KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E./B.Sc.
Year : IV

Course : COMP 472
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **encircle**.

1. What is the main objective of AI?
   a. Enhance hardware efficiency
   b. Mimic human intelligence
   c. Improve network security
   d. Develop new programming languages

2. Which of the following is an uninformed search technique?
   a. A* search
   b. Hill climbing
   c. Depth-first search
   d. Genetic algorithm

3. In AI, an agent's environment is defined as:
   a. The programming language it uses
   b. Everything external that affects the agent
   c. The internal structure of the agent
   d. The performance measure of the agent

4. Which of these is not a property of a good performance measure for agents?
   a. Completeness
   b. Optimality
   c. Flexibility
   d. Execution speed

5. What does "iterative deepening search" combine?
   a. Depth-first and breadth-first search
   b. Local search and adversarial search
   c. A* search and genetic algorithms
   d. Backpropagation and Boltzmann machines

6. The minimax procedure is used in:
   a. Probabilistic reasoning
   b. Logical inference
   c. Adversarial search
   d. Neural networks

7. What is the primary advantage of A* search over greedy search?
   a. It uses less memory
   b. It guarantees optimality
   c. It is faster
   d. It avoids backtracking

8. In propositional logic, a well-formed formula must:
   a. Be valid
   b. Contain no connectives
   c. Follow syntactic rules
   d. Be consistent

9. Which of the following is a property of a horn clause?
   a. Contains exactly two literals
   b. Contains at most one positive literal
   c. Contains no quantifiers
   d. Is always true

10. Which network uses a self-organizing map?
    a. Boltzmann machine
    b. Hopfield network
    c. Kohonen network
    d. Perceptron

11. In Fuzzy Learning, the learning process focuses on:
    a. Binary decisions
    b. Non-crisp values
    c. Logical resolution
    d. Deterministic networks

12. Backpropagation in neural networks is used to:
    a. Minimize a cost function
    b. Enhance input weights
    c. Randomize outputs
    d. Reduce processing time

13. Which of the following is not a learning approach in AI?
    a. Supervised learning
    b. Reinforcement learning
    c. Fuzzy clustering
    d. Static learning

14. Bayes' theorem is mainly used in:
    a. Logical inference
    b. Probabilistic reasoning
    c. Search optimization
    d. Semantic nets

15. The Boltzmann machine is a type of:
    a. Probabilistic graphical model
    b. Recurrent neural network
    c. Feedforward network
    d. Self-organizing map

16. Which of these uses a genetic algorithm?
    a. Semantic networks
    b. Optimization problems
    c. Logical inference
    d. Neural network training

17. What does "alpha-beta pruning" aim to achieve?
    a. Increase search depth
    b. Minimize search space
    c. Improve statistical reasoning
    d. Simplify logical representation

18. Which AI concept uses "frames"?
    a. Semantic networks
    b. Structured knowledge representation
    c. Statistical reasoning
    d. Local search optimization

19. The "Hopfield network" is mainly used for:
    a. Pattern recognition
    b. Logical reasoning
    c. Causal inference
    d. Search optimization

20. Decision trees are best suited for:
    a. Logical inference
    b. Structured knowledge representation
    c. Classification problems
    d. Probabilistic reasoning

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Given a pack of cards each of which has a letter written on one side and a number written on the other side as shown in the figure below and it is claimed that the following rule (in italic and bold font) is true:

   If a card has a vowel on one side, then it has an even number on the other side.
   Explain which card or cards to turn over in order to decide whether the rule is true or false.
   The shown cards are: **E 4 T 7**

2. Explain the concept of "admissible heuristic" in search algorithms and provide an example.

3. Using truth tables, verify the validity of the logical statement: $(p \wedge q) \rightarrow (p \vee q)$.

4. Describe how Genetic Algorithms are used to solve optimization problems. Provide an example.

5. List the advantages and limitations of frame-based knowledge representation.

6. Write the FOPL representation of the statement "Every human has a mother."

7. Describe the structure and working of the Perceptron Model.

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Explain the backpropagation algorithm in detail, including its steps and mathematical formulation.

9. Discuss the structure of Boltzmann machines and their applications in AI.

10. Compare and contrast the various approaches to knowledge representation, including semantic nets, frames, and conceptual dependencies.