

Regular (2066 & Later Batch)			
Exam.	BE	Full Marks	80
Level	BCT	Pass Marks	32
Programme	III / II	Time	3 hrs.
Year / Part			

Subject: - Artificial Intelligence (CT 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Discuss any two fields of your daily life where artificial intelligence has been applied. (7)
2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. $\text{LOGIC} + \text{LOGIC} = \text{PROLOG}$
Show all the step of solving through constraint satisfaction problem. (7)
3. Discuss the hill-climbing search algorithm along with problems associated with it and discuss their solutions. (9)
4. Given premises: Every American who sells weapons to hostile nations is a criminal. The country Abc is enemy of America. All of the missiles in Abc were sold by John. John is an American.
Proof: John is a criminal. (10)
5. What are the different knowledge representation models? Discuss semantic nets with an example. (7)
6. What is Fuzzy learning? Explain with a practical example. (4)
7. Explain the learning framework with suitable example. (6)
8. What is a Hopfield Network? Explain all the steps involved in the Hopfield Network with suitable example. (8)
9. Explain different steps of expert system development with an example. (8)
10. What is a natural language processing? Explain it. (6)
11. Write short notes: (any two) (4 x 2 = 8)
 - i. Skolemization
 - ii. Machine vision
 - iii. Human Brain verses Neural Network

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
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| 1. What is artificial intelligence (AI)? Explain the Turing and its importance in artificial intelligence. [7] | |
| 2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. [7] | |
| 2] RIGHT + RIGHT = WRONG
Show all the step of solving through constrain satisfaction problem. | |
| 3. What is blind search? Explain depth first search algorithm with an example and compare it with breadth first search. [9] | |
| 4. Explain all the steps involved in conversion of conjunctive normal form (CNF) with an example. [10] | |
| 5. What is a frame? Explain it with suitable example. [7] | |
| 6. What is genetic algorithm (GA)? Explain operator of GA with its importance. [10] | |
| 7. What is neural network? Differentiate between supervised and unsupervised learning. [6] | |
| 8. What is expert system? Explain general architecture of an expert system. [8] | |
| 9. What is natural language processing (NLP)? Explain different steps of NLP. [8] | |
| 10. Write short notes on: (any two)
a) Horn clause
b) Machine vision
c) Perceptron [4x2] | |

Exam.	Regulation		
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1. Define AI. When a machine is said to be passed Turing test? Give any two examples of constraint satisfaction problem. [2+5+1]
2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. $\text{WRONG} + \text{WRONG} = \text{RIGHT}$. Explain the steps that you have followed. [5+3]
3. Differentiate between informed and blind search. How depth search is different to breadth first search. Compare with evaluation parameters. [4+4]
4. All oversmart persons are stupid. Children of oversmart persons are naughty. Ram is children of Hari. Hari is oversmart. Show that Ram is naughty. Using FOPL based resolution method. [8]
5. Explain the step involved in conjunctive normal form (CNF) with suitable example. [8]
6. What is semantic net? Explain with suitable example. [8]
7. What is machine vision? Discuss about the algorithm of Genetic Algorithm. [2+6]
8. What is neural network? Explain back-propagation algorithm learning.. [4+4]
9. What is an Expert System? Explain the steps of an Expert System development. [4+4]
10. Define machine translation in NLP. Explain the challenges of machine translation. [1+7]

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1. What is Artificial Intelligence (AI)? Discuss brief history of AI with Chronological development. [2+6]
2. Why searching is necessary in AI? Explain about the role of production system with suitable example. [2+6]
3. What is horn clause? Differentiate between Depth First Search and Breadth First Search. [1+7]
4. Explain backward chaining with suitable example and compare with forward chaining. [4+4]
5. Why do we need FOPL? State any three rules of inference. How can we make the machine with learning capacity? [2+3+3]
6. Define Boltzmann Machine. How knowledge can be represented using semantic network? Explain with suitable example. [1+7]
7. What is Machine Learning? What is Fuzzy Logic? Explain the Fuzzy Inference with suitable example. [2+6]
8. Differentiate declarative knowledge and procedural knowledge. Explain the architecture of expert system. [2+6]
9. What is the role of perceptron in neural network? Explain about backpropagation algorithm. [3+5]
10. What is Natural Language Processing (NLP)? Discuss the different issues related with NLP with example. [2+6]

