2. What is the definition of "rationality"? What is the formal definition of a "rational agent"?
[4 points - 2 points for each question]

Rationality means doing the right thing. Formally, For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has (see Lecture 1 pg 28).

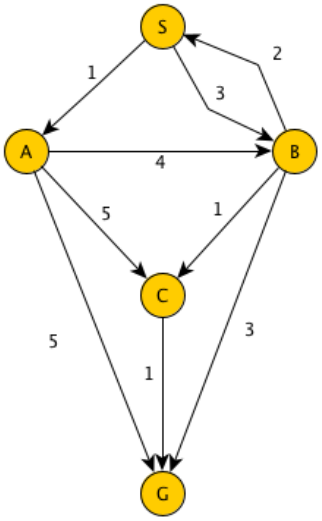
3 Fill out the space and time complexity of the following search algorithms (pick the most accurate choice). Assume that **m** is the depth of the tree, **s** is the depth of the shallowest goal state in the search tree, and **b** is the branching factor.
[6 points, equally distributed between 8 choices]

Algorithm	Space Complexity	Time complexity
Backtracking	O(bm)	O(b^m)
Dfs	O(bm)	O(b^m)
BFS	O(b^s)	O(b^s)
IDFS	O(bs)	O(b^s)

4 What is the definition of alpha in the alpha-beta pruning algorithm? What is the initialization value for the alpha?
[4 points - 2 points for each question]

α: MAX’s best option on path to root
α is initialized to -∞

5. On the following graph, assuming that 'S' is the starting node and 'G' is the goal node, write down the path from 'S' to 'G' and the ordered list of explored nodes for each of the following algorithms. Please note that you may use algorithm-specific assumptions about the graph (i.e., constant costs, etc.). Break any ties in alphabetical ordering. [10 points]



Paths:
[1 point each]
DFS = S -A-B-C-G
BFS = S-A-G
UCS = S-B-C-G

Ordered List of Explored Nodes:
[1 point each]
DFS = S - A - B - C - G
BFS = S - A - B - C - G
UCS = S - A - B - C - G

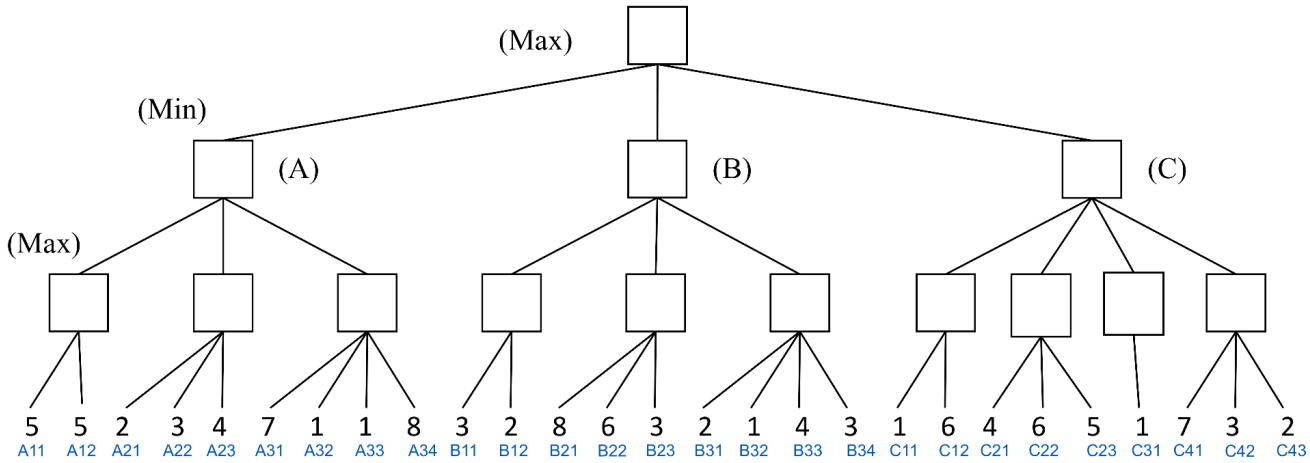
Come up with an admissible heuristic function for the given graph above.
[2.5 points for any admissible heuristic]
h(S) = 4 <= h*(S) = 5
h(A) = 4 <= h*(A) = 5
h(B) = 1 <= h*(B) = 2
h(C) = 1 <= h*(C) = 1
h(G) = 0 <= h*(G) = 0

What is the path that the A* algorithm finds given the heuristic function you provided?
[1.5 points]
Path = S - B- C - G

6 Supposed h_1 and h_2 are admissible heuristics. Suppose we are using A*-search. Why is it a good idea to use $\max(h_1,h_2)$ rather than either h_1 or h_2 alone as the heuristic evaluation function? Please explain your answer. Consider the optimality and efficiency of the search. [3 points]

Since both are admissible then we know for all nodes n, h(n) <= h*(n). If we take the max we are more likely to estimate a value h(n) closer to h*(n) the true value. This will increase the efficiency of our search and improve optimality, although optimality is not guaranteed unless the function is consistent.

7 The game tree below illustrates a position reached in a game. Process the tree left-to-right. Right now, it's Max's turn to move. At each leaf node, the estimated score by the heuristic evaluator is stated.



What are the values of each of the nodes A, B, and C? [0.11 point each]
A=4, B=3, C=1

What is the max's best move at the root? (A, B, or C?) [0.33 point]
Choice = A

What score does the max expect to receive? [0.34 point]
Score = 4

Process the tree left to right. List the nodes (use letters) that will be pruned by the alpha-beta pruning algorithm. [7 points or -0.5 for each missing node]
List = [A32, A33, A34, B21, B22, B23, B31, B32, B33, B34, C23, C41, C42, C43]