



United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam: Fall 2022

Course Code: CSE 3811, Course Title: Artificial Intelligence

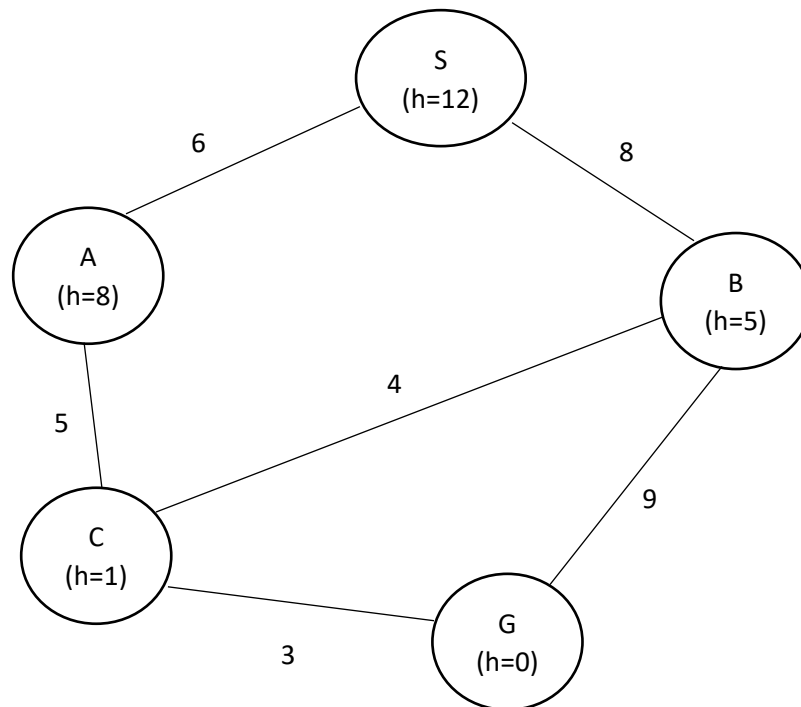
Total Marks: 30

Duration: 1 hour 45 minutes

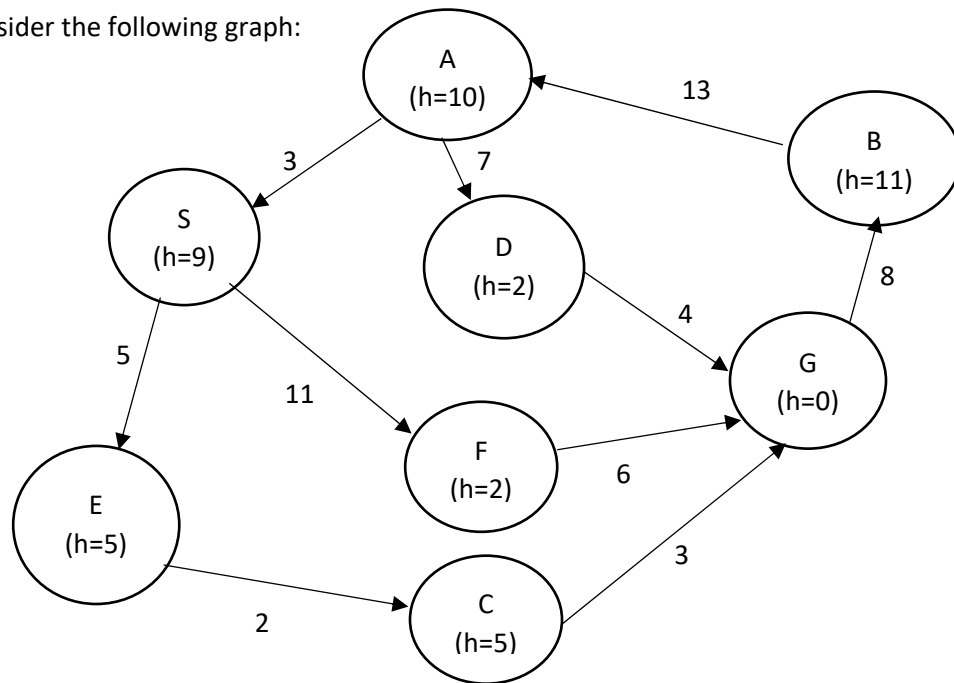
Answer all questions. Marks are indicated in the right side of each question.

[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.]

1. Suppose you are designing an artificially intelligent wall painting robot. The wall is divided into 144 squares in a 12 x 12 grid design. The robot can paint a single square in a singular action. It then moves the hand to the next square and paints. The job is finished when the whole wall is painted. Give a formal description of this problem as a search problem. What is the size of the state space? **[1.5+.5]**
2. Consider the following directed search space. S is the initial state. G is a state that satisfy the goal test. Find out the solution paths and costs returned by the following search algorithms: **[2+1+2+2]**
 - a. Uniform Cost Search
 - b. Greedy Best First Search
 - c. A* Tree Search
 - d. A* Graph Search



3. a. Consider the following graph:



Here **S** is the starting node and **G** is the goal node. Now change only the heuristic values of **any two** nodes so that the heuristic values become both admissible and consistent. Mention the updated values and corresponding node names. [3]

b. Suppose you have two heuristic functions **h1** and **h2**, both of which are **admissible**. You have decided to create several new heuristic functions defined as follows:

- $h_3(n) = 0$
- $h_4(n) = 2 \times h_1(n)$
- $h_5(n) = h_2(n)/2$
- $h_6(n) = (h_1(n) + h_2(n))/2$
- $h_7(n) = \max(h_1(n), h_2(n))$
- $h_8(n) = \min(h_1(n), h_2(n))$

Now answer the following questions:

[2]

- i. Which heuristic is possibly inadmissible?
- ii. Among h_5 and h_6 which one is dominant?
- iii. Which heuristic will expand the maximum number of nodes?
- iv. In your opinion which heuristic is the best?

