



# United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

## Mid Exam

Spring 2019

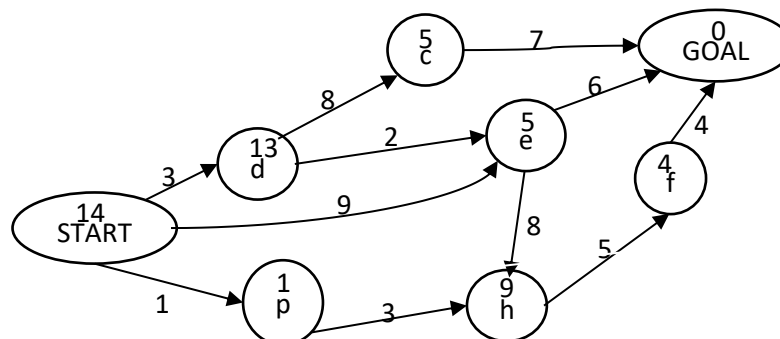
Course Code: CSI 341 Course Title: Artificial Intelligence

Total Marks: 30

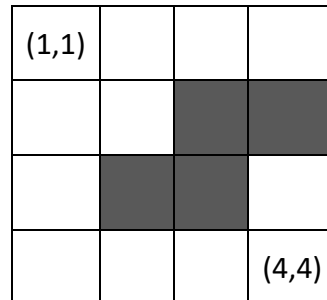
Duration: 1 hour 45 minutes

There are 8 questions. **Answer all questions.** Marks are indicated in the right side of each question.

1. "An agent that senses only partial information about the state cannot be perfectly rational", say whether it is true or false and support your answer. [1]
2. Give PEAS description of the task environment of a UIU Admission Office Counselor agent. [1]
3. A 3-foot-tall monkey is at the door in a room where some bananas are suspended from the 8-foot ceiling in the middle of the room. He would like to get the bananas. The room contains two 3-foot-high boxes at the window. For this problem, provide the search problem formulation including the number of states. [3]
4. Consider a 3x3 vacuum-world problem. Determine which of the uninformed and informed algorithms discussed in the class would be appropriate for this problem and support your answer. Should the algorithm use tree search or graph search? [4]
5. For the following graph, show the solution paths and the associated actual path costs for the following search algorithms. Heuristics are labeled on the nodes and actual costs on the arcs. In case of ties during removing from frontier, use alphabetical order. [6]
  - a. IDS
  - b. UCS
  - c. Greedy Search
  - d. A\* Search



6. a.



Suppose you are designing a robot which has to navigate through a maze to reach a specific destination. In the grid shown in the figure, the robot will start in location (1,1) and the goal is location (4,4). The shaded regions are blockades and have to be avoided. You want to use hill climbing search to solve this problem. Now answer the following:

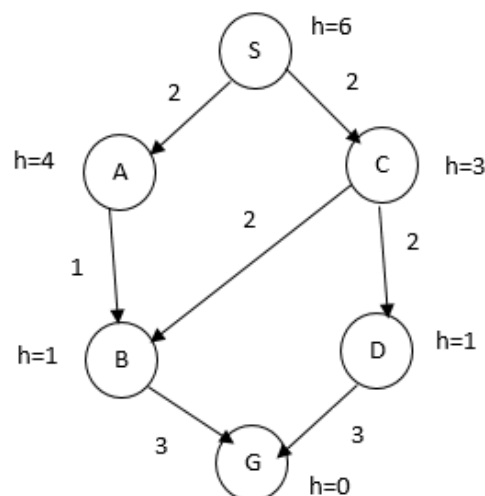
i. Design a suitable cost function for hill climbing algorithm. [1]

ii. Can your algorithm always reach global optimum? Explain your answer. [2]

b. "Simulated Annealing starts to behave like hill climbing as temperature  $T$  approaches zero" - justify this statement as either true or false with proper reasoning. [2]

c. What is the purpose of mutation in genetic algorithm? [1]

7. a. Will A\* Tree Search be optimal for the following state space graph? Will A\* Graph Search be optimal? Briefly explain your answer. [3]



b. Suppose you have three heuristics,  $h_1$ ,  $h_2$  and  $h_3$ . Among these  $h_1$  and  $h_2$  are admissible but  $h_3$  is not admissible. You decide to create the following new heuristic functions defined as follows:

i.  $h_4(n) = \max(h_1(n), h_2(n), h_3(n))$

ii.  $h_5(n) = \min(h_1(n), h_2(n), h_3(n))$

iii.  $h_6(n) = \max(h_1(n), 3 \times h_2(n))$

iv.  $h_7(n) = \min(h_2(n), h_3(n))/2$

Among these four which are unambiguously admissible heuristics? [2]

8. a. What is the time complexity and space complexity of minimax search algorithm? [1]

b. Show the nodes that will be pruned in minimax search algorithm with alpha-beta pruning for the following tree. [3]