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1. What is Artificial Intelligence (AI)? Discuss history of AI in brief. [2+5]
2. What is the advantage of depth limit search? Compare it with other search strategies. [4+4]
3. If X is on the top of Y, Y supports X. If X is above Y and they are touching each other, X is on the top of Y. A cup is above a book. A cup is touching a book. Show that supports (book, cup) is true. [8]
4. Give an example of learning by analogy. How knowledge can be represented using semantic network? Explain with suitable example. [1+7]
5. Explain Backward Chaining with suitable example. [7]
6. What is conceptual dependency? Explain some of common primitives used in conceptual dependency. [2+5]
7. What makes a problem "Well Defined"? Explain with a sample example of a state-space search framework. [3+4]
8. What is Artificial Neural Network (ANN)? Compare ANN with human brain with its functioning principle. [3+5]
9. Define knowledge acquisition with example. Explain the architecture of expert system. [2+6]
10. Compare the following: [4x3]
 - a) Declarative versus Procedural Knowledge
 - b) Pragmatic versus Phonetic Analysis
 - c) Genetic algorithm based versus Fuzzy based learning

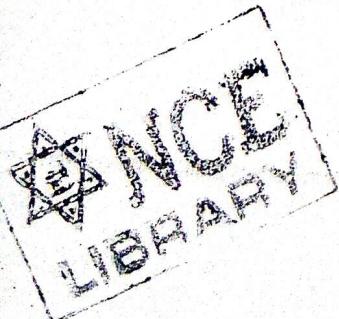
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1. Distinguish between knowledge and learning. What does acting humanly refer to? Explain. Define well defined problems. [2+5+1]
2. Solve the following cryptoarithmetic problem with necessary steps. [7]

$$\text{ONE} + \text{ONE} + \text{TWO} = \text{FOUR}$$
3. How informed search is different from uniformed search? Explain min-max algorithm with suitable example, also discuss how alpha-beta is different from min-max algorithm. [2+4+3]
4. What is causal network? Explain reasoning in belief network with suitable example. [2+5]
5. What is neural network? Describe its types. A doctor knows that the disease meningitis causes the patient to have a stiff neck 50% of the time. The doctor also knows that the probability that a patient has meningitis is 1/50,000, and the probability that any patient has a stiff neck is 1/20. Find the probability that a patient with a stiff neck has meningitis? [3+5]
6. What is machine learning? Explain genetic algorithm along with different operators of genetic algorithm. [2+8]
7. Define expert system? Discuss about the general architecture of an expert system. [2+2+2+2]
8. How does machine vision help in Artificial Intelligence? Explain how back propagation algorithm helps in machine learning. [2+4]
9. Compare the followings: [3+5]
 - Forward versus backward chaining
 - Hopfield versus Kohonen network
 - Analogy versus Inductive learning



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1. What is an Artificial Intelligence (AI)? Explain any two applications of AI in real field. [7]
2. What do you understand by Constraint satisfaction problem? Solve the following Crypt-arithmetic problem. [1+6]

SEND
 + MORE
 MONEY

3. What is a searching? Explain Breadth First Search and Depth First Search and compare their performance criteria. [9]
4. What is a knowledge, representation and reasoning? Describe forward chaining with practical example. [2+5]
5. Assume the following facts: [7]
 - John likes all kinds of food.
 - Apples are food.
 - Chicken is food.
 - Anything anyone eats and isn't killed by is food.
 - Bill eats peanuts and is still alive.
 - Sue eats everything Bill eats.

