COMS 4701 - Homework 1 - Conceptual

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Question 1

a)

1,3

b)

2,3,5,6

c)

1,3

Question 2

a)

Performance: Speed of response, accuracy of text parsing and encoding, providing relevant and correct answers while maintaining human-like interactions, security
Environment: The humans who put out queries
Actuators: Putting out text to respond
Sensors: various text processing algorithms to accurately parse the text and also understand the semantics, context and intent

b)

Observability: It is fully observable as there can only be one user at a time and ChatGPT will have full access to that user's request.
# of agents: Single agent system as only one input in the form of text can be given at a time.
Deterministic/Stochastic: The environment is stochastic as the agent's response won't determine the next state of the environment as the user can say whatever he wants.
Discrete/Continuous: The environment is continuous as the text input of the user is not discrete and the action which is also a text is not discrete.
Static/Dynamic: The environment is static as the user cannot change the input text while ChatGPT is in the middle of creating a response.

Question 3

1)

Cities visited: Houston, Dallas, New Orleans, El Paso, Little Rock, Atlanta, Miami, Los Angeles
Path: Houston → Dallas → El Paso → Los Angeles

2)

Cities visited: Houstan, Dallas, El Paso, Los Angeles
Path: Houston → Dallas → El Paso → Los Angeles

3)

Cities visited: Houstan, Dallas, New Orleans, Little Rock, Saint Louis, El Paso, Oklahoma City, Atlanta, Nashville, Miami, Kansas City, Santa Fe, Charleston, Chicago, Raleigh, Denver, Phoenix, Washington, Pittsburgh, Los Angeles
Path: Houston → Dallas → El Paso → Los Angeles

Question 4

a)

UCS: A, C, F, G

b)

Iterative deepening depth first search: Level 0: A, Level 1: A, B, C, Level 2: A, B, D, E, C, F, G

c)

Greedy best-first search: A, B, E, D, C, G

d)

A* search: A, C, G

e)

No, since for a heuristic to be admissible $h(n) \leq h^*(n) \forall n$ but,
$h(A) = 100 > h^*(A) = 70$

Question 5

Given, $h_1(n) \leq h^*(n)$ and $h_2(n) \leq h^*(n) \forall n$

1)

To check: $h(n) = \min\{h_1(n), h_2(n)\}$ is admissible
Yes, it is admissible because for a heuristic to be admissible it must never overestimate the actual cost and since $h(n)$ picks the min of $h_1(n)$ & $h_2(n)$ and the max of these values is still less than $h^*(n)$ so $h(n)$ also ensures that it underestimates or equals the actual cost.

2)

To check: $h(n) = \max\{h_1(n), h_2(n)\}$ is admissible
Yes, it is admissible because for a heuristic to be admissible it must never overestimate the actual cost and since $h(n)$ picks the max of $h_1(n)$ & $h_2(n)$ and the max of these values is still less than $h^*(n)$ so $h(n)$ also ensures that it underestimates or equals the actual cost.

3)

To check: $h(n) = wh_1(n) + (1-w)h_2(n)$ with $0 \leq w \leq 1$ is admissible
To prove: $h(n) \leq h^*(n)$
We know that,

$$wh_1(n) \leq wh^*(n) \tag{1}$$

$$(1-w)h_2(n) \leq (1-w)h^*(n) \tag{2}$$

Adding both the equations we get
$wh_1(n) + (1-w)h_2(n) \leq h^*(n)$
$\implies h(n) \leq h^*(n)$