CS 171, Intro to A.I., Winter Quarter, 2020 — Quiz # 1 — 25 minutes

NAME: _____ UCINetID _____

YOUR ID#: _____ ID# TO RIGHT: _____ ID# TO LEFT: _____ ROW: _____ SEAT: _____

1. (42 pts total, 3 pts each) SEARCH METHODS AND FAIRNESS. Say that a search method is **Fair** if, for any point in time during any search, it is guaranteed that every node on the fringe (= frontier = open-list = queue) at that point in time eventually will be expanded provided that a goal is not discovered in the meantime.

Say a search method is **Not Fair** if, for some point in time during some search, it is possible that some node on the fringe at that time might never be expanded even if no goal is ever discovered.

Here, you are doing Tree Search (that is, do not remember expanded nodes). Assume that ε is a small positive constant, and that every step cost is ≥ ε (that is, every step cost is bounded away from 0). As always, the branching factor is finite.

Fill out this table of search conditions as F (= Fair) or N (= Not Fair) to indicate if the

		SEARCH SPACE CHARACTERIST	
		Finite Graphs without Loops (i.e., without Cycles)	Infinite Graphs (i.e., with Cycle
SEARCH METHOD	Depth First Search	**F**	**N**
	Breadth First Search	**F**	**F**
	Uniform Cost Search	**F**	**F**
	Iterative Deepening Search	**F**	**F**
	Bidirectional Search (using Breadth First Search)	**F**	**F**
	GreedF Best First Search	**F**	**N**
	A* Search	**F**	**F**

DFS can get caught in a loop, or in an infinitely deep search space can miss all goals and just keep on going right on down.

A malicious demon could choose very misleading heuristic values for nodes, and so lead GBFS entirely astray forever.

2. (24 pts total, 4 pts each) Label the following statements as True (T) or False (F).

2.a. __T__ Local search algorithms generally operate only on one (or a few) current node(s).

2.b. __F__ Local search algorithms generally are used to find the globally optimal solution.

2.c. __T__ In tabu search recently visited states are temporarily excluded from being visited again.

2.d. __F__ The random restart wrapper randomly decides whether to return the current node or keep searching.

2.e. __T__ Local search difficulties include shoulders, local maximums, "flat" local maximums, and ridges.

2.f. __T__ Hill-climbing moves to the best successor that improves the current state, or returns if no such child.

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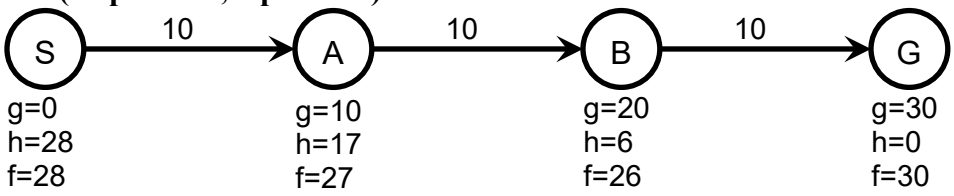
3. (30 pts total, 5 pts each) ADMISSIBLE AND CONSISTENT HEURISTICS. The problems below are very simple search problems; but this question is about Heuristics, not about Search. Step costs are indicated next to each arc. Next to each node is shown g = path cost so far, h = heuristic value, and f = g+h. S is the Start node and G is the Goal node. **Label the following search spaces as Y (= Yes) or N (= N) to indicate if the heuristic function shown is Admissible/Consistent.**

3.a. (10 pts total, 5 pts each)



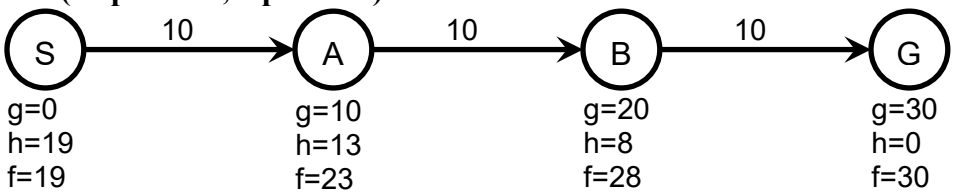
Admissible because h(n) ≤ h*(n) for all nodes n.

Not consistent because (among others) f(S) = 28 > 27 = f(A), i.e., f() is not non-decreasing along any path. Also, cost(S,A) + h(A) = 27 < 28 =h(S) violates the triangle inequality.

3.a.i. (5 pts) (Answer Y=Yes or N=No) Y Is the heuristic above (h) admissible?

3.a.ii. (5 pts) (Answer Y=Yes or N=No) N Is the heuristic above (h) consistent?

3.b. (10 pts total, 5 pts each)



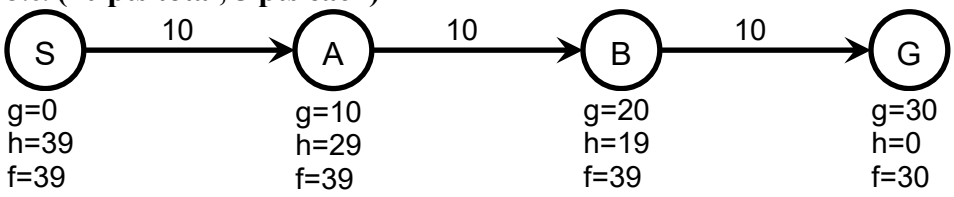
Admissible because h(n) ≤ h*(n) for all nodes n.

Consistent because f() is non-decreasing along any path. Also, every node and its successor satisfies the triangle inequality.

3.b.i. (5 pts) (Answer Y=Yes or N=No) Y Is the heuristic above (h) admissible?

3.b.ii. (5 pts) (Answer Y=Yes or N=No) Y Is the heuristic above (h) consistent?

3.c. (10 pts total, 5 pts each)



Not admissible because (among others) h(S) = 39 > 30 = h*(S).

Not consistent because f(B) = 39 > 30 = f(G), i.e., f() is not non-decreasing along any path. Also, cost(B,G) + h(G) = 10 < 19 =h(B) violates the triangle inequality.

3.c.i. (5 pts) (Answer Y=Yes or N=No) N Is the heuristic above (h) admissible?

3.c.ii. (5 pts) (Answer Y=Yes or N=No) N Is the heuristic above (h) consistent?

4. (4 pts total, 1 pt each) Your book defines a task environment as a set of four things, with the acronym PEAS. Fill in the blanks with the names of the PEAS components.

Performance (measure) Environment Actuators Sensors

See Chaps. 2, 3.1-3.3.