Prove that John likes peanuts using resolution refutation

6. What are semantic nets and frames? How frames are useful in semantic nets. [7]
7. What is a machine learning? Explain in detail about Boltzmann machines with suitable algorithm and explanations. [2+8]
8. What is a neural network? Explain the back propagation algorithms and perceptron. [2+4+4]
9. What is an expert system? Explain its advantages and disadvantages. [8]
10. What is a Natural Language Processing? Describe Natural Language Processing Steps and its application. [2+6]

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1. If the Turing Test is passed, does this show that computers exhibit intelligence? State your reasons. [7]
2. What is a Constraint satisfaction problem? Solve the following crypto-arithmetic problem with necessary steps:
LOGIC+LOGIC=PROLOG. [3+4]
3. Searching is an important part of AI, justify it. Explain any two types of blind search and compare them in terms of space and time complexity. [2+7]
4. What is a rule based reasoning? Explain Backward Chaining with suitable example. [7]
5. Using resolution solve the following statements:
All pompeian are Romans. All Romans were either loyal to Caesor or hated him. Everyone is loyal to someone. People only try to assassinate rulers they not loyal to. Marcus tried to assassinate Caesor. Marcus was pompeian. Find, did Marcus Caesor? [7]
6. What are Frames and Semantic Net? Convert the given sentences in semantic Net.
 i) A person is a mammal.
 ii) Sakti Gauchan is a person.
 iii) Person has nose.
 iv) Sakti Gauchan is in Nepalese team.
 v) Uniform color of sakti Gauchan is Red/Blue. [7]
7. What is a machine learning? Explain genetic algorithm (GA) along with GA operators. List some of areas where GA can be applied. [2+6+2]
8. What do you understand by a perceptron? How can we design a neural network that acts as an OR gate. [2+7]
9. Differentiate between declarative knowledge and procedural knowledge. Describe expert system with its architecture and practical uses. [2+7]
10. Explain different steps involved in the natural language processing (NLP) with suitable block diagram and examples. [3+6]

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1. If the Turing Test is passed, does this show that computers exhibit intelligence? State your reasons. [7]

2. Solve the following puzzle by assigning numeral (0-9) in such a way that each letter is assigned unique digit which satisfy the following addition. [7]

$$\text{ONE} + \text{ONE} + \text{TWO} = \text{FOUR}$$

3. Explain the necessity of searching techniques in AI? Differentiate between Breath first search and Depth first search with their performance criteria. [4+5]

4. Assume the following facts: [8]

- i) Horses, cows, pigs are mammals
- ii) An offspring of a horse is a horse
- iii) Bluebeard is a horse
- iv) Bluebeard is Charlie's parent
- v) Offspring and parent are inverse relations
- vi) Every mammal has a parent

Prove Charlie is a horse using resolution refutation.

5. What is causal net? How does Bayes Theorem calculate the probability in a causal net? Explain with example calculation. [7]

6. Convert given sentences into Semantic Network. [7]

- i) The height of the adult male is 5.10
- ii) Baseball player is an adult male.
- iii) Adult male is a person.
- iv) Batting average of Baseball players is 0.252
- v) Pee-wee-Reese is a Fielder.
- vi) Fielder is Baseball player.
- vii) Team of pee-wee-Reese is Brooklyn Dodger.

7. "Learning is an essential characteristic for intelligent agents." List down justification on this statement. Write about the role learning with suitable example. [4+4]

8. What are applications of Expert System? Describe the Development stages of Expert System briefly. [2+6]

9. Define a NLU and a NLG. List down the different steps involved in the natural language processing (NLP) with suitable examples. [2+7]

10. Define Hebbian learning. Use Hebbian learning algorithm to Construct Hebbian Network which perform line AND Function. [3+7]

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1. Define Artificial Intelligence (AI). Describe the importance and practical application of AI. [6]
2. A farmer has a goat, a wolf and a cabbage on the west side of a river. He wants to get all of his animals and his cabbage across the river onto the east side. The farmer has a row boat but he only has enough room for himself and one other thing. The wolf will eat the goat if they are left together alone. The goat will eat the cabbage if they are left together alone. How can the farmer get everything on the east side? [8]
 - i) Formulate this puzzle as search
 - ii) Solve this problem-using search (any method)

Draw the search tree and show the final solution
3. Devise an example to show how A* algorithm uses path cost and heuristic cost to generate best solution. [8]
4. Consider the following axioms: [10]
 - i) Anyone whom Mary loves is a football star
 - ii) Any student who does not pass does not play
 - iii) John is a student
 - iv) Any student who does not study does not pass
 - v) Anyone who does not play is not a football star.

