KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
CSE 3209
Artificial Intelligence

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

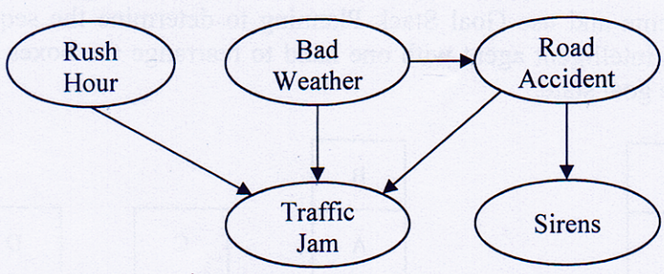
(Answer **ANY THREE** questions from this section in Script A)

1. a) What is Artificial Intelligence (AI)? To what extent are the following computer systems instances of AI? Explain. (12) [CO1]
   (i) Supermarket Bar-Code Scanners (ii) Web Search Engines
   (iii) Voice-Activated Telephone Menus
   b) Consider a rabbit grazing in a carrot field. What are its sensors, actuators, and environment? Discuss its sensors, and actuators are well-suited to its environment. (13) [CO2]
   c) Give a demystified classification of AI. "The most subfield in AI focuses on smaller components thought to be necessary for producing intelligent programs" – justify the statement. (10) [CO3]

2. a) Explain why problem formulation must follow goal information. (08) [CO1]
   b) What is PEAS? For each of the following activities, give a PEAS description of the task environment and characterize it in terms of (i) Automated Taxi Driving, (ii) Automated ~~Neating~~ Knitting Machine. (13) [CO2]
   c) How does a simple reflex agent differ from a goal based agent? "Learning agent is suitable for dynamic environment" – justify this statement using an appropriate example. (14) [CO3]

3. a) What is a fuzzy logic system? Explain. (10) [CO1]
   b) Explain different operations on fuzzy sets. Use pictorial view for their clarity. (10) [CO2]
   c) Design a fuzzy logic based washing machine system using a fuzzy expert system development methodology. (15) [CO3]

4. a) Formulate graph-coloring problem as a constraint satisfaction problem. Use minimum conflict local search for solving this problem and draw the constraint graph. (10) [CO1]
   b) What is a parse tree in NLP and for what purpose is it used? Construct a grammar for the following sentence:
   "The traveler shot the tiger with the gun." and also draw the syntactic tree. (13) [CO2]
   c) How the uncertainty accommodated in the probabilistic reasoning. Derive the joint probability function for the following Bayesian network. (12) [CO3]



SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Consider the following directed weighted graph with heuristic values: (18) [CO3]

Node	Successors (Cost)	$h(n)$
S	A(2), B(5)	7
A	C(2), D(4)	4
B	D(1), E(3)	3
C	G(5)	2
D	G(2)	1
E	G(2)	0
G	–	0

i) Perform A* search step by step starting from node S to G, showing $f(n) = g(n) + h(n)$ values.

ii) If we replace $h(n)$ with $2 * h(n)$, how would the search order and final path change? Explain what this tells you about the sensitivity of heuristics in A*.

b) "According to the company policy, it is considered intrusion if any employee accesses confidential files without clearance. Tom accessed confidential files and Tom does not have clearance." (12) [CO3]
Using forward-chaining of first-order-logic, prove that Tom is an intruder.

c) Explain the concepts of completeness and optimality of a search algorithm. (05) [CO1]

6. a) Consider the Grundy's game: (17) [CO2]
There is a single heap of coins. Two players, Max(first player) and Min(second player), play alternately. On each turn, a player selects a heap of size $n \geq 3$ and splits it into two unequal positive integer heaps, i.e.,

$$n \rightarrow i + (n - i), \text{ where } i \neq (n - i)$$

The game ends when no valid split is possible. The player who cannot move loses.
Apply the Minimax algorithm to the initial state consisting of a single heap of 7 coins, and determine whether any optimal move is available for the Max player by showing the complete game tree.

b) Given the following statements: (08) [CO2]

$$\alpha : x + y = 4$$
$$\beta : x * y \geq 2$$

where $0 < x, y \leq 3$, determine whether $\alpha \vDash \beta$. Justify your answer.

c) Differentiate between Greedy-best first search and A* search using an example. (10) [CO2]

7. a) Consider a large adversarial game with a high branching factor and limited computation time per move. Compare Minimax without heuristic evaluation, Minimax with heuristic evaluation, and Monte Carlo Tree Search (MCTS) in terms of efficiency and optimality. Justify which method is most suitable for designing an intelligent agent under these constraints. (12) [CO3]

b) Convert the following statements into propositional logic and use model checking to prove that Macavity is responsible for the crime: (17) [CO2]
"Either cat fur or dog fur was found at the scene of the crime. If dog fur was found, officer Thompson had an allergy attack. If cat fur was found, then Macavity is responsible for the crime. Officer Thompson did not have an allergy attack."

c) Find the predicates, functions and terms from the following sentences: (06) [CO3]

