

**Problem 1(1pts):** Notes of discussion

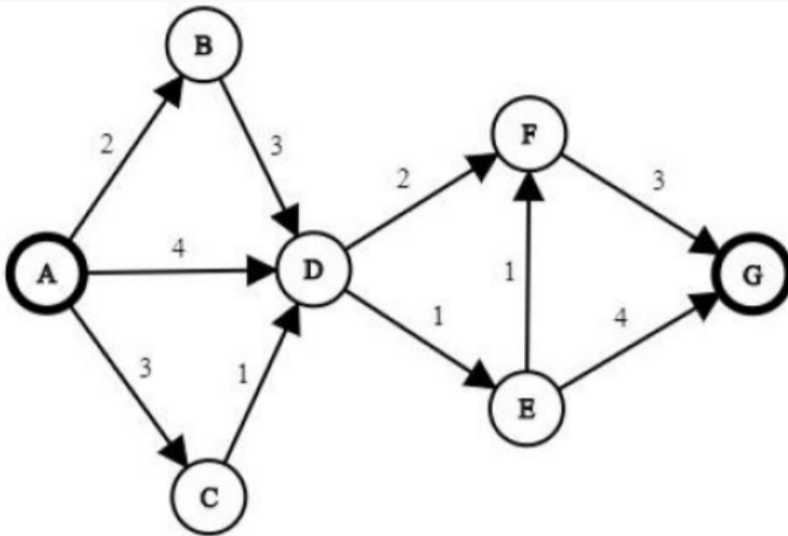
I promise that I will complete this QUIZ independently, and will not use any electronic products or paper-based materials during the QUIZ, nor will I communicate with other students during this QUIZ.

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 \_\_\_\_\_:

- (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.

\_\_\_\_\_.

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

\_\_\_\_\_.

**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?

(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