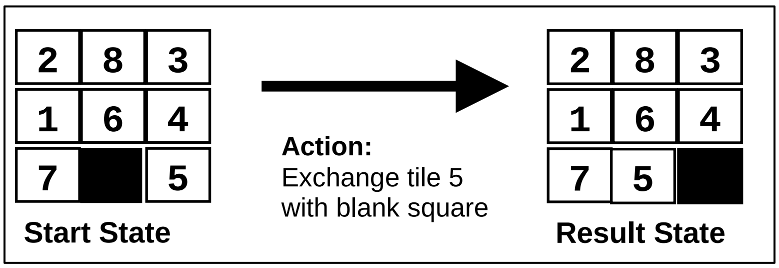
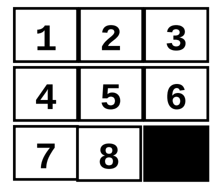
CS-171, Intro to A.I., Fall Quarter, 2018—Quiz # 1—20 minutes

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. <u>**Neighbors** of a state are those other states that are accessible by **one action.**</u>





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) = ________ h1(Result State) = __________ h1(Goal State) = ___________

1.b. (6 pts total, 2 pts each) h2(Start State) = ________ h2(Result State) = __________ h2(Goal State) = ___________

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.

____

1.d. (8 pts total, -3 pts for each mistake, but not negative) <u>List all actions</u> in the **Start State** that <u>**improve**</u> the score of <u>the **h1** heuristic.</u> Format an action as its tile number. Give your answer as a list of all such tile numbers**,** or write None.

____

1.e. (8 pts total, -3 pts for each mistake, but not negative) <u>List all actions</u> in the **Start State** that <u>**improve**</u> the score of <u>the **h2** heuristic.</u> Format an action as its tile number. Give your answer as a list of all such tile numbers**,** or write None.

____

1.f. (7 pts) <u>For Hill-Climbing with the **h1** heuristic,</u> the **Result State** above is (mark X in one blank):

a Local Minimum___ a Local Maximum___ a Global Minimum___ a Global Maximum___ Flat___ None of above___

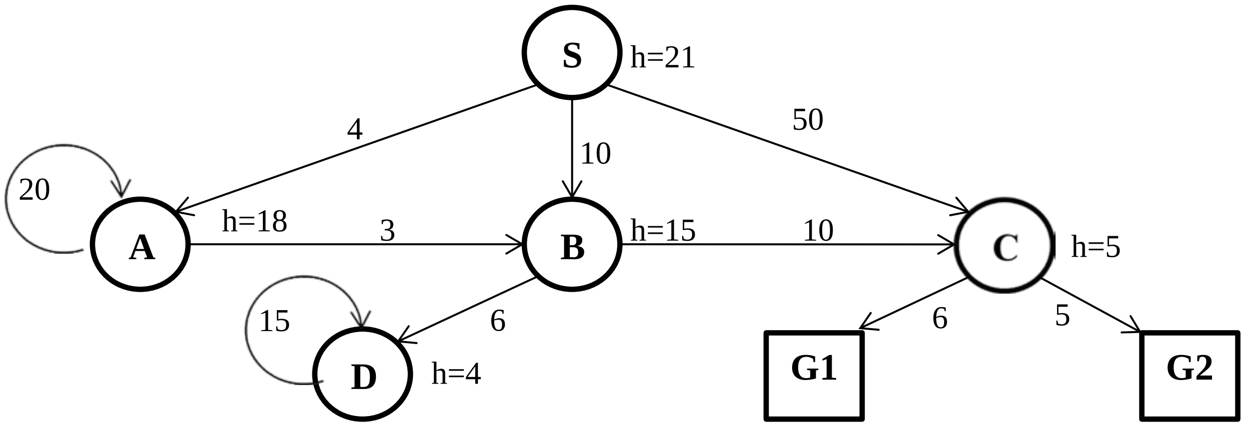
1.g. (7 pts) <u>For Hill-Climbing with the **h2** heuristic,</u> the **Result State** above is (mark X in one blank):

a Local Minimum___ a Local Maximum___ a Global Minimum___ a Global Maximum___ Flat___ None of above___

****** TURN 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.



2.a. (example) DEPTH-FIRST SEARCH:
2.a.i Order of expansion: S A A A A A A ...

2.a.ii Path to goal found: None Cost of path found: None

2.b. (10 pts total) BREADTH-FIRST SEARCH:

2.b.i (8 pts) Order of expansion: ______________________________

2.b.ii (2 pts) Path to goal found: ________________ Cost of path found: ______

2.c. (10 pts total) ITERATIVE DEEPENING SEARCH:

2.c.i (8 pts) Order of expansion: ______________________________

2.c.ii (2 pts) Path to goal found: ________________ Cost of path found: ______

2.d. (10 pts total) UNIFORM COST SEARCH:

2.d.i (8 pts) Order of expansion: ______________________________

2.d.ii (2 pts) Path to goal found: ________________ Cost of path found: ______

2.e. (10 pts total) GREEDY BEST FIRST SEARCH:

2.e.i (8 pts) Order of expansion: ______________________________

2.e.ii (2 pts) Path to goal found: ________________ Cost of path found: ______

2.f. (10 pts total) A* SEARCH:

2.f.i (8 pts) Order of expansion: ______________________________

2.f.ii (2 pts) Path to goal found: ________________ Cost of path found: ______

Scratch Paper (1) Please Do Not Detach From Test

Scratch Paper (2) Please Do Not Detach From Test