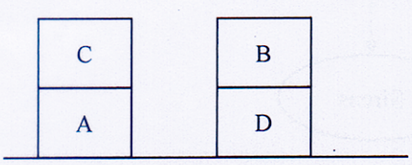
i) `Brother(John, Richard)`

ii) `>(Length(LeftLegOf(Richard)), Length(LeftLegOf(John)))`

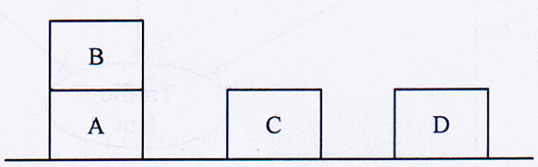
iii) `Sibling(John, Richard)` $\Rightarrow$ `Sibling(Richard, John)`

8. a) "Alpha-Beta pruning is necessary for developing Game." – justify your answer using an example. (09) [CO2]

b) Design the action schema and use Goal Stack Planning to determine the sequence of actions required for an intelligent agent with one hand to rearrange the boxes from the given initial state to the goal state. (15) [CO2]



Initial State



Goal State

c) Explain the Sussman Anomaly. (05) [CO2]

d) Convert the following propositional logic expression into CNF, showing all the intermediate steps: (06) [CO2]

$$A \Leftrightarrow (B \vee C)$$

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
CSE 3217
Mobile Computing

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
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SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) How is a scene captured by the camera and displayed on the screen? (08) [CO1]
   b) A mobile processor overheats when running video editing software. The system must reduce the temperature without stopping the application. Explain how DVFS can help to solve this problem. Also discuss the performance trade-offs. (12) [CO2]
   c) A modern smartphone includes context aware features. The device performs the following actions: (09) [CO3]
      i) When the user enters a meeting room, the phone automatically switches to silent mode.
      ii) The phone displays restaurant recommendations based on the user's previous search history.
      iii) The user presses a voice button and says "Turn on WiFi", and the phone enables WiFi.
      iv) The phone shows weather updates on the notification panel.

      Identify which actions represent which category of context awareness and differentiate between the categories.
   d) In Swift delegation, why is the delegate usually declared as a weak variable? (06) [CO4]

2. a) A startup wants to launch an app quickly without Appstore approval. Should they build a native app or a web app? Write the disadvantages of the other app type in this scenario. (08) [CO2]
   b) Describe the four key principles of HIG. Evaluate whether strict adherence to HIG limits innovation in UX design. Justify your answer with examples. (12) [CO3]
   c) Define iOS. Briefly explain the iOS architectural layers with necessary figures and explanations. (15) [CO4]

3. a) Suppose you are designing a mobile app for new users. Identify the user-centric design principles that should be applied and briefly justify each. (08) [CO3]
   b) Examine how Accordion reduces cognitive load compared to long scrolling pages. Also, analyze the differences between Card and Carousel in presenting information efficiently. (14) [CO2]
   c) Note down the key features of the mobile system. Justify the statement – "network connectivity is useful but not essential for mobile computing". (13) [CO1]

4. a) Differentiate between DVM and Android Runtime. (06) [CO4]
   b) Write down the major challenges of wireless communication and suggest suitable solutions for each challenge. (10) [CO1]
   c) A university wants to develop a student mobile app for course registration, notices, and fee payment. The team needs to organize information so that the students can use the app easily. Write down the steps of IA you would follow to design this app. Briefly explain each step. (13) [CO3]
   d) What is transaction management? Write down the properties of it. (06) [CO2]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Explain hidden and exposed terminal problems. What happens in the case of such terminals when ALOHA Reservation and MACA protocols are used in the network? (15) [CO1]
   b) A cellular system has total 630 channels. With cluster size 7 and cell radius 3km. Find: (10) [CO2]
      i) The channel capacity of a single cell.
      ii) The minimum separation between co-channel cells.
   c) "Cloud computing is a service-oriented architecture" – justify the statement. (10) [CO1]

6. a) Explain the IP packet delivery process with necessary diagram(s) for mobile nodes where foreign networks offer co-located care-of-address. (12) [CO1]
   b) In a converged media environment, how would you provide protection to user rights? How can you prevent events like "Facebook-Cambridge Analytica Data Scandal"? (10) [CO3]
   c) In dynamic traffic scenario, why does ADVMAC outperform SMAC and TMAC? Explain with necessary diagrams. (13) [CO2]

7. a) Design a network for disaster-prone environments that support real-time monitoring. Explain your proposed architecture, necessary components, and energy efficiency design choices. (15) [CO3]
   b) Illustrate the reasoning behind why traditional energy efficiency mechanisms don't work in cloud environment with appropriate diagrams. (10) [CO2]
   c) Define contention window size. Write down the difference between BMAC and XMAC. (10) [CO1]

8. a) "Data recovery and backup vulnerability poses significant security risk in cloud computation" – justify the statement. (10) [CO2]
   b) Explain the DFWMAC-PCF protocol with necessary explanation and diagram. (13) [CO1]
   c) Explain the purpose of DHCP and how it can be used for mobility and support of mobile IP with necessary diagram. (12) [CO1]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
HUM 3247
Engineers and Society

