6. (a) Why do we require 'unification'?
Find the *mgu* of the following:
{ Q(h(x,y), w), Q(h(g(v), a), f(v)), Q(h(g(v)), f(b)) } 2+4

(b) Convert the following *wff* into clause form. 6
$\forall x[B(x) \rightarrow (\exists y [Q(x,y) \wedge \sim P(y)] \wedge \sim\exists y [Q(x,y) \wedge Q(y,x)] \wedge \forall y [\sim B(y) \rightarrow \sim E(x,y)])]$

(c) Consider the following facts:
Jack, Jill and Bill are members of the City Club.
Every member of the City Club is either footballer or cricketer or both.
No cricketer likes rain.
All footballers like cloud.
Bill dislikes whatever Jill likes and likes whatever Jill dislikes.
Jill likes rain and cloud.
Use resolution to answer:
Can there be anyone who is a member of the City Club who is footballer but not cricketer? 8

(a) Why do we require 'unification'?
Find the *mgu* of the following: {P(x,z,y), P(w,u,w), P(A,u,u)}.

(a) Give the clausal form for the following: $\exists x \exists y\ (p(x,y) \wedge q(x,y))$

(b) Given the premises $\forall x.(p(x) \Rightarrow q(x))$ and $\forall x.(q(x) \Rightarrow r(x))$, use Resolution to prove the conclusion $\forall x.(p(x) \Rightarrow r(x))$.

(c) Find out the resolvents for the following pair of clauses: {P(z,b), Q(z)} and {~P(a,z), R(z)} 3

5.~~(a)~~ Why do we require 'unification'?

(b) Find the *mgu* of the following:
{ Q(h(x,y), w), Q(h(g(v), a), f(v)), Q(h(g(v)), f(b)) }

(c) Convert the following *wff* into clause form.
$\forall x\ (f(x) \Rightarrow \exists y\ (m(x,y))) \wedge \forall x \forall z\ ((a(x,z) \vee b(x,z)) \wedge c(z,3))$

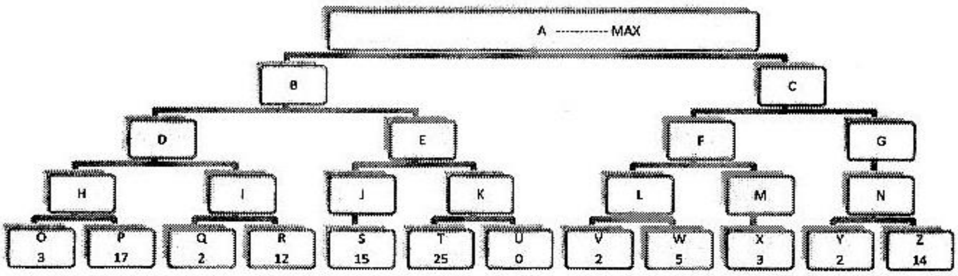
(d) What is Skolemization? Eliminate Existential quantifier from the following WFF:

$\forall x\ [\exists y\ \ Animal(y) \wedge \neg Loves(x,y)] \vee [\exists z\ \ Loves(z,x)]$

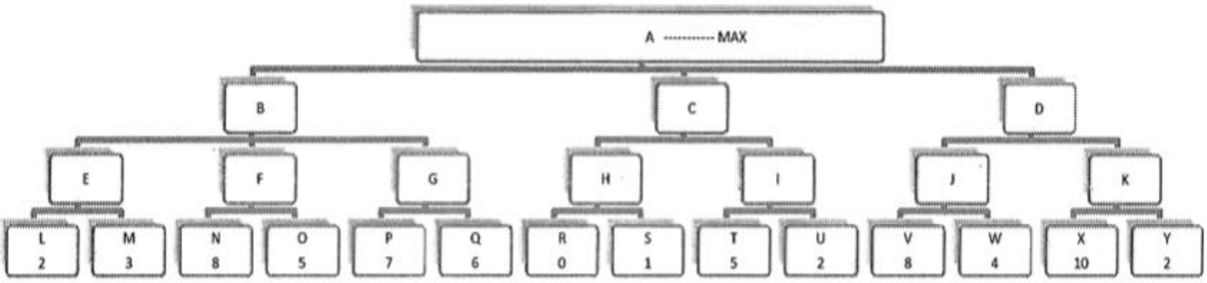
(a) Find the *mgu* of the following: {P(y, y, B), P(z, x ,z)}
(b) Convert the following *wff* into clause form.

