# 2017

# COMPUTER AND INFORMATION SCIENCE

## Paper – CISM – 401

## (Artificial Intelligence)

## (Elective – I)

## Full Marks – 70

*The figures in the margin indicate full marks*

*Candidates are required to give their answers in their own words as far as practicable*

Answer ***any five*** questions

1. *(a)* Write a prolog program to solve the following problem. Your clauses should be explained clearly.

The relation **nodoubles (L1, L2)** takes two lists of symbols as argument. When a symbol S appears more than once in L1, only the first occurrence of S in L1 is preserved in L2 and subsequent occurrences are eliminated? For example, if

L1 = [b, c, de, c, f, b, a, de, b]

then L2 = [b, c, de, f, a]

*(b)* A game tree is an AND/OR tree. Why? 10+4

2. *(a)* What are common uses of 'cut' in prolog? Explain each with an example.

*(b)* What do you mean by a production system? Discuss.

*(c)* Give the characteristics of an expert system. 6+5+3

3. A heuristic function h is said to be consistent (monotone) if for every pair of nodes 'm' and 'n' in the search graph,

h(m) – h(n) <= c(m,n) where

(i) n is a descendant of m;

(ii) c(m,n) is the cost of the cheapest path between m and n;

(iii) c(m,n) is taken to be infinity if no path exists between m and n.

Validate each of the following statements giving brief explanation.

*(a)* Manhattan heuristic function for 8-puzzle problem is consistent.

*(b)* If heuristic is consistent then the heuristic is admissible but the reverse is not true.

*(c)* The f_values of the sequence of nodes expanded by A* is non-decreasing if heuristic function is consistent. 5+5+4

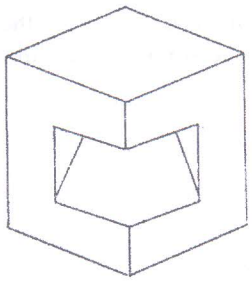
4. *(a)* For a given state-space search graph, construct a set of nodes(states) such that at every instant algorithm A* will always choose a node for expansion from your constructed set. Justify your claim with a supporting proof.

*(b)* A rule-based expert system produces an inference net(chain). Explain the concept of these chains with an example of your choice, if necessary. Also highlight when to use what type of chain. (4+5)+5

5. *(a)* Confused n-queens problem seeks to place n queens in an $n \times n$ chess board such that every pair of queen attacks each other. Formulate this problem as a Constrained satisfaction problem. Give an expression for the number of solutions of confused n-queens problem.

*(b)* Explain Waltzs' algorithm to detect whether a given line drawing of a three faced polyhedral object which is free from cracks and shadows is valid or not. Take a line drawing of your choice. 7+7

6. Suppose you are supplied with a line drawing of a polyhedral object which is free from cracks and shadows. If the line drawing cannot be labeled (using Waltz's algorithm) with only from the set of 18 legal junctions, then what will be your conclusion about the given line drawing? Using this algorithm, label the lines of the following line drawing of a polyhedral object. Show the steps.



Does the algorithm give unique solution? If not, why? 14

7. *(a)* Consider the following English sentences : 7+7

(i) Everyone who loves all animals is loved by someone

(ii) Anyone who kills an animal is loved by no one

(iii) Jack loves all animals

(iv) Either Jack or Curiosity killed the cat, who is named as Tuna

From these given sentences, find that the statement "Curiosity kill the cat" is true or false using resolution.

*(b)* Explain $\alpha - \beta$ pruning algorithm to select the move that is to be played by the first player in a 2-person perfect information game of your choice.