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
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SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1.	a)	Define the terms "Profession" and "Professional Engineer". Mention at least three key characteristics of a professional engineer.	(10)	[CO1]
	b)	Compare the role and responsibilities of an engineer in the public sector and private sector. Mention at least three differences.	(15)	[CO2]
	c)	As a professional engineer, what should you do if you found unethical practices in either sector? Provide two ethical actions you should take and justify them briefly.	(10)	[CO3]
2.	a)	What is meant by engineering accreditation? Explain the role of an accreditation body in ensuring quality education.	(10)	[CO1]
	b)	Briefly describe BAETE and BAC. Mention the major functions/responsibilities of these accreditation bodies.	(13)	[CO2]
	c)	Why is accreditation important for engineering programs? Mention at least four benefits of accreditation for: (i) Students, (ii) Graduates, (iii) Institutions, and (iv) Society/Industry.	(12)	[CO3]
3.	a)	As a responsible CSE engineer, recommend practical measures to ensure safety and reduce liability including testing, validation, audit, fallback systems, human oversight, documentation, and compliance with standards.	(10)	[CO3]
	b)	What is whistleblowing in engineering practice? Discuss ethical and professional considerations an engineer must evaluate before whistleblowing?	(12)	[CO2]
	c)	Describe the concept of professionalism for international engineers. Explain the challenges engineers face in the context of globalization.	(13)	[CO2]
4.	a)	Identify and explain the major workplace rights of engineers and explain why these rights are necessary for ethical engineering practice.	(09)	[CO1]
	b)	A software engineer fails to implement proper encryption in a healthcare system. As a result, patient medical records are leaked online. Evaluate the situation by identifying: i) Duty of care and negligence. ii) Impact under data protection/cyber law.	(11)	[CO3]
	c)	A private company deploys a smart agriculture system using IoT sensors, drones, and AI analytics to monitor crops and optimize irrigation in rural Bangladesh. i) Examine the positive and negative societal implications of this system focusing on productivity and food security, cost, and accessibility and impact on traditional farmers. ii) For the smart agriculture system, explain the meaning of $risk = probability \times consequence$ and identify one technical risk, one operational risk, and one environmental risk.	(15)	[CO2]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5.	a)	What is meant by Research and Development (R&D) in engineering? Explain the importance of R&D in technological innovation.	(10)	[CO1]
	b)	Compare government research grants and private research funding. Explain the differences and their impacts on engineering research.	(10)	[CO2]
	c)	Explain Copyright and Intellectual Property (IP) right engineering research and development using an example.	(15)	[CO3]

6. A software engineer named Ms. Tania, working in a private software company, is assigned to develop a mobile banking application. During the testing phase, she discovers a serious security vulnerability that may expose user personal data.

Her project manager insists on releasing the product quickly to meet the deadline and tells her that the issue can be fixed in a later update. At the same time, the company is trying to attract investors, so they want to avoid any delay or negative reporting. As an engineer and computing professional, Ms. Tania is concerned about public safety, user privacy, and professional responsibility. Now, answer the following:

a) What is meant by professional code of ethics? Why are codes of ethics important for engineers and computing professionals? Explain. (12) [CO1]

b) Discuss any three ethical principles (rules/commitments) of the IEEE code of ethics that are relevant to this situation. Explain briefly how they apply to Ms. Tania's case. (13) [CO2]

c) Ms. Tania decides to report the issue to higher management and refuses to approve the release until it is fixed. Now, evaluate her decision based on the IEB code of ethics and professional responsibility. (10) [CO3]

7. a) An engineering startup is developing a smart wearable device for health monitoring. During the development process, the team creates original software, designs a unique product shape and considers using some existing patented technology to improve performance. They also plan to sell their product in international markets. (12) [CO3]

   i) Identify and describe two types of intellectual property that the company could apply to protect its software and product design.

   ii) Discuss the possible legal and ethical consequences if the company uses patented technology without permission.

b) Define and explain ethics, goodness, rightness, consequentialism, and utilitarianism. Show how these ideas help a CSE engineer make responsible decisions. (11) [CO1]

c) Propose a responsible research management guideline for CSE researchers covering plagiarism, data handling, authorship, publication ethics, and accountability. (12) [CO2]

8. A software engineer named Mr. Khabir is working in a financial technology company that provides online banking service. One day, the company's system is attacked, and customer data is leaked on the dark web. Further investigation reveals the followings:

   i) An attacker used hacking techniques to access the system.

   ii) Some employees are victims of phishing and identity theft.

   iii) Fake news is being spread online damaging the company's reputation.

   iv) The attacker may be part of a larger group involved in cyber terrorism targeting financial institutions.

The company now faces legal, ethical, and security challenges under cyber law.

a) What is cyber law and cyberspace? Explain the importance of cyber law in controlling cybercrime. (10) [CO1]

b) Explain any three types of cybercrimes against individuals, institutions, or the state mentioned in the above scenarios. (12) [CO2]

c) How do cybercrimes such as hacking and identity theft affect organizations and society? Suggest preventive measures those an organization should adopt. (13) [CO3]