170K	3
P10	86K	1

Memory Block	Size
Block 1	220K
Block 2	55K
Block 3	20K
Block 4	120K
Block 5	75K
Block 6	35K

6. (a) Explain Demand Paging with proper diagram. Identify the tasks of dirty bits and protection bits of the page table. 3+1

(b) Consider the following reference string for a page replacement system: 4

Reference string: **1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5**

Using FIFO (First-In-First-Out) page replacement algorithm, calculate the number of page faults:

- When the number of frames is 3
- When the number of frames is 4

Based on the above results, explain Belady's anomaly.

(c) Consider the following page references: 6

5, 6, 4, 5, 7, 9, 2, 4, 3, 7, 4, 6, 4, 9, 4, 6, 7, 8, 3, 5, 2, 1, 3, 4, 6, 2, 4, 3

Assuming demand paging with four frames and the frames are given below:

4
5
6

Apply LRU (Least Recently Used), and Optimal Page Replacement algorithms, and identify the algorithm that shows the best performance in this context.

7. (a) A disk has 50 blocks (numbered 0 to 49), and each block is 1 KB in size. The disk currently has the following files stored using contiguous allocation: **3+1**

File	Starting Block	Length (in blocks)
A	0	10
B	12	5
C	20	8

Draw a schematic diagram of the disk showing the locations of files A, B, C, and the free blocks. A new file D of size 6 KB needs to be stored. Can it be stored contiguously? If yes, suggest the starting block; if not, explain why.

(b) Describe acyclic-graph directory structure in a file system. Analyze the methods used by the operating system to prevent cycles when linking directories. **2+2**

(c) Suppose a disk drive has 2000 tracks (0-1999) and the disk queue having I/O requests in the following order as follows: **3+3**

100, 250, 1500, 750, 950, 200, 1450, 850, 150, 1850, 550, 1100, 1720, 90, 310, 280, 350, 480, 1375, 1530, 1780, 1890, 1410, 270, 170

Current position of the Read-Write head is 400 and assume that previous request was at 345. Starting from the current head position, identify the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms:

- SSTF
- SCAN

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Department of Computer Science and Engineering

CSE 3105: Compiler Design (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.

Answer 05 out of 07 questions.

1 **a.** 4

digit → **[0-9]**
digits → **digits$^+$**
number → **digits (. digits)? (E[+-]? digits)?**
letter → **[A-Za-z]**
id → **letter (letter | digit)***
if → **if**
then → **then**
else → **else**
relop → **< | > | <= | >= | = | <>**

Consider the above regular expression, write down the tokens as <Token_Name, Attribute_Value> of the following C program:

```
int main(){
  // 2 variables
int a, b=2;
    a = 10;
 if(a==b){
     printf("%d is not larger", a);
 }
printf("Geeks are always smart, as they believe 5==5");
```

Omit the character sequences that are not matched with regular expression.

b. For the above regular expression in **1(a)**, draw transition diagram for **relop** token. 4

c. Summarize on the followings: 6

(i) Token
(ii) Patterns
(iii) Lexemes

2 **a.** Consider the following grammar: 6

S → D M Y | I Y | D J
I → D M
J → M Y
D → NN
M → October
Y → NNNN
N → 0|1|2|3|4|5|6|7|8|9

(i) Show the LMD and RMD for the string "**27 October 2025**" using the above grammar.
(ii) Explain how an ambiguous grammar can be determined. Identify whether the above-mentioned grammar is ambiguous or not.

b. Eliminate left-recursion from the following grammar:

K → KungfuPanda | Kungfu | Furious5 | $O_w$ogway

F → KFT | KFM | KFMa | KFV

O_w → KFmasterofmaster | FKshijumaster | $O_w$dragonKF | warriorKF

P → Po | ε

T → Tigress | ε

M → Monkey

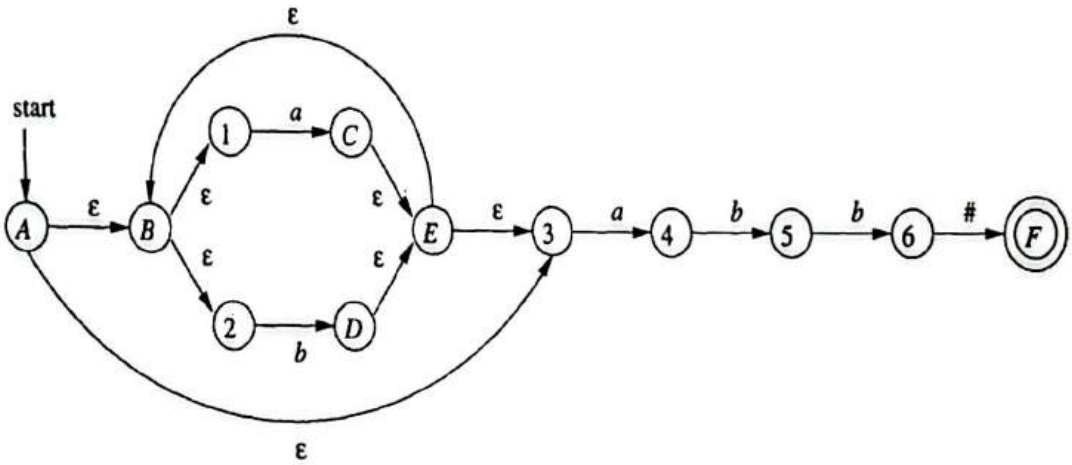
M_a → f$M_a$antis

V → fViper

C → fCrane

c. Write down the algorithm of elimination of left factoring. **3**

3 a. Consider the following Finite Automata: **6**



Give the Formal Definition of the above Finite Automata and identify whether it is a DFA or an NFA with proper explanations. If it is an NFA, then convert it into DFA using subset construction method.

b. Draw the NFA for the following expressions (Use Thompson's Construction Rules): **5**

(i) $(((AB)^?C) \mid D)^+$

(ii) $AB^+DC \mid PQ^*R$

(iii) $MN^*T \mid XY^+$

(iv) $PR\ (P \mid R)^+\ PR$

(v) $(X^?|Y)^* \mid (YZ^*)^+$

c. Given a DFA missing several transitions, identify and explain how you would systematically locate and redirect all undefined transitions to maintain determinism. **3**

4 a. Consider the following grammar to answer the following questions: **6**

T → threeIdiotsTF| virus

F → farhanT | rajuT| ε

I → rancho

(i) Compute the FIRST and FOLLOW of all non-terminals in the given grammar.

(ii) Construct the corresponding LL parsing table.

(iii) State whether the given grammar is suitable to be parsed using the predictive parsing method or not. Use the previously constructed LL parsing table to give your answer. (Assume T is the starting state of the grammar)

b. Differentiate between Recursive Descent Parsing and Predictive Parsing. Consider the following grammar and generate the parse tree for the string **id*id+id** by employing Recursive Descent Parsing approach. 5

$$E \rightarrow T+E \mid T$$
$$T \rightarrow F*T \mid F$$
$$F \rightarrow (E) \mid id$$

c. Explain why LL(1) parsers require grammars to be free of left recursion and left factoring. 3

5 a. Identify whether there is shift-reduce conflict for LR(0) parsing for the following grammar by constructing the LR(0) parse table. 6

$$S \rightarrow Aa \mid bAc \mid dc \mid bda$$
$$A \rightarrow d$$

b. Analyze the approaches that can be adopted to resolve shift-reduce conflicts. Point out whether the SLR(1) parsing approach can resolve the shift-reduce conflict of the grammar of **question no 5(a)**. Construct the SLR(1) parse table for the grammar. 5

c. Construct the parse tree for the input string **abbcde** using the following grammar by employing Shift-Reduce parsing. 3

$$S \rightarrow aTRe$$
$$T \rightarrow Tbc \mid b$$
$$R \rightarrow d$$

6 a. Construct the 3-address code, Quadruple, Triple, and Indirect Triple for the following expressions: 6

(i) **x = (a+a)*b/c*((a+a+a+a)↑(c+d))*((a+a)-(a+a))**
(ii) **distance=starting_velocity*time+0.5*acceleration*time*time**

b. Differentiate between Parse Tree and Syntax Tree. Consider the following infix expressions: 5

