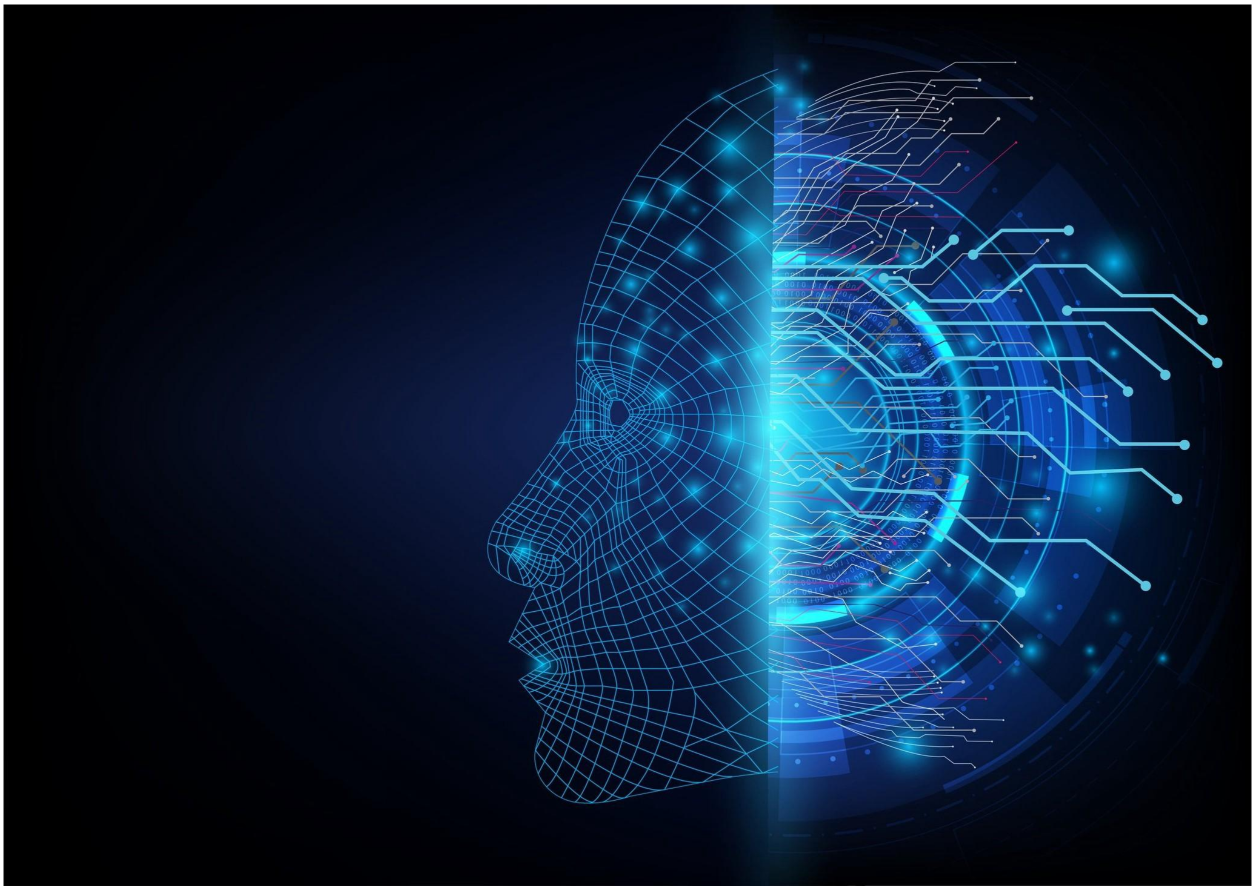
Question 2

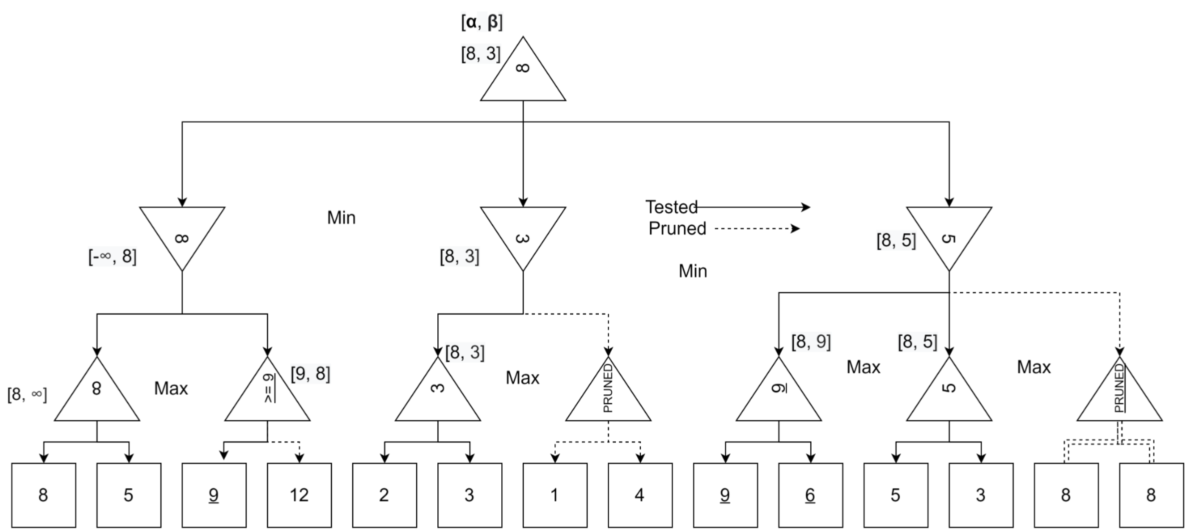
Candidate Number: 59069

Artificial Intelligence - CS3AI18



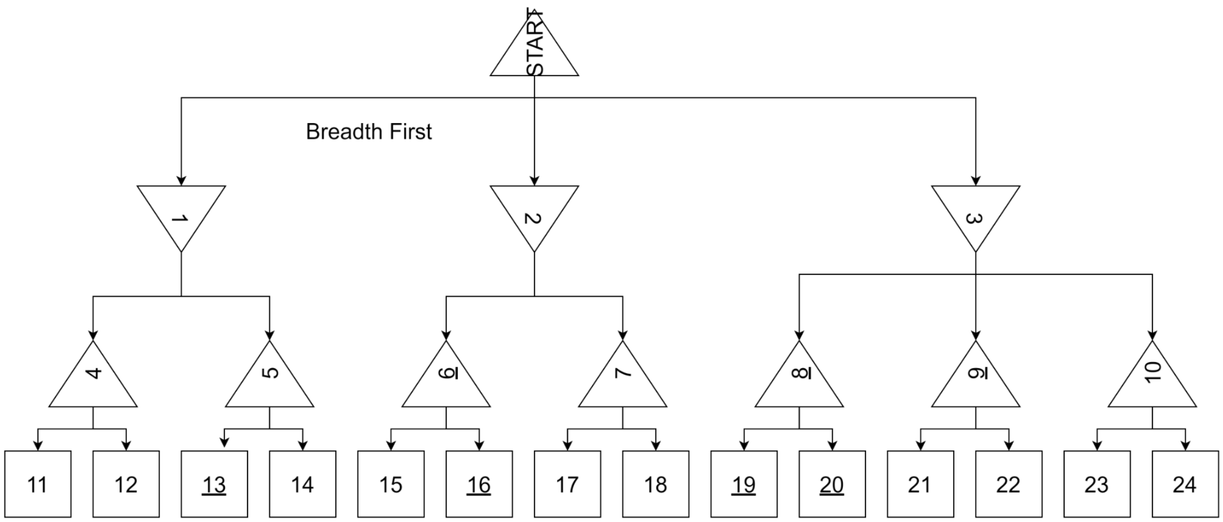
2. Answer Question 2(a) and 2(b) by annotating copies of Figure Q2-1 on your answer sheet.

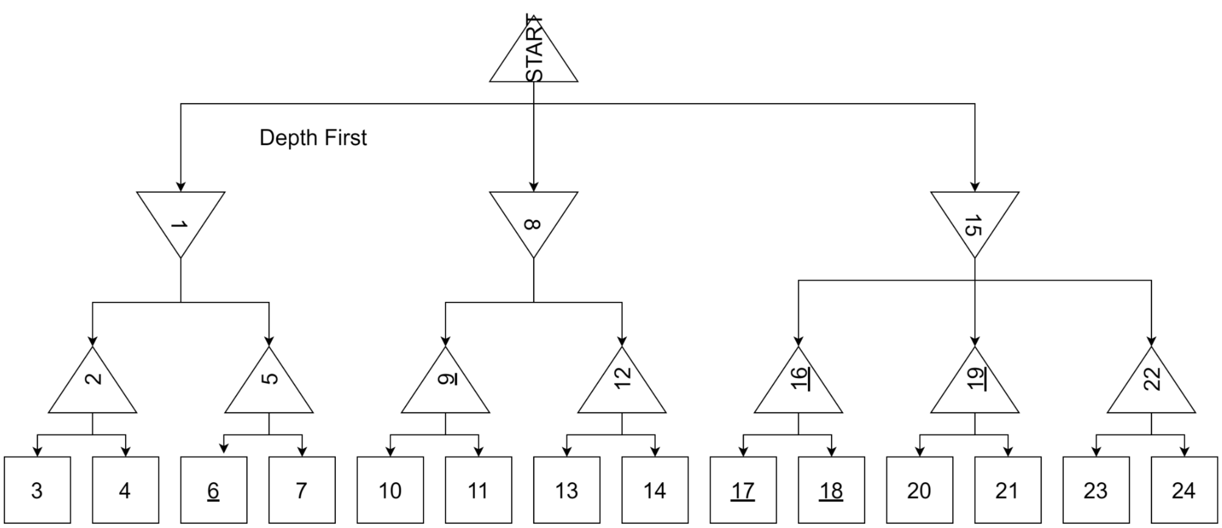
(a) Alpha-beta pruning improves search speed by pruning branches of a Minmax game tree. Show which branches the alpha-beta pruning algorithm will prune in the following game tree. Write next to Min player nodes (indicated as Downward triangle) and Max player nodes (indicated as Upward triangle) the value that nodes will play.