4. Answer the following questions:

a. Suppose you are trying to solve the 8 queens problem using greedy hill climbing search. How will the performance be affected if you allow sideways move (choose equal valued successors if better ones are not generated)? [2]

b. What is the difference between Randomly Restarting Hill Climbing Search k times and local beam search with a beam size of k ? [2]

c. What will happen in the local beam search if we set the beam size(k) to be 1? [1]

d. What is the role of the temperature, T in Simulated Annealing? How do chances of taking bad moves change with the value of T ? [2]

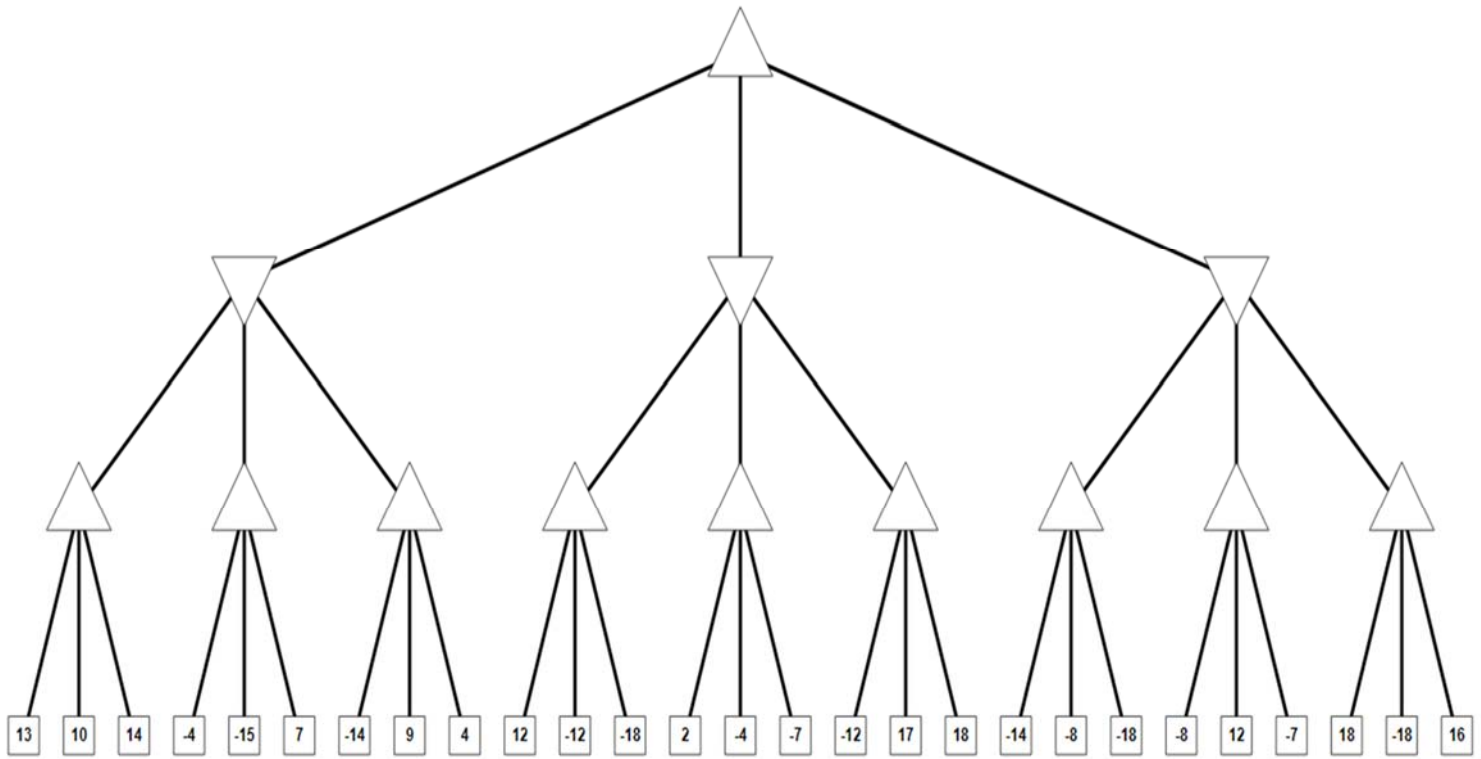
5. Consider the following game tree.

[4]

△ Max

▽ Min

Apply minimax search and show which nodes will be pruned if you use alpha-beta pruning.



6. Consider the following map of Bangladesh where borders among the eight divisions have been marked. You need to color each of these divisions using three colors (Red/Green/Blue) such that two adjacent divisions do not receive the same color.

Now **formulate** the problem as CSP, Show the **Constraint Graph** and solve the problem **must applying** both Minimum Remaining Values(MRV) and Least Constraining Value(LCV) heuristics.

[5]