(i) **((a↑b)+c)*(c-d)+((e-f)*(a/b))**
(ii) **a + (b - c) * ((d / e) ↑ f)**

Convert the given infix expressions into equivalent postfix expressions. Using the postfix expressions, construct the syntax trees by simulating the stack-based algorithm.

c. Show the constructing step of DAG of the following expression- 3

a + a * (b - c) + (b - c) * d

7 a. The following three address code is to implement the Quicksort Algorithm. Considering the following code answer the following questions. 6

1. i = m-1	11. t5 = a[t4]	21. a[t10] = x
2. j = n	12. if t5>v goto (9)	22. goto (5)
3. t1 = 4 * n	13. if i>=j goto (23)	23. t11 = 4 * i
4. v= a[t1]	14. t6 = 4 * i	24. x = a[t11]
5. i = i+1	15. x = a[t6]	25. t12 = 4 * i goto (19)
6. t2 = 4 * i goto (2)	16. t7 = 4 * i	26. x = a[t11]
7. t3 = a [t2]	17. t8 = 4 * j	27. t12 = 4 * I goto (15)
8. If t3<v goto (5)	18. t9 = a[t8]	28. a [t12] = t14
9. j = j -1	19. a[t7] = t9	29. t15 = 4 * m
10. t4 = 4 * j	20. t10 = 4 * j	30. a[t15] = x

(i) Identify the leaders for the code.

(ii) How many basic blocks are present in the above code?
(iii) Identify the instructions that are selected as leader more than 2 times.

b. Draw the Basic Block and Flow Graph for the above-mentioned code of **question no 7(a).** **5**

c. Identify the optimization techniques that can be applied on the following code. Rewrite the code after applying optimization techniques. **3**

```
int main() {
    int a = 10, b = 2;
    int c = a + b;
    int f = a + b;
    int i = f;
    int temp2;
    while (i < 20) {
        temp2 = a * b;
        i++;
    }
    if (c < 0) {
        i = e + f;
    }
    return temp2 + i;
}
```

Kishoreganj University
3rd Year 1st Semester B. Sc. (Engg.) Final Examination-2024
Department of Computer Science and Engineering
CSE 3107: Information System Design (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.
Answer 5 out of 7 questions.

1 Suppose you are part of a student development team at Kishoreganj University that has been assigned to design and develop a system called Smart Campus Connect. The goal of this system is to make campus life more connected and convenient by allowing students to discover and register for university events, manage club memberships, book rooms for activities, and receive event announcements in one place. Your team will follow the complete software design and development process, from gathering requirements and creating system designs to managing the project using professional tools and best practices.

a. Identify the key stakeholders involved in the Smart Campus Connect project and describe the type of information you would gather from each group. **4**

b. Explain how you would plan and conduct the requirement collection process for developing the Smart Campus Connect system. Discuss how you would select appropriate elicitation techniques and ensure the collected requirements are accurate, complete, and free from bias. **5**

c. After collecting the initial requirements, your team needs to prepare a Software Requirements Specification (SRS) document. Explain what major sections you would include in the SRS and why each section is important. **5**

2 a. Explain the Waterfall model in software development. Considering the nature of the Smart Campus Connect project described in Question 1, discuss whether this model would be suitable and justify your answer based on its characteristics and limitations. **4**

b. The team decides to adopt a Prototyping approach instead. Explain how this approach works, why it might be more appropriate for developing the Smart Campus Connect system, and what advantages it offers in terms of stakeholder engagement and requirement refinement. **5**

c. Describe the key phases of the V-Model and explain how verification and validation are embedded at each stage. In your explanation, clarify how the V-Model ensures both process discipline and early defect detection. **5**

3 a. Develop a Use Case Diagram for the Smart Campus Connect system involving the actors Student, Event Organizer, and Admin. **4**

b. Draw or describe a Level-0 Data Flow Diagram (DFD) that represents how event registration information moves through the Smart Campus Connect system. In your answer, explain how the DFD supports understanding of the system's logical flow and data dependencies. **5**

c. Explain how a Class Diagram and a State Diagram, when used together, provide complementary perspectives on a system. Discuss what each reveals about the design of Smart Campus Connect and why both are essential for complete system modeling. **5**

