National University of Computer & Emerging Sciences, Karachi
Spring-2021 Department of Computer Science
Mid Term-1
18th March 2021, 1:00 PM – 2:00 PM

Course Code: CS461/401	**Course Name:** Artificial Intelligence
Instructor Name / Names: Dr. Fahad Sherwani, Dr. Rauf Shams Malick, Ms. Saeeda Kanwal	
Student Roll No:	**Section:**

Instructions:

- Return the question paper.
- Read each question completely before answering it. There are **3 questions** on **2 pages.**
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 60 minutes **Max Marks: 12.5**

Question # 1 **[4 Marks]**

A. Missionaries and Cannibals is a problem in which 3 missionaries and 3 cannibals want to cross from the left bank of a river to the right bank of the river. There is a boat on the left bank, but it only carries at most two people at a time (and can never cross with zero people). If cannibals ever outnumber missionaries on either bank, the cannibals will eat the missionaries.

1. Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution. Draw a diagram of the complete state space.

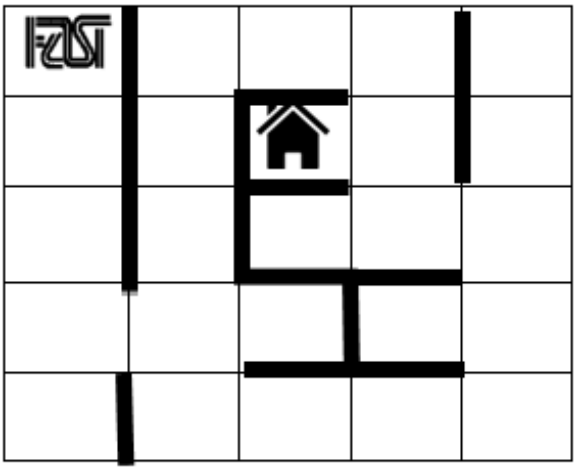
2. Suggest an appropriate search algorithm that can provide an optimal solution. Is it a good idea to check for repeated states?

B. Let A (x, y) be the distance between two cities X and Y. Can the estimation [A (x, y)/2] provide an optimal result? Justify your answer.

C. Explain a scenario in which Iterative Deepening Search (IDS) performs much worse than Depth-First Search (DFS).

Question # 2 **[4 Marks]**

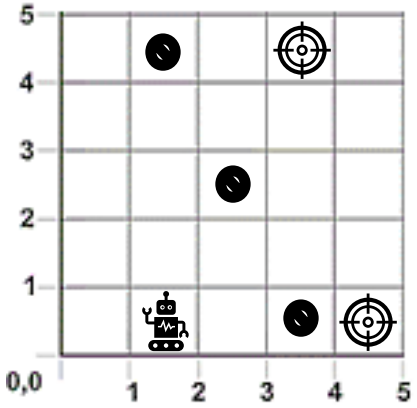
You come to university with your friend in his conveyance, but due to PSL the routes are blocked and must choose an Alternate way. Now his task is to reach from FAST NUCES to the Home using the matrix provided. He has got a lucky friend like you who will run **BFS and DFS** both; and will then tell him which algorithm is better. Tell the search nodes first and then tell the pathway (together with path cost) followed using both the strategies.



A. Draw the Search Tree
B. Successor States: Represent with Digits
C. Avoid blocked paths
D. Actions: Vertical and Horizontal, not Diagonal
E. Apply BFS and DFS Algorithms

Question # 3 **[4.5 Marks]**

Consider a poultry farm as depicted below. The farm is further divided into tiles each of 1*1 square foot. For the given farm there exists 2 locations where food and waters are co-located. A robot has been developed to fill the water and feed pots at the same time. The robot has to identify the goal path and to identify the optimal route towards each goal sequentially. The robot can only move in right-left-upward-downward directions, each with a unit cost.



A. Design a heuristic mechanism that would not be overestimating the path cost using the Manhattan distance formula, given as, Distance = |x1 - x2| + |y1 - y2|
B. Show a dry run for the A* algorithm to reach only one goal node present at (4, 5).
C. Mention the problem associated with A* and what could be a practical solution?

BEST OF LUCK