

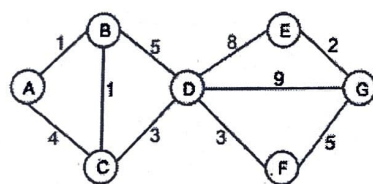
Name:

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1. Consider the state space graph at figure 1. A is the start state and G is the goal state. The costs for each edge are shown on the graph. Each edge can be traversed in both directions. There are two heuristics h_1 and h_2 . Now answer the following questions:

(a) What are the possible paths returned by each of these search-strategies? In case of ties, follow the alphabetical order. Use graph-searches (avoid repeated states) for all the cases except the last one. [5]

- Depth First Search
- Breadth First Search
- Uniform Cost Search
- A* search with h_1
- A* search with h_2 without saving visited states (tree-search version).



Node	h_1	h_2
A	9.5	10
B	9	12
C	8	10
D	7	8
E	1.5	1
F	4	4.5
G	0	0

Figure 1: State-space graph for question 1

- ~~A-B-D-G~~ A-B-D-E-G
- A-B-D-G
- A-B-C-D-F-G
- A-B-C-D-F-G
- A-B-C-D-F-G

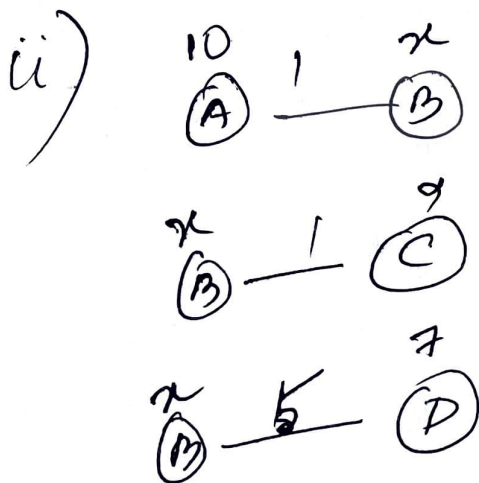
- (b) Consider the same state-space graph. Suppose you are completing a new heuristic function h_3 shown below. All the values are fixed except $h_3(B)$.

Node	A	B	C	D	E	F	G
h_3	10	?	9	7	1.5	4.5	0

For each of the following conditions, write the set of values that are possible for $h_3(B)$. For example, to denote all non-negative numbers, write $[0, \infty]$, to denote the empty set, write \emptyset , and so on.

- What values of $h_3(B)$ make h_3 admissible? [2]
- What values of $h_3(B)$ make h_3 consistent? [1.5]
- What values of $h_3(B)$ will cause A* graph search to expand node A, then node C, then node B, then node D in order? [1.5]

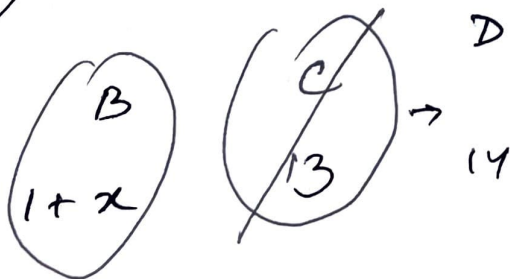
i) actual cost at B = 12
 $h(B) \leq 12$



$$\begin{aligned}
 10 - x &\leq 1 \rightarrow x \geq 9 \\
 x - 9 &\leq 1 \rightarrow x \leq 10 \\
 x - 7 &\leq 5 \rightarrow x \leq 12
 \end{aligned}$$

$x \in [9, 10]$

iii) A will push B and C



$$1 + x > 13 \Rightarrow x > 12$$

$$1 + x \leq 14 \Rightarrow x \leq 13$$

$$x \in [12, 13]$$