4 a. In the Smart Campus Connect prototype, some students said they could not understand what the navigation icons meant. What will you do in this situation to solve the problem as a designer? 4

b. During user testing, students mentioned that the home screen looked too crowded, and the team now wants to decide how to improve the interface before the next round of testing. As a designer, what specific changes would you suggest to make the layout clearer and more user-friendly? 5

c. The design team is deciding how to collect user feedback for the next prototype. They can either ask users to rate each screen or observe them performing real tasks. Which method would you choose, and why? 5

5 a. There is a common printing service for printing secured official documents in an office which is used by different departments. Sometimes, multiple departments send lots of printing request simultaneously and want to get assured of their request is being addressed. What technology should be recommended by the designer of such a system? Also draw a block diagram for the required design. 5

b. You have developed an application for different clients. You need to deploy that quickly in different types of servers of the clients. What DevOps technology will serve your purpose? 5

c. In your hardware infrastructure, servers of different capacity are being used. Which load balancing algorithm is best suited for your case? 4

6 a. Explain why Version Control Systems (VCS) such as Git are important when several students work together on a project like Smart Campus Connect. 4

b. Your team members are working on different parts of the Smart Campus Connect system. They are unsure whether to work directly on the main branch or to create separate branches for each feature. What would you suggest they do, and why? 5

c. While merging code, both Badhon and Pronomita edited the same file named eventController.js, which caused a merge conflict. As part of the development team, what steps would you take to fix the conflict properly so that both developers' work is included? 5

7 a. As project manager how do you form your team for the following software projects: 4
i) A project for solving complex scientific problem
ii) Development of ERP with many modules
iii) A software which must be ready at the beginning of the next year

b. Define software failure. What are the components of failure cost? How can software failures be prevented during development? 3

c. Explain the term measure and metric with examples in the discipline of software measurement. Also explain two measurement principles with necessary examples. 4

d. Your goal is to evaluate the performance of the programmers. Define the metrics to achieve this goal using goal oriented software measurement. 3

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3rd Year 1st Semester B. Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

CSE 3109: Artificial Intelligence (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1 a. What is Artificial Intelligence (AI)? Do you think it can be both rational and ethical at the same time? **2**

b. Shortly compare the approaches "Acting Humanly" and "Acting Rationally." **2**

c. A smart delivery drone operates in a busy city environment. It must deliver packages efficiently while avoiding collisions, saving battery power, and maintaining customer satisfaction. The environment includes unpredictable weather, moving obstacles, and varying delivery priorities. The drone uses onboard sensors and data from a cloud system to make decisions autonomously. **10**

i. Identify and describe the characteristics of the drone's environment (observable/partially observable, deterministic/stochastic, static/dynamic, discrete/continuous, etc.) with justification.

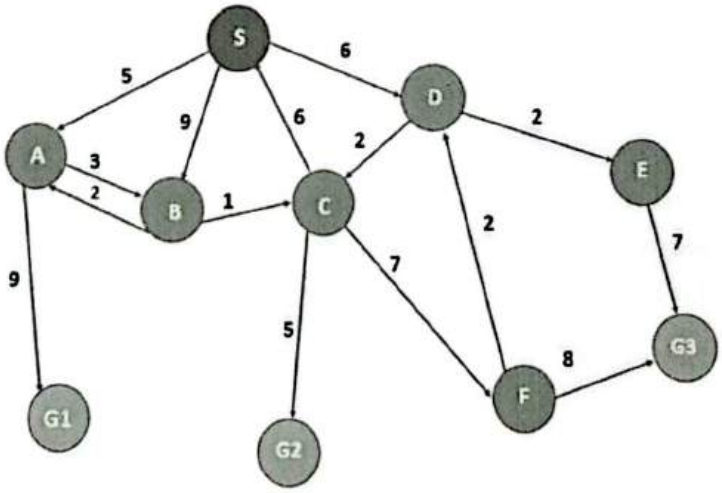
ii. Which type of agent is more appropriate for this drone scenario? Justify your answer.

iii. Draw and label the architecture of the agent that is suitable for the scenario.