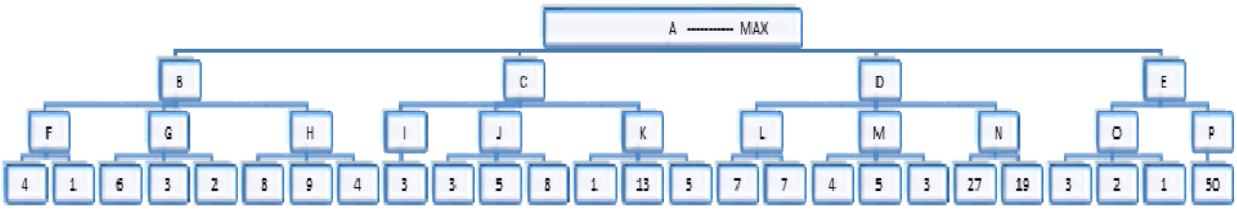
$(\forall x)\ \{P(x) \rightarrow \{(\forall y)\ [P(y) \rightarrow P(f(x,y))\ ] \wedge \sim (\forall y)\ [Q(x,y) \rightarrow P(y)]\}\}.$

(d) Compare the efficiency of α-β pruning algorithm over MINIMAX with respect to time, space and correctness in obtaining a solution. 4



(e) Discuss with example - "AND-OR graph is applicable for solving real life problems." 5





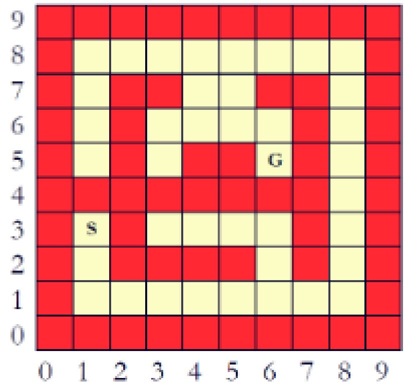
(a) A milkman carries a full 12-litre container. He needs to deliver exactly 6 litre to a customer who only has an 8-liter and a 5-litre containers.

Solve this milk-jug problem using formal search procedure (mention the start state, goal state, operators etc.)

Draw the search tree and find the shortest path to the goal state.

What is the cost of optimal solution? 10

(e) Model "Old Man" using suitable membership function. Then graphically represent "Not very Old". 5



In this problem, an agent is trying to traverse a maze from the starting point **S** to the goal point **G**. In each step, the agent can move in one of the four compass directions; each move costs 1 unit. The agent always considers alternative moves in the following order:

1. Move North
2. Move East
3. Move South
4. Move West

Apply **A*** search algorithm to solve this problem. Number the squares in the order the agents visits the squares, starting with 0 at the starting point. You do not need to re-expand nodes already visited; this means that you can "jump" from the current node to the next node in the queue.

Calculate the path cost on the basis of one cost unit per move. The heuristics to use is the function of the difference between the horizontal position of the current node and the goal node, plus the difference in the vertical position of the current node [xn,yn] and the goal node [xg,yg] and it is: h([x,y]) = (|xg - xn|) + w(|yg - yn|) (where, w is a real number and is equal to your Roll number /100 [the symbol "/" represents division])

For this problem,

- Mark the sequence in which the nodes are visited in the maze.
- Draw the corresponding search tree.
- Fill in the table with the information about the search trace. (initial one is S, and you may need to insert the rows into the table)

Current Node	Path Cost	Heuristic	f-cost	Queue
S				

(a) Consider the maze shown in Fig. 1. S is the initial state at location (3,2) and G is the goal state at location (5,2). Shaded squares are blocked cells. **Consider that the same state will be visited only once. The next state is expanded in the following fixed order: North, West, South, East.**

[Turn over

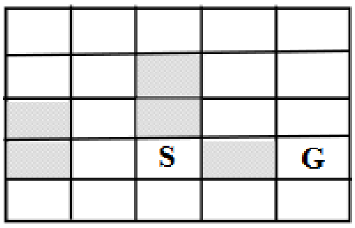


FIG. 1

i) Draw the search tree using BFS. Represent each node using its (x,y) coordinates. Number the nodes in the order visited by BFS. 4

ii) Find out the order of nodes searched using ID and IB. 3+3

iii) Now assume that each move has an associated cost--- North has cost 2 and all other moves have cost 1. What is the order in which nodes are visited using UCS? 4

(b) Write briefly on IDA* search process highlighting its concept, advantages and limitations. 6