City University

Faculty of Science & Engineering

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination Semester: Spring 2018

Course Code: CSE 417 Course Title: Artificial Intelligence

Total Marks: 40 Duration: 2 hours

Answer any 4(four) questions ***4 X 10 =40***

1(a) Convert the following expression into clausal form. *5*

$\exists x\ \forall y\ (\forall z\ P(f(x),y,z) \rightarrow (\exists u\ Q(x,u)\ \&\ \exists v\ R(y,v)))$

(b) Show that- *5*

i) $P \leftrightarrow Q$ is equivalent to $(P \rightarrow Q) \wedge (Q \rightarrow P)$.

ii) ii) $\neg\ (Q \rightarrow P)\ \underline{\vee}\ (P \wedge Q)$ is equivalent to Q.

2(a) Given the grammar and lexicon below

S → NP VP	Det → The
NP → N 6 =	N→rain
NP → DT N	N → rains
VP → V ADVP	ADVP → down
ADVP → ADV	V→rain
	V → rains

i) Show one possible top-down parsing for the following sentence using above grammar and lexicon. *3*

The rain rains down

ii) Draw a Syntactic Tree representing one parse of the above sentence. *3*

(b) Translate the following sentences in English to sentences in first order predicate logic *4*

i. All purple mushrooms are poisonous.

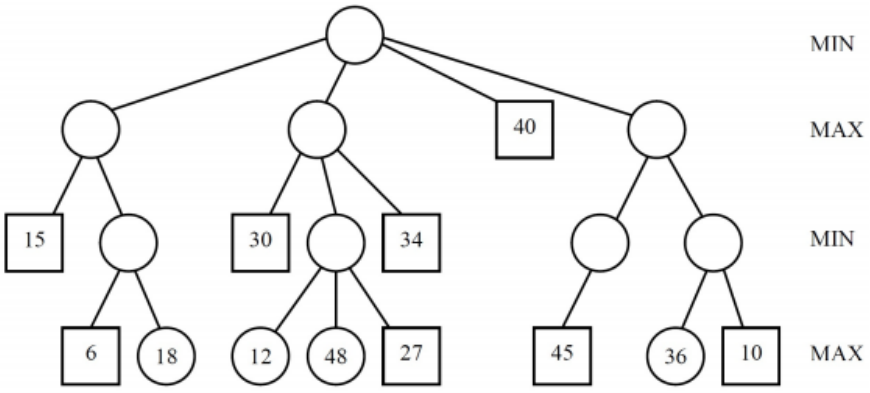
ii. No student loves Bill..

iii. There is a student who is loved by every other student

iv. Every gardener likes the sun..

3(a) First Order Predicate Logic has two quantifiers- Universal and Existential. Explain these terms with suitable examples. *2*

(b) Consider the following tree

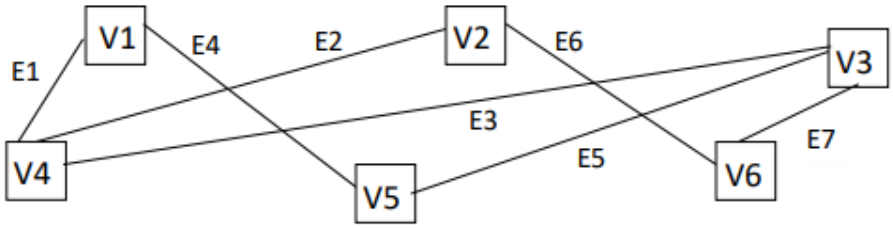


i) Evaluate and fill the heuristic values for all the empty states in the game tree above.Assume that the minimax algorithm is being used, according to the labels on the right. *2*

ii) On the same diagram above, indicate which states will not be explored if alpha-betapruning is used. Show your work by showing the alpha and beta valuesassociated with each node(you can redraw the tree below if necessary). *4*

(c) Prove that $\neg(p \wedge q) \wedge \neg(\neg p \vee \neg q)$ is unsatisfiable. *2*

4(a) Consider the following graph with 6 square-shaped vertices and 7 undirected edges. In this problem, you can color each vertices using one color from the following set of 3 colors, { Red, Green, Blue }. No two adjacent variable has the same color.



i) You are asked to solve this graph-coloring problem as constraint satisfaction problem. Assign values for each variable. *3*

ii) Assume that you have not assigned any variables yet. List all variables that might be selected by the Degree Heuristic *2*

iii) Consider the assignment below. V2 is assigned R. Cross out all the values that would be eliminated by forward checking: *2*

V1	V2	V3	V4	V5	V6	V7
RGB	R	RGB	RGB	RGB	RGB	RGB

(b) Let's consider the Sudoku puzzle as pictured below. The objective of the game is just to fill a 9 x 9 grid with numerical digits so that each column, each row, and each of the nine 3 x 3 sub-grids (also called boxes) contains one of all of the digits 1 through 9. *3*

Sudoku Puzzle

	9	3	6	2	8	1	4	
	6						5	
	3			1			9	
	5		8		2		7	
	4			7			6	
	8						3	
	1	7	5	9	3	4	2	

Sudoku Solution

2	7	1	9	5	4	6	8	3
5	9	3	6	2	8	1	4	7
4	6	8	1	3	7	2	5	9
7	3	6	4	1	5	8	9	2
1	5	9	8	6	2	3	7	4
8	4	2	3	7	9	5	6	1
9	8	5	2	4	1	7	3	6
6	1	7	5	9	3	4	2	8
3	2	4	7	8	6	9	1	5

Can this be represented as a constraints satisfaction problem? How?

5(a) Consider the following binary constraint network: There are 4 variables: X1, X2, X3, X4, with domains: D1 = {1, 3, 4}, D2 = {3, 8, 9}, D3 = {2, 3, 5}, D4 = {3, 5, 9}. *4*
The three binary constraints are: (X1 ≥ X2), (X2 > X3 or X3 − X2 = 2), (X3 ≠ X4).
Does the CSP have a solution? If yes, give a solution. (You don't have to explain how you found the solution; just provide an assignment that satisfies all the constraints).

(b) In dealing with natural language, a computer system needs to be able to process and manipulate language at a number of levels. Now mention the name of the levels. Why we need pragmatic analysis in natural language processing? Explain with proper example. *4*

(c) *2*

B A S E
B A L L
=G A M E S

Solve the above crypt arithmetic problem by assigning value for each letter.