CS 101 Fall 2021 - Quiz 9-A

11/13/2021 - 20 Minutes **Name:** **ID number:**

Problem 1(1pts): Notes of discussion

I promise that I will complete this QUIZ independently, and will not use any electronic products or paper-based materials during the QUIZ, nor will I communicate with other students during this QUIZ.

True or False: I have read the notes and understood them.

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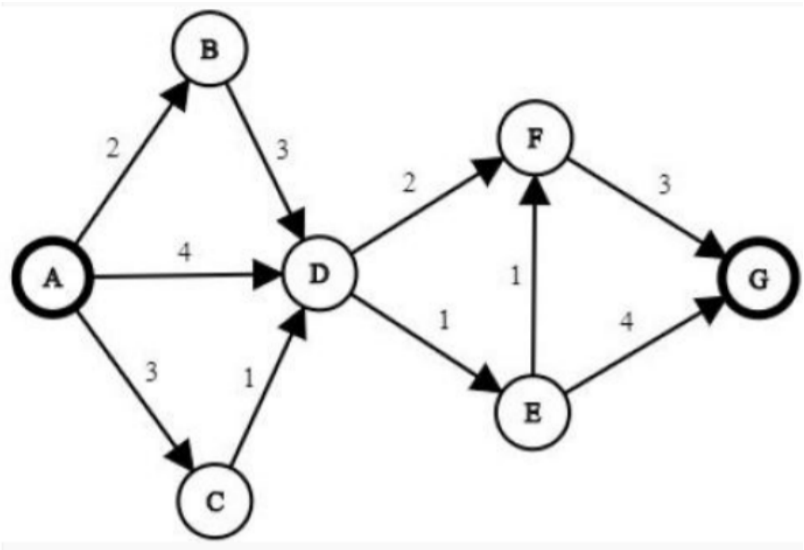
Problem 2(2+4+3pts) Fill in the blanks

Consider the following directed graph in which we will apply A* graph search to find the shortest path from node A to node G. Additionally, we are given a heuristic function h as follows: $h(A) = 7, h(B) = 5, h(C) = 6, h(D) = 4, h(E) = 3, h(F) = 3, h(G) = 0$.



(1) The given heuristic values are *B*:

(A) Admissible as well as consistent

(B) Admissible but not consistent

(C) Consistent but not admissible

(D) Neither admissible nor consistent

(2) Write down the sequence of node popped from the priority queue when doing A* graph search. If several nodes have the same priority, pop them following alphabetical order.

ABDECFG.

(3) Besed on (2), what path is returned?

$A -- > D -- > E -- > G$.

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Problem 4 (2+3+3pts) Floyd-Warshall

Consider the following implementation of the Floyd-Warshall algorithm. Assume $w_{ij} = \infty$ where there is no edge between vertex i and vertex j, and assume $w_{ii} = 0$ for every vertex i.

Algorithm 1 Floyd-Warshall

```
for i = 1 to n do
  for j = 1 to n do
    A[i, j, 0] = w_ij
    P[i, j] = −1
  end for
end for
for k = 1 to n do
  for i = 1 to n do
    for j = 1 to n do
      A[i, j, k] = A[i, j, k − 1]
      if A[i, j, k] > A[i, k, k − 1] + A[k, j, k − 1] then
        A[i, j, k] = A[i, k, k − 1] + A[k, j, k − 1]
        P[i, j] = k
      end if
    end for
  end for
end for
```

(1) What does $P[i, j] = k$ mean?

Answer: The current shortest path between vertex i and j will pass vertex k.

(2) Assume matrix P, which is the output of the above algorithm is given. Consider the following matrix for graph G with 7 vertices. What is the shortest path from vertex 1 to vertex 2 in graph G? What is the shortest path from vertex 5 to vertex 7 in graph G?

P	1	2	3	4	5	6	7
1	-1	5	4	-1	4	4	-1
2	5	-1	5	5	-1	5	6
3	4	5	-1	-1	-1	-1	6
4	-1	5	-1	-1	3	3	1
5	4	-1	-1	3	-1	3	6
6	4	5	-1	3	3	-1	-1
7	-1	-1	6	1	6	-1	-1

1 to 2: 1,4,3,5,2

5 to 7: 5,3,6,7