Birla Institute of Technology & Science, Pilani
Work-Integrated Learning Programmes Division
Second Semester 2018-19
Mid Semester Examination(Make-up)

Course No.	: DSECL ZG557
Course Title	: Artificial & Computational Intelligence
Nature of Exam	: Open Book
Weightage	: 40%
Duration	: 2.5 Hours
Date of Exam	: 17 / 11 / 2019, AN

No. of Pages = 3
No. of Questions = 4

Time of Exam: 2:00 PM to 4:30 PM

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered only in the page ranges mentioned against each question
3. *Assumptions made if any, should be stated clearly at the beginning of your answer.*

Answer all the questions

Question -1 [3 + 3 + 3 +2 =11 M] **[Page 03 - 07]**

(a) Construct an admissible heuristic that is not consistent. Explain
(b) Explain why more informed heuristics develop the same or less of the search space. Explain
(c) Provide a state space in which iterative deepening search performs much worse than depth-first search (for example, $O(n^2)$ vs. $O(n)$). Explain
(d) Is it true that h(n) = 0 is an admissible heuristic for the 8-puzzle problem. Why?

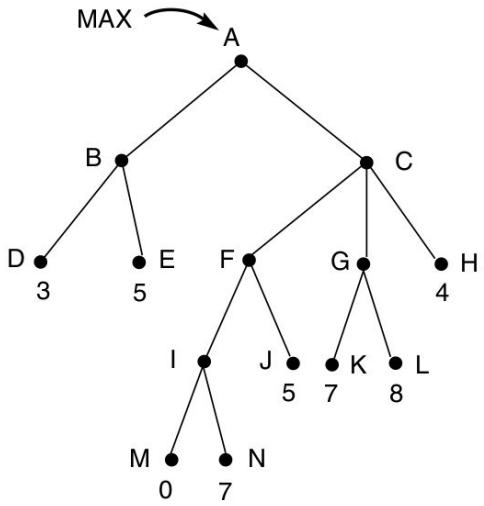
Question -2 [7+3 = 10 M] **[Page 08 - 15]**

(a) Consider an agent is tasked with a scheduling problem, where there are five activities to be scheduled in four time slots. We represent the activities by the variables A, B, C, D, and E, and the domain of each variable is { 1, 2, 3, 4 }. The domain indicate the time slot by when an activity can be scheduled. The constraints on the schedule are as below:

```
A > D
D > E
C  = A
C > E
C  = D
B ≥ A
B  = C
C  = D + 1
```

Explain with all the steps how do you use arc consistency to solve this problem. Provide pictorial description for all the steps.

(b) Consider the following game tree:



Demonstrate with the move that A makes using alpha-beta pruning algorithm.

Question -3 [5+5 = 10 M] **[Page 16 - 22]**

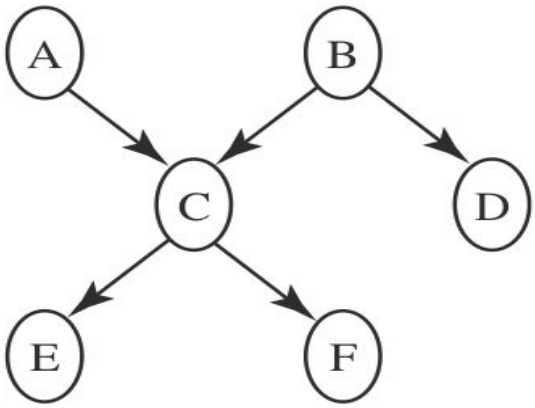
Read the following:

All human relations are utilitarian. Human relations are utilitarian only when people in those relations are selfish and calculative. I am a human. People are humans. Unselfish people are nice. I am nice.

(a) Formulate using FOL the factual statements in the description above. Use appropriate quantifiers that precisely express the statements. For names of predicates, use words from the description above only. Assume that human relations are binary.
(b) Either show a contradiction in them or prove that they are consistent.

Question -4 [4+5 = 09 M] **[Page 23 - 27]**

Consider the following belief network



with Boolean variables (we write *A = true* as a and *A = false* as ¬a) and the following conditional probabilities:

$$
\begin{aligned}
P(a) &= 0.9 \\
P(b) &= 0.2 \\
P(c|a,b) &= 0.1 \\
P(c|a,\neg b) &= 0.8 \\
P(c|\neg a,b) &= 0.7 \\
P(c|\neg a,\neg b) &= 0.4
\end{aligned}
\qquad
\begin{aligned}
P(d|b) &= 0.1 \\
P(d|\neg b) &= 0.8 \\
P(e|c) &= 0.7 \\
P(e|\neg c) &= 0.2 \\
P(f|c) &= 0.2 \\
P(f|\neg c) &= 0.9
\end{aligned}
$$

(a) Explain how do you compute P(e) using Enumeration.

(b) Explain how do you compute P(e) using Variable Elimination (VE). How do you explain the performance improvements achieved using VE over Enumeration