2 a. Why planning is important in AI? Differentiate between searching and planning. **4**

b. What is blind search? Between blind (uninformed) and informed search strategies, which would you prefer to use in solving AI problems? Justify your answer with reasons. **4**

c. Find the least cost path form source S to one of the goals (G1, G2, G3) using uniform cost search from the following graph. **6**



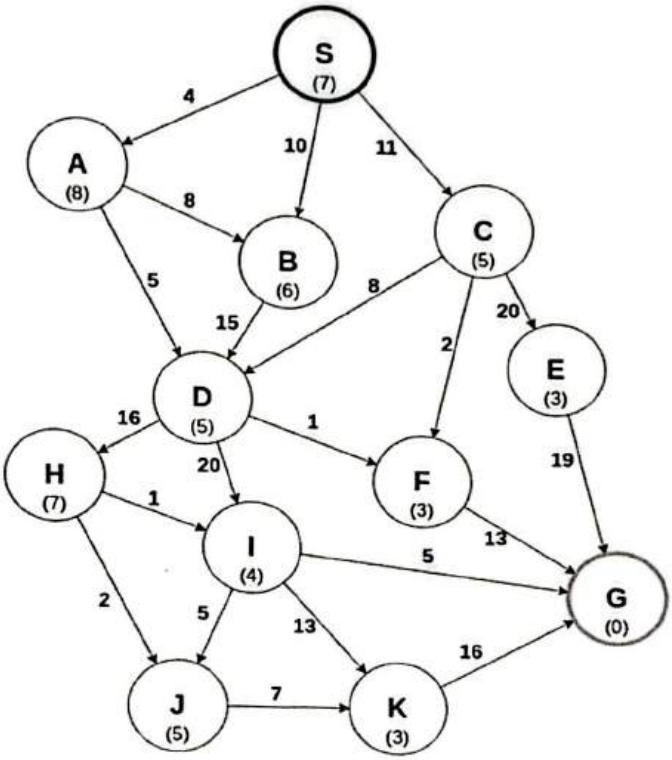
3 a. Describe how Artificial Intelligence, Machine Learning, and Deep Learning are related. Explain their hierarchical relationship and illustrate it with examples or a simple diagram to show how each subset fits within the other. **4**

b. Describe the difference between supervised, unsupervised, and reinforcement learning with suitable examples. **4**

c. How artificial neuron is related to biological neuron? Describe the internal structure of an artificial neuron with proper diagram. **6**

4 a. What is the limitation of depth first search? How it can be solved? 3

b. Consider the following directed graph. Node **S** is the source and node **G** is the destination. The values beside the edges represent the distances between nodes, while the values inside each node (enclosed in parentheses) represent the heuristic estimates of the straight-line distance from that node to the destination. Apply A* search in the graph to find optimal path from **S** to **G**. 6

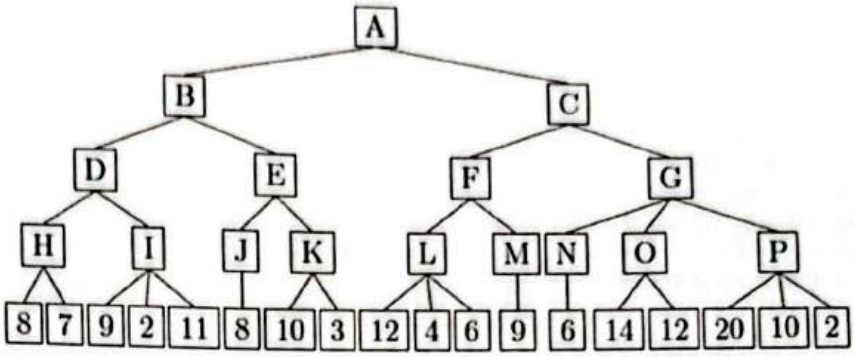


c. What is the drawback of hill climbing algorithm? How it can be solved? 5

5 a. Why is it important to study Game Theory in Artificial Intelligence? Explain its relevance and applications in AI decision-making and strategic interactions. 4

b. What do you mean by a zero-sum game? Give an example. 2

c. Consider the following tree-like graph. Suppose that the top level is a MAX node (the A node is MAX node). Use Minimax algorithm with alpha beta pruning to determine what action A should take and the associated utility. 8