Prove that "If John does not study, then Mary does not love John" Resolution by Refutation.
5. A doctor is called to see a sick child. The doctor has prior information that 90% of sick children in that neighborhood have the flu, while the other 10% are sick with measles. Let F stand for an event of a child being sick with Flu and M stand for an event of a child being sick with measles. Assume for simplicity that there no other maladies in that neighborhood. A well-known (and common) symptom of measles is a rash and has probability of 0.95. [8]

However, very occasionally, children with flu also develop rash and has probability of 0.08.

Upon examining the child, the doctor finds a rash. What is the probability that the child has measles?
6. Explain Frames and Semantic Net with examples. List down their advantages and limitations. [4+4]
7. What is Fuzzy Logic and why is it important? Explain about Mamdani Fuzzy Inference Method with example. [3+7]
8. What do you understand by Perception? How can we design a neural network that acts as an XOR gate? [1+7]
9. Differentiate between declarative knowledge and procedural knowledge. Describe expert system with its architecture and practical uses. [3+5]
10. What is Natural Language processing? Explain the different steps in the natural language processing. [2+4]

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1. What is a rational agent? "System that think like humans" and "System that act like humans" are the part of artificial intelligence. Justify these statement with practical example. [1+6]
2. Define constraint satisfaction problem (CSP). Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. SWIM + WEAR = RELAX. [1+6]
3. Why Searching is important in problem solving? What do the drawbacks of greedy best-first search and how A* search algorithm solve it. Explain with an example. [2+7]
4. a) Assume the following facts:
 - John likes all kinds of food.
 - Apples are food.
 - Chicken is food.
 - Anything anyone eats and isn't killed by is food.
 - Bill eats peanuts and is still alive.
 - Sue eats everything bill eats.
 Prove that John likes peanuts using resolution.
- b) Differentiate between forward and backward chaining. [4]
5. What is Frame? How is it different from semantic net in knowledge representation? [7]
6. Define inductive Learning. Explain in detail about ID3 process with suitable example. [2+6]
7. What is self-organizing Map (SOM)? Explain all the steps involved in SOM with suitable example. [2+5]
8. Justify that the study of gene is one of important part in the AI. List down the steps involved in genetic algorithm with an example. [4+4]
9. How knowledge acquisition is performed in expert system? Explain one real expert system example with proper architecture. [2+5]
10. Write short notes on: (Any two)
 - a) Machine Vision
 - b) Supervised Vs Unsupervised learning
 - c) Back Propagation Algorithm

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1. Define AI. What is the importance of Turning Test in AI? List applications of AI. [2+4+2]
2. What is problem space? Solve the following crypto arithmetic problem by showing all the steps. [2+6]
BASE + BALL = GAMES
3. Discuss the hill climbing search algorithm along with problem associated with it and discuss their solutions. Why simulated annealing is important? [6+2]
4. Given premises “Every American who sells weapons to hostile nations is a criminal. The country XYZ is enemy of America. All of its misallies in XYZ were sold by Donald, who is an American.” Prove that Donald is a criminal by using FOPL based resolution refutation method. [8]
5. Why CNF is required? Explain all the steps used to convert a quantified statement with suitable example. [2+6]
6. Why semantic network and frames are important in AI? Provide examples of both with FOPL statements example. [2+6]
7. What is a genetic algorithm? Explain all steps in genetic algorithm with block diagram and operators. [8]
8. List the importance of expert system in real life. Draw block diagram of expert system architecture and explain all blocks. [2+6]
9. What is a McCulloch/Pitts neural network? Explain it with reference to AND gate. Justify that it cannot be applied to Exclusive OR gate. [8]
10. Justify that NLP is one of the important part of an AI. Explain the steps involved in the NLP. [8]
