Tribhuvan University

Institute of Science and Technology

2067

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Bachelor Level/ Second Year/ Forth Semester/ Science — Full Marks: 60
Computer Science and Information Technology (CSc.255) — Pass Marks: 24
(Introduction to Cognitive Science) — Time: 3 hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

1. Why cognitive science is important in the computer science? Compare it with philosophy and explain it with suitable examples.
2. Define and explain artificial intelligence. Act rationally is an important part of artificial intelligence, justify it with suitable example.
3. The object based system can represent knowledge, explain it with practical examples.
4. Explain the algorithm of breadth first search with suitable example. How can you modify it, explain.

OR

What do you mean by A* search? Explain it with an algorithm and suitable example.

5. Why Turing machine is required? Design a Turing machine with finite west of states as q_0, q_1 and q_2, alphabets are "a" and "b", initial state is q_0 and assume 5 suitable examples.
6. List down the all Chomsky hierarchies. Explain in detail about type 0 with practical examples.
7. Explain the mathematical model of neural network system with suitable example. Also explain the importance of neural networks.
8. Explain the perceptron with suitable practical example and algorithm.
9. Explain penrose approach in the cognitive science. What is its relation with Descartes, explain with suitable example.
10. Why lexicon and morphology are required in natural language processing, explain suitable example?

OR

What are the parameters of language processing? Explain in detail about syntax with suitable example.

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Attempt all the questions.

1. Compare cognitive science with sociology and explain it with examples. Differentiate between linguistics of artificial intelligence?
2. Differentiate between think humanly and act humanly with suitable examples. What are the applications of artificial intelligence?
3. What do you mean by first order predicate logic? Explain it with practical example.
4. Differentiate between depth first search and breadth first search with example.

OR

Differentiate between hill-climbing search and A* search with example.

5. Design a Turing machine with finite set of states as q_0 and q_1, alphabets are 'a', 'b', and 'c', initial state is q_0 and assumes 5 suitable transitions. What are the practical applications of Turing machine?
6. Differentiate between types I and type II Chomsky hierarchies with examples. Explain the role of Chomsky hierarchy in the computation?
7. Explain the biological neuron. Explain the mathematical model of neural network system with suitable example.
8. Explain the back propagation practical example and algorithm.
9. Explain Searle approach in the cognitive science. What is its relation with Descartes, explain with example.
10. How can you generate parse tree in the natural language processing? Explain it with example.

OR

Differentiate between syntax and semantics in the natural language processing. How can you modify it with pragmatic approach?

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Candidates are required to give their answers in their own words as far as practicable.
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Attempt all the questions.

1. Define cognitive science with two examples. Compare it with psychology and explain with suitable example.
2. Explain briefly the background of artificial intelligence. The rational thinking is important in artificial intelligence, justify it with suitable example.
3. Knowledge can be represented with if then rules, explain it with two practical examples.
4. The searching can be represented using tree. Explain the algorithm of depth first search with suitable example.

   OR

   Hill-climbing search is a heuristic search, justify it along with algorithm and practical example.
5. What do you understand by Turing machine? Design a Turing machine with finite set of states as q_0 and q_1, alphabets are 'a' and 'b', initial state is q_0 and assume 6 suitable transitions.
6. Explain the basic model for computation with suitable practical example.
7. What are the importance of neural network? Explain the mathematical model of neural network system with suitable example.
8. What do you mean by Hebbian Learning? Explain it with suitable practical example and algorithm.
9. Explain Gelernter approach in the cognitive science. What is its relation with Descartes, explain with suitable example.
10. Differentiate between natural language understanding and generating with suitable example.

    OR

    List the parameters of natural language processing. Explain in detail about auditory inputs with suitable example.

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Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

1. Explain the cognitive science and its applications.
2. Explain the artificial intelligence task domains with example.
3. Explain the steps involved in building a system to solve an artificial intelligence problem.
4. What do you mean by AO* algorithm? Explain with example.

   OR

   Differentiate between procedural and declarative knowledge.
5. Explain with block diagram of the components of a typical expert system
6. Differentiate between depth-first and breadth first search with example.
7. Explain the Turing machine with suitable example.
8. Mention the types of all Chomsky hierarchies and explain two of them with practical example.
9. Define the terms:
   a) Gelernter
   b) Pinker
10. Explain the parameters of natural language processing with its syntax and suitable example.

    OR

    Mention the steps of natural language processing and explain them in briefly.

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(Introduction to Cognitive Science) — Time: 3 hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

1. Define the cognitive science and its applications in computer science. Compare cognitive science with other science.
2. Explain the architecture of an expert system and its applicability in different areas.
3. Explain the various approaches and issues in knowledge representation and also explain the various problems in representing knowledge.
4. Differentiate between procedural and declaration knowledge with an example.

OR

Explain A* search algorithm with example.

5. Explain the breadth first search technique with example and also explain the benefits of it.
6. Derive the mathematical model of neural network system with example and also explain about its importance.
7. What are the steps in natural language processing? List and explain them briefly.
8. Explain the Chomsky Hierarchy with example.
9. Explain the pinker approach in the cognitive science. What is its relation with Descartes? Explain.
10. Why lexicon and morphology are needed in natural language processing? Explain with example.

OR

Explain the parameter of natural language processing with its syntax and example.

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Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

1. What is cognitive science? Differentiate between cognitive science and other science.
2. Explain and state the characteristics of AI problem and also explain the first characteristic with suitable example.
3. Explain the A^* algorithm with example.
4. Explain with example of depth first search. What are the benefits of using depth first search?

   OR

   Explain with example of Breadth first search and its benefits.
5. Explain briefly the key difference between procedural and declaration knowledge.
6. Explain the various approaches and issues in knowledge representation with example.
7. Explain the AO^* algorithm and its application.
8. Explain with suitable example how Turing machine works?
9. Define the terms:
   a) Pinker
   b) Searle
10. List down the steps in natural language processing and explain them briefly.

    OR

    What are the parameters of natural language processing? Explain syntax with suitable example.

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Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

1. How can you define connectionist computational cognitive science model? How far theories and principles of psychology are interrelated to the cognitive science theories? (3+3)

2. How Descartes justified mind-body problem with his popular wax argument? What was the response of Turing to his demonstration? (6)

3. How important computation is in cognitive science? What components a Physical Symbol System (PSS) consists of? Construct a PSS for Arithmetic Computation.
4. Define elements of a computing model. Why Turing machines are considered as a useful model to the real computers? (2.5+3.5)
5. How Artificial Neural Networks can exploit the self-Organization capability? Construct a multilayer recurrent neural network with at least six neuron nodes. Allocate the required input, weights and activation function with your own assumption. Finally, compute the mathematical expression for final output of the network.

6. How morphological analysis is done? In language understanding models, how ambiguities in languages can be addressed by pragmatic analysis? (2.5+3.5)
7. What do you mean by Qualia? How Gelernter uses this term to define consciousness? What was his response to mind-body problem? (2+2+2)
8. Why learning is important in Neural Network? How Hebbian Learning can be used to train Neural Networks? Illustrate with an example? (1+5)
9. How hill climbing search works in a state space? How can you say that hill climbing search is not complete? Support your answer with an example. Configure the required state space and assign the heuristic with your own assumptions. (6)
10. What do you mean by inferential adequacy property of knowledge representation system? How resolution can be used to infer conclusions in predicate logic? Mention the steps with an example. (1+5)