**COMP3702/7702 ARTIFICIAL INTELLIGENCE**
**Semester 2 2014**
**Mid-Term Exam: Friday, 10 October 2014**
**Time: 60 minutes**

**Student ID:**
**Name:**

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1. Suppose we are given a simplified map as shown in Fig. 1.

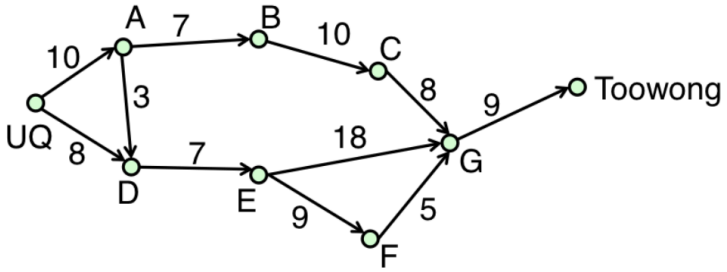


Fig. 1. The labels on the edges represent the cost of moving.

Please write down the expansion order to find a path from UQ to Toowong if we use:

A. [10 marks] Iterative Deepening DFS.
B. [10 marks] Greedy Best First Search.
C. [10 marks] A* search.

Please use the following heuristic function if you need one.
h(UQ) = 30; h(A) = 25; h(B) = 15; h(C) = 9; h(D) = 28; h(E) = 25; h(F) = 13; h(G) = 7; h(Toowong) = 0.

2. Questions on properties of search algorithms and heuristic. For this question, let's assume we are searching for a path from UQ to Toowong on the map shown in Fig. 1.
   A. [10 marks] Is the heuristic function in question 1 admissible? Please explain why or why not.
   B. [10 marks] Is the heuristic function in question 1 consistent? Please explain why or why not.
   C. [10 marks] Suppose the heuristic at node G in question 1 is changed to: h(G) = 10, will A* search using this modified heuristic (i.e., the heuristic in question 1 with h(G)=10) find an optimal solution? Please explain why or why not.

3. [10 marks] I believe in Assignment 1 you have seen that when the state space has many dimensions, search on a uniform grid discretization of the state space does not perform well. Please explain why is this the case.

4. [15 marks] Let's consider a robotic tag game: A robot needs to tag a human target as soon as possible. Suppose the target and the robot is moving in an environment of size 1mX1m and the robot will automatically tag a human target if the distance between the robot and the target is less than 15 cm. In one time step, the robot can move in any direction with a distance of at most 40cm, while the target can move in any direction with a distance of at most 30cm. Furthermore, the robot knows the exact behavior of the human target. The problem in this game is to find a path for the robot, so that it can tag the human target as soon as possible. If the position of both the robot and the target are fully observable. Then,

   A. [5 marks] Assuming there is a solution to the robotic tag game described above, can we solve it using one of the search algorithms that we have studied in the first part of the class (i.e., one of BFS, DFS, Iterative Deepening DFS, Uniform cost search, Greedy best first search, and A*)? You don't need to worry about efficiency in this question.

   B. [10 marks] If the answer to 4A is yes, please define the state space and the action space of the search problem. Otherwise, please explain why not.

5. Please consider the following pseudo code

```
MYSTERYSEARCH
    Set the initial vertex I as root of the search tree.
    Push I to the queue.
    Loop
        t = front of the queue.
        Remove t from the queue.
        If t is the goal vertex, then return.
        Otherwise
                Put the results of successor(t) as children of t in the search tree.
                Push the results of successor(t) at the back of the queue.
```

   A. [5 marks] What search algorithm is MYSTERYSEARCH?

   B. [10 marks] Will bidirectional search reduce the time and space complexity of MYSTERYSEARCH? Please explain why or why not.

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