(b) Show the sequence of nodes (number the nodes of Figure Q2-1) visited by a breadth-first search and a depth-first search algorithms.
(5 marks)

Assume start node == node 0





2C:

(c) Find an optimal path between S and T using the A* algorithm from the city distance graph shown in Figure Q2-2. List the calculated values for each node of the optimal path. Justify your answer by citing a non-optimal path. In Figure Q2-2, S is the start state and T is the goal state; each node has a city name (S, A, B, C, D, T) and its respective heuristic value, and links show the distance from one city node to another. What admissible heuristic would you use for the problem in Figure Q2-2?

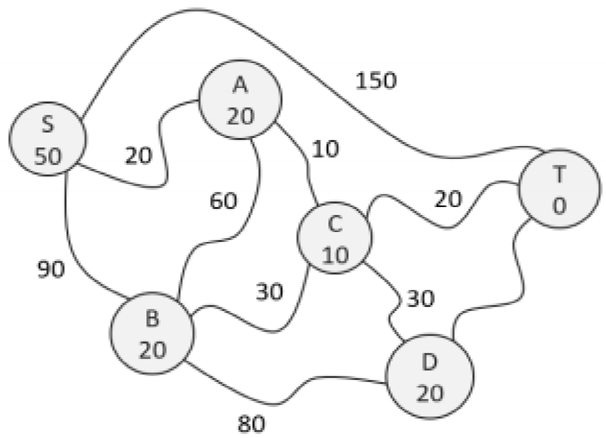


Figure Q2-2: City distance graph (8 marks)

Respective heuristic value is used as H

Start At **S**

S → A = 20 + H(20) = 40

S → B = 90 + H(20) = 110

S → T = 150 =H(0) = 150

(S→)A → B = 20 + 60 + H(20) = 100

(S →)A → C = 20 + 10 + H(10) = 40

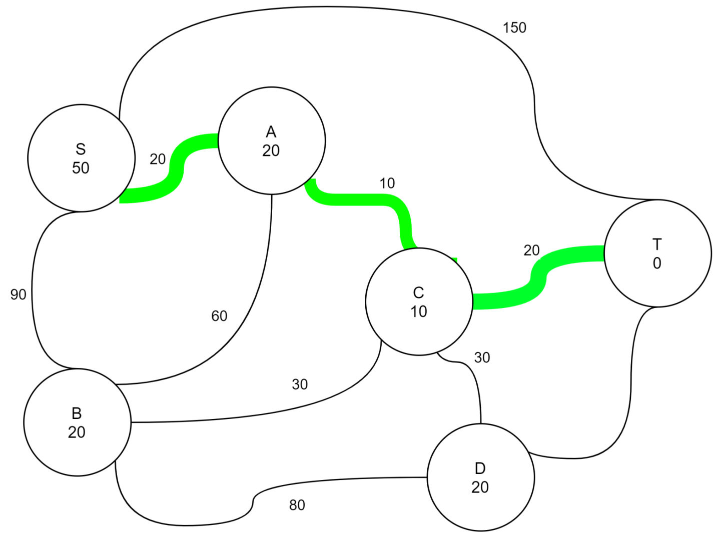
(S → A →) C → B = 20 + 10 + 30 + H(20) = 80

(S → A →)C → D = 20 + 10 + 30 + H(20) = 80

(S → A →) C → T = 20 + 10 + 20 +H(0) = 50

Shortest path from S → T

S → A → C → T = 50



A non-optimal solution would be directly from **S** → **T** with a length of **150**.

An admissible heuristic is one that never overestimates the cost of reaching the goal. The heuristic used for this appears to be directly related to the distance from T.

It is most likely $h(n) = \sqrt{(n_x - T_x)^2 + (n_y - T_y)^2}$ representing a straight line to the point. This is a very good heuristic to use for this problem.