6 a. From the given dataset shown in Table 6(a), we train a Naïve Bayes classifier. Each row refers to an apple instance with three categorical features (size, color, and shape) and one class label indicating whether the apple is good or not. **7**

Table 6(a): Training Data for Naïve Bayes classifier

RID	Size	Color	Shape	Class: good apple
1	Small	Green	Irregular	No
2	Large	Red	Irregular	Yes
3	Large	Red	Circle	Yes
4	Large	Green	Circle	No
5	Large	Green	Irregular	No
6	Small	Red	Circle	Yes
7	Large	Green	Irregular	No
8	Small	Red	Irregular	No
9	Small	Green	Circle	No
10	Large	Red	Circle	Yes

Given a new apple with features x = (Small, Red, Circle), what is the estimation of $p(y = w_o \mid x)$? Would the Naïve Bayes classifier predict y=yes or y=no for the apple x?

b. The following Figure 6(b) represents a multilayer neural network with one hidden layer. **7**

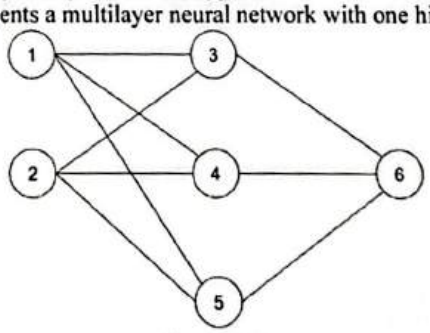


Figure 6(b)

A weight on the connection between nodes i and j is denoted by w_{ij}, such as w_{13} is the weight on the connection between nodes 1 and 3. The following table lists all the weight in the network.

$W_{13} = 0.9$ $W_{14} = 0.2$ $W_{15} = 0.1$	$W_{36} = 0.3$ $W_{46} = 0.6$ $W_{56} = 0.8$
$W_{23} = 0.3$ $W_{24} = 0.8$ $W_{25} = 0.5$	

Determine the modified weights for w_{13} and w_{46}, after one iteration of training back propagation algorithm.

7 a. Define heuristics and the properties of heuristics in terms of AI-based search algorithms. Describe the characteristics of the following heuristic algorithms: 4

i. Iterative Deepening A* (ID-A*)
ii. Recursive Best First Search (RBFS)
iii. Simplified Memory Bounded A* (SM-A*)

b. Illustrate a possible solution if an AI agent fails to operate in an environment because of a large number of states and huge amount of operations to perform. 5

Based on the five components of problem-solving, formulate the problem described in Figure 7(b) (apply the concept of state mapping problem).

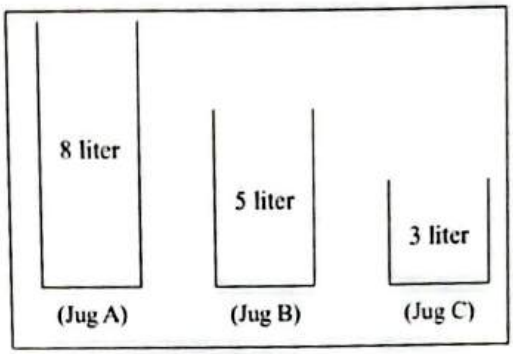


Figure-7(b): A three Jars problem

Problem descriptions:

i. There are three jugs A, B, and C with capacities of 8 liters, 5 liters, and 3 liters respectively.
ii. Only the 8-liter jug is filled up with water.
iii. There are no measuring scales.
iv. There is no extra water supply.
v. There are no extra jugs to use.
vi. Goal: By a series of pouring back and forth among the three jugs, divide the 8 liters into two equal amounts (4 liters in Jug A and 4 liters in Jug B).

c. Formulate a state mapping tree based on the problem description in Question 7(b) (Figure-7(b)). 5