End Semester Examination

Monsoon Semester 2020

(M.Sc Computer Science IIIrd Semester)

Artificial Intelligence

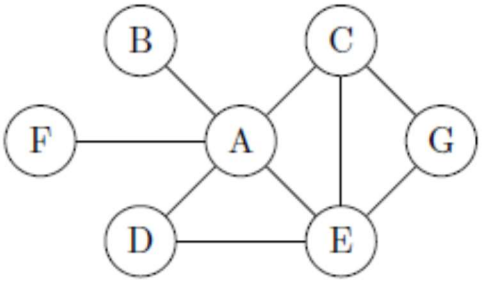
Time: 2 hrs **Max Marks: 40**

Note: All the questions are compulsory. Write the answers neatly on white sheets or note book pages. Mention your name and roll number on each page. Click the photo of all the pages and create a single pdf file and upload on the google classroom.

Question 1: Differentiate between informed and uninformed search methods. List the uninformed search methods and discuss their optimality.

[3+7=10 Marks]

Question 2: Consider solving the following CSP with backtracking search where we enforce consistency of all arcs before every value assignment. For each of the variable orderings below specify at which variables backtracking might occur. Recall that backtracking occurs at a variable X when after a value from the filtered domain of X has been assigned to the variable X the recursion returns to X without a solution and the next value from the filtered domain of X gets assigned. If enforcing arc consistency results in any empty domains then the ensuing value assignment doesn't happen and the algorithm backtracks.



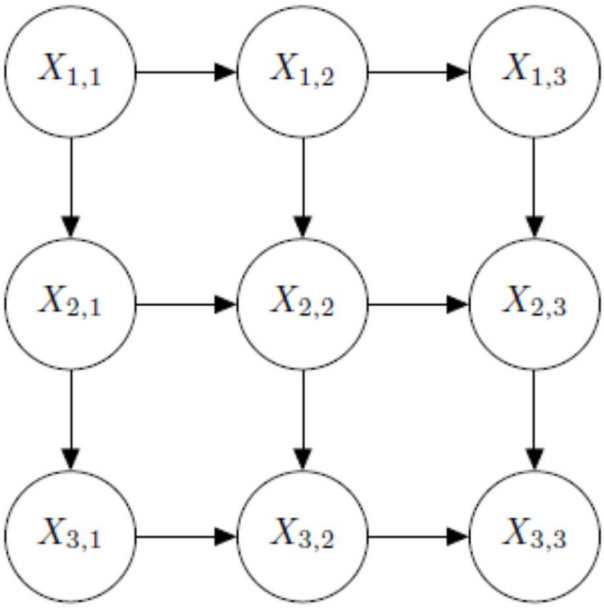
Answer the following:

(i) On which variables algorithm might backtrack for ordering A, B, C, D, E, F, G

(ii) On which variables algorithm might backtrack for ordering G, A, B, C, D, E, F

[3+3=6 Marks]

Question 3: Given the following Bayesian network

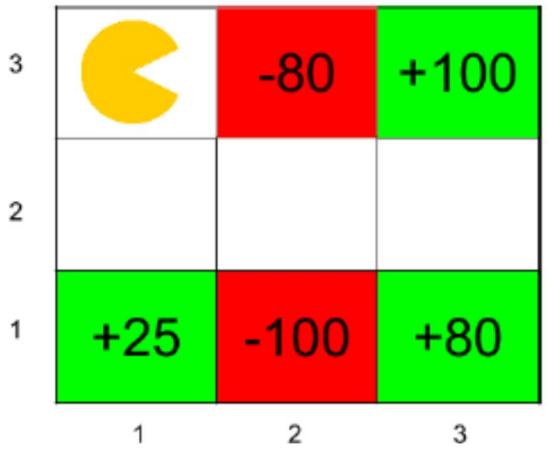


(i) Which random variables are independent of $X_{3,1}$ given $X_{1,1}$?

(ii) Which random variables are independent of $X_{3,1}$ given $X_{1,1}$ and $X_{3,3}$?

[2.5+2.5=5 Marks]

Question 4: Consider the grid-world given below and Pacman who is trying to learn the optimal policy. If an action results in landing into one of the shaded states the corresponding reward is awarded during that transition. All shaded states are terminal states, i.e., the MDP terminates once arrived in a shaded state. The other states have the North, East, South, West actions available, which deterministically move Pacman to the corresponding neighboring state (or have Pacman stay in place if the action tries to move out of the grad). Assume the discount factor $\gamma = 0.5$, for all calculations. Pacman starts in state (1, 3).



(i) What is the value of the optimal value function V* at the following states: V*(3, 2); V*(2, 2) and V*(1, 3).

(ii) The agent starts from the top left corner and you are given the following episodes from runs of the agent through this grid-world. Each line in an Episode is a tuple containing (s, a, s`, r)

Episode 1	Episode 2	Episode 3
(1,3), S, (1,2), 0	(1,3), S, (1,2), 0	(1,3), S, (1,2), 0
(1,2), E, (2,2), 0	(1,2), E, (2,2), 0	(1,2), E, (2,2), 0
(2,2), S, (2,1), -100	(2,2), E, (3,2), 0	(2,2), E, (3,2), 0
	(3,2), N, (3,3), +100	(3,2), S, (3,1), +80

Using Q-Learning updates with learning rate α = 0.5, what are the following Q-values after the above three episodes:

Q((3, 2), N); Q((1, 2), S) and Q((2, 2), E).

[4.5+4.5 = 9 Marks]

Question 5: Write the steps to convert any propositional logic form into CNF.

[4 Marks]

Question 6: Explain the process of substitution and unification in first order logic with examples.

[6 Marks]