CS-171, Intro to A.I., Fall Quarter, 2018—Quiz # 1—20 minutes

NAME:

YOUR ID: ______ ID TO RIGHT: ______ ROW: _____ SEAT: _____

1. (50 pts total) HEURISTICS. You are a robot assigned to solve the 8-puzzle, a sliding tile puzzle. Recall that your only action is to choose a tile adjacent to the blank square and then exchange it with the blank square. The result is that the chosen tile occupies the spot previously occupied by the blank square, and the blank square occupies the spot previously occupied by the chosen tile. The example below left shows the result of choosing tile 5 to exchange with the blank tile. The state below right is the goal state. Neighbors of a state are those other states that are accessible by one action.



1	2	3
4	5	6
7	8	

Goal State

Recall two commonly used heuristics:

- h1(n) = the number of misplaced tiles in state n (the blank square does not count as a tile)
- h2(n) = sum of the distances of the tiles from their goal in state n (the blank square does not count as a tile)

1.a. (6 pts total, 2 pts each) h1(Start State) = 6 h1(Result State) = 6 h1(Goal State) = 0

1.b. (6 pts total, 2 pts each) h2(Start State) = 9 h2(Result State) = 8 h2(Goal State) = 0

1.c. (8 pts total, -3 pts for each mistake, but not negative) <u>List all available actions</u> in the Start State. Format an action as its tile number. Give your answer as a list of all such tile numbers, or write None.

5, 6, 7

1.d. (8 pts total, -3 pts for each mistake, but not negative) List all actions in the Start State that impute the b1 heuristic. Format an action as its tile number. Give your answer as a list of all such tile numbers	Questions 1.f&g				
<u>une in neuristie.</u> Format an action as its the number. Give your answer as a list of an such the numbers	were canceled.				
None	Everyone gets				
1.e. (8 pts total, -3 pts for each mistake, but not negative) List all actions in the Start State that <u>imp</u> the h2 heuristic. Format an action as its tile number. Give your answer as a list of all such tile numbers	them right, regardless of what				
5	R&N Fig. 4.3 and				
1.f. (7 pts) For Hill Climbing with the h1 heuristic, the Result State above is (mark X in one blank):-	pp. 122-123 were deemed to be				
a Local Minimuma Local Maximuma Global Minimuma Global Maximum Flat_X	confusing about local maximum				
1.g. (7 pts) For Hill-Climbing with the h2 heuristic, the Result State above is (mark X in one blank):	and local				
a Local Minimum X a Local Maximum a Global Minimum a Global Maximum Flat	minimum.				
IUKN PAGE OVER AND CONTINUE ON THE OTHER SIDE """"					

2. (**50 pts total, 10 pts each**) **STATE-SPACE SEARCH.** Execute Tree Search through this graph (do not remember visited nodes, so repeated nodes are possible). It is not a tree, but pretend you don't know that. Step costs are given next to each arc, and heuristic values are given next to each node (as h=x). The successors of each node are indicated by the arrows out of that node. (Note: A, D are successors of themselves.) Successor nodes are returned in left-to-right order. (The successor nodes of S are A, B, C; the successor nodes of A are A, B; the successor nodes of B are D, C; and the successor nodes of C are G1, G2. For LIFO and FIFO queues the children will be processed in those node orders, i.e., assume that the child list is concatenated to the front or back of the queue in the order stated above. Priority queues are always sorted by the queue sort function.)

The start node is S and there are two goal nodes, G1 and G2. For each search strategy below, indicate (1) the order in which nodes are expanded, and (2) the path and cost to the goal that was found, if any. Write "None" for the path and cost if the goal was not found. The first one is done for you, as an example.

	$\mathbf{S}_{h=21}$		
20 A h	$\begin{array}{c} 4 \\ 10 \\ \hline 10 \\ $	C h=5	
	b = 4 $G1$	G	2
2.a. (example) DEPT	H-FIRST SEARCH:		
See Section 3.4.3 and Fig. 3.17.	d: None	Cost of path found:	None
2.b. (10 pts total) BR	EADTH-FIRST SEARCH:	eost of pain found.	110110
See Section 3.4.1 and Fig. 3.11.	xpansion: <u>S A B C (G1)</u>		
2.b.ii (2 pts) Path to g	oal found: <u>S C G1</u>	Cost of path found:	56
2.c. (10 pts total) ITE	ERATIVE DEEPENING SEARCH:		
See Sections 3.4.4-5 and Figs. 3.18-19.	nsion: <u>S S A B C (G1)</u>		
2.c.ii (2 pts) Path to g	oal found: <u>S C G1</u>	Cost of path found:	56
2.d. (10 pts total) UN	IFORM COST SEARCH:	_	
See Section 3.4.2 and Fig. 3.14.	xpansion: <u>S A B D C (G2)</u>		
2.d.ii (2 pts) Path to g	oal found: <u>S A B C G2</u>	Cost of path found:	22
2.e. (10 pts total) GR	EEDY BEST FIRST SEARCH:	_	
See Section 3.5.1 and Fig. 3.23.	xpansion: <u>S C (G1) or S C (G2)</u>		
2.e.ii (2 pts) Path to g	oal found: <u>S C G1 or S C G2</u>	Cost of path found:	56 or 55
2.f. (10 pts total) A*	SEARCH:		
See Section 3.5.2 and Figs. 3.24-25.	xpansion: <u>S A B D C G2</u>		
2.f.ji (2 pts) Path to g	al found: S A B C G2	Cost of path found:	22