



COMSATS University Islamabad
Terminal Examination Fall 2020

Class: BCE-7A/B

Subject: CSC 462: Artificial Intelligence

Instructor: Dr. Atif Shakeel / Dr. M. Azfar Yaqub

Time Allowed: 180 minutes

Marks: 50 marks

7th January 2021

Instruction for the Paper: (Read Carefully)

1. Copying is not allowed.
2. Your answers should be compiled in a pdf file. (you can use MS word for conversion)
3. The name of the pdf file should be "CSC462_FA18-BCE-XXX_final.pdf"

(Note: You will lose 1 mark after each passing minute after the due time. So, manage your time carefully and submit the PDF within time.)

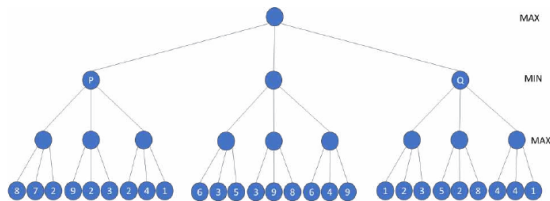
Question 1: CLO-4 (5 pts)

Answer true/false for each of the following statements.

- i. Depth first search will find an optimal path with respect to the number of steps in the path.
- ii. Breadth-first search is a special case of uniform cost search
- iii. ML is a set of techniques that turns a dataset into a software.
- iv. Regression is used for prediction.
- v. Depth first search will find an optimal path with respect to the cost of the path.
- vi. Regression is used to discover casual relationship
- vii. Is it possible to design a Linear regression algorithm using a neural network?
- viii. Breadth first search will find an optimal path with respect to the number of steps in the path.
- ix. Classification is used to predict continuous value.
- x. Breadth first search will find an optimal path with respect to the cost of the path.

Question 2: CLO 2 (10 pts) (Game Tree Search)

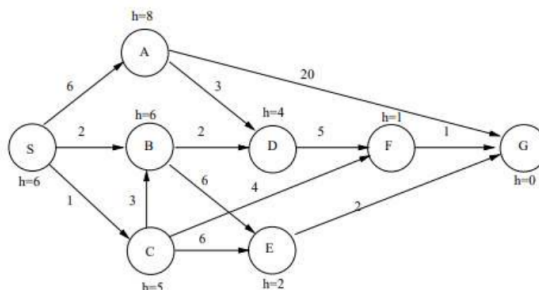
Use the figure of min-max problem given below to the answer the following questions.



- (a) What is the final value of this game?
- (b) Is the final value of beta at the root node (after all children have been visited) $+\infty$?
- (c) What is the final value of beta at the node labeled P (after all of P's children have been visited)?
- (d) Will any nodes be pruned?
- (e) What value will Q return to its parent?

Question 3: CLO 1 (10 pts) (Search)

Consider the search problem below with start state S and goal state G. The transition costs are next to the edges, and the heuristic values are next to the states.

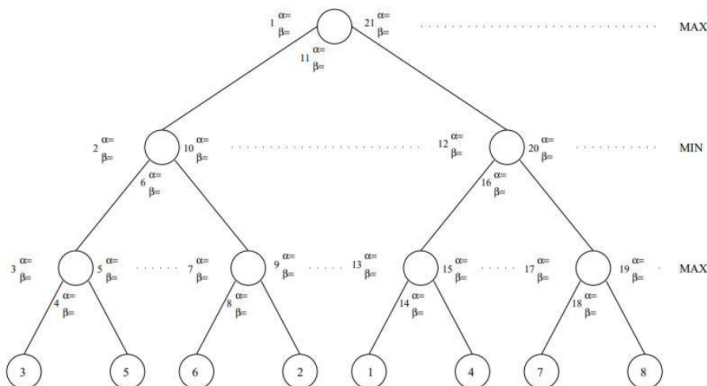


- If we use Uniform-Cost Search, What is the final path for this search?
- If we use Depth First Search, and it terminates as soon as it reaches the goal state, What is the final path for this DFS search? If a node has multiple successors, then we always expand the successors in increasing alphabetical order.
- If we use A* search, What is the final path for this A* search?

Question 4: CLO-2 (10 pts) (Search)

Perform the alpha-beta pruning algorithm on the following tree, searching left before right:

- Record to the left of a node the alpha and beta values upon first visiting the node.
- Record under a node the alpha and beta values after visiting the left child of the node.
- Record to the right of a node the alpha and beta values upon visiting both children.
- Circle any nodes (including leaves) that are not visited.
- Alpha and beta values need not be written for unvisited nodes nor for leaf nodes.
- Write in the game-theoretic value of the root node in the circle.
- Draw arrows along the path that would be taken if both players made optimal decisions.



Question 5: CLO-3 (5 pts) (Local Search/Optimization)

Suppose you are running GAs on bitstrings of length 16, in which we want to maximize symmetry: the extent to which the bitstring is a mirror image of itself (also known as being a palindrome). More formally:

Score = Number of bits that agree with their mirror image position.

Examples:

- $\text{Score}(1100110110110011) = 16$ (this is an example of an optimal bitstring)
- $\text{Score}(0000000011111111) = 0$
- $\text{Score}(0100000011111111) = 2$
- Suppose you run GA with the following parameter settings:
- Single-point crossover
- Mutation rate = 0.01
- Population size 1000 (with an initial population of randomly generated strings)
- Stochastic Universal Sampling for selection (i.e. Roulette-wheel style)

Let N = the number of crossovers performed before an optimal bitstring is discovered.

What is the most likely value of N ?

Question 6: CLO 4 (10 pts) (Short Answers)

1. What is the difference between supervised and unsupervised learning?
2. When should you use classification over regression?
3. What are the different methods used to find the best fit line for data in linear regression?
4. What is the difference between simulated annealing and genetic algorithm?