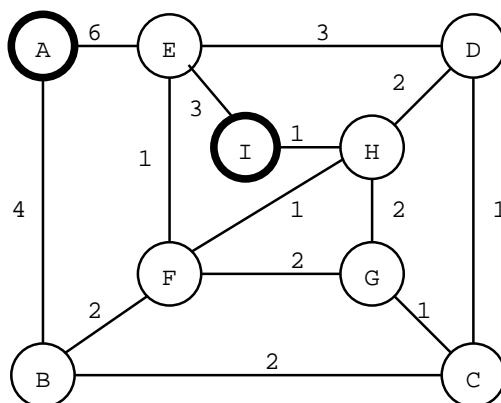


## CS347 SP2005 Quiz 2 Key

This is an open-book open-notes quiz. The *only* prohibited items are electronic devices. Mark every sheet of paper you use with your name and the string “cs347sp2005 quiz2” (omittance, even if it is partial, will be penalized at 1 point per sheet). If you are caught cheating, you will receive a zero grade for this quiz. The max number of points per question is indicated in square brackets after each question. The sum of the max points is 28. You have 28 minutes to complete this quiz. Good luck!

The following questions on this page are about the following state space graph. Let A be the start state and I the goal state. The edge labels indicate step-cost, the vertex labels contain the node identifier in the form of a letter. The order in which successors are generated is counterclockwise, ending at exactly 9 o'clock. Example: H generates first F, then G, then D, and finally I. When sorting by  $f$ -value, nodes with equal  $f$ -value are ordered such that the earlier a node is generated, the higher its priority. Nodes already on the open list have higher priority than newly added nodes with equal  $f$ -value. Heuristic  $h(\text{node})$  is defined in the following table:

node	$h(\text{node})$
A	3
B	1
C	4
D	2
E	3
F	2
G	2
H	1
I	0



1. What is the diameter of this state space? Explain your answer! [2]  
3; this is the largest minimal number of steps between any two nodes.
2. Give the execution trace for Uniform Cost Graph Search (UCGS). [8]

open	closed	eval
A0	-	A0
B4E6	A	B4
E6C6F6	AB	E6
C6F6I9D9	ABE	C6
F6D7G7I9	ABEC	F6
D7G7H7I9	ABECF	D7
G7H7I9	ABECFD	G7
H7I9	ABECFDG	H7
I8	ABECFDGH	I8

goal found; solution = ABFHI; path-cost(ABFHI)=8

3. Is UCGS optimal for this problem? Explain your answer! [2]

Yes, because the branching factor is finite, the step costs are all positive, and UCGS is always optimal under those conditions.

4. Give the execution trace for  $A^*$  Graph Search ( $A^*$ GS) employing heuristic  $h$ . [7]

open	closed	eval
A3	-	A3
B5E9	A	B5
F8E9C10	AB	F8
H8E9C10G10	ABF	H8
I8E9C10G10D11	ABFH	I8

goal found; solution=ABFHI; path-cost(ABFHI)=8

5. Is for this problem  $h$  admissible? Explain your answer! [4]

Yes, because as can be seen from the following table no node overestimates the remaining path-cost:

node	$h(\text{node})$	$C^*(\text{node})$
A	3	8
B	1	4
C	4	4
D	2	3
E	3	3
F	2	2
G	2	3
H	1	1
I	0	0

6. Is for this problem  $h$  consistent? Explain your answer! [3]

No, because  $h(C) = 4 > 3 = c(C, D) + h(D)$ .

7. Is  $A^*$ GS employing heuristic  $h$  optimal for this problem? Explain your answer! [2]

Yes, because it found the same solution as UCGS which we previously stated to be optimal for this problem.