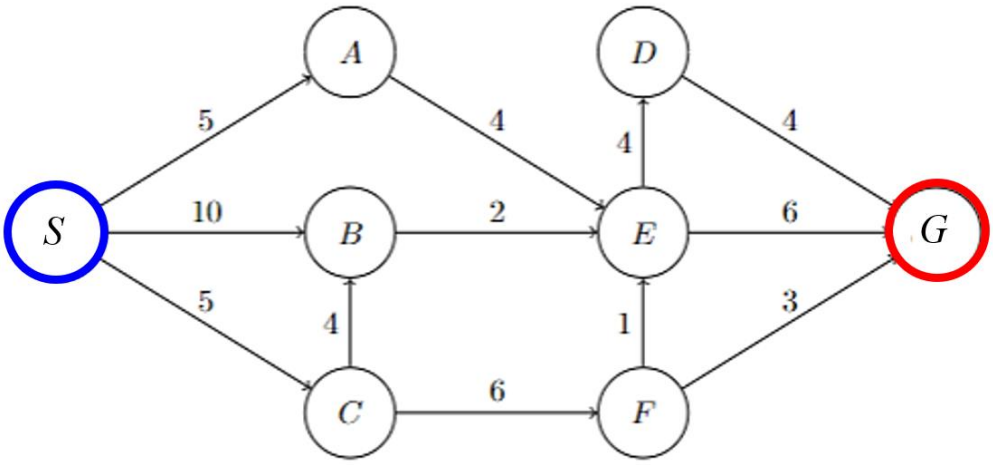
IN-CLASS EXERCISE (I2)

Student ID:..... Duration: 20 mins Date: 27/02/2024

Student name: ..... Score: ...../ 3

Q1 (2.5pts) Consider the following graph. The initial state is **vertex A**, and the goal state is **vertex G**. The heuristic table is shown aside the graph. **Ties are broken in alphabetical order**.



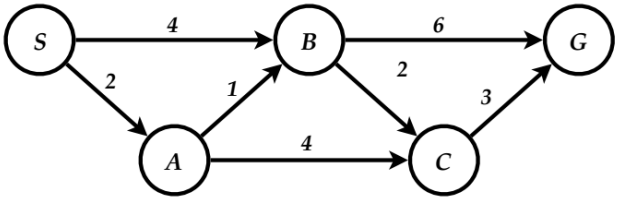
Vertex	Heuristic
S	2
A	6
B	4
C	6
D	2
E	2
F	3
G	0

For each of the following search strategies, state the order in which states are expanded and the path returned. Vertices should be presented in their exact order. *Note that:*

- *The path returned will not be accepted if the list of expanded states is wrong.*
- *We apply early stopping for BFS, DFS, and GBFS.*

Algorithm	**List of expanded states in exact order**	**Path returned**
Uniform cost search (0.5pt)	S A C B E F D G	S C F G
Breadth-first search (0.5pt)	S A B C E	S A E G
Depth-first search (0.5pt) avoid repeating any state on the current path	S A E	S A E G
GBFS (0.5pt)	S B E	S B E G
A* (0.5pt)	S A C E B F G	S C F G

Q2 (0.5pt) Consider the following graph, whose initial state is **vertex S** and goal state is **vertex G**. The aside table shows two heuristics. Which of the two heuristics is **inadmissible**? Explain your answer.



	S	A	B	C	G
H1	8	3	7	2	0
H2	7	4	5	2	0

H1. Since H1(B) = 7 > H*(B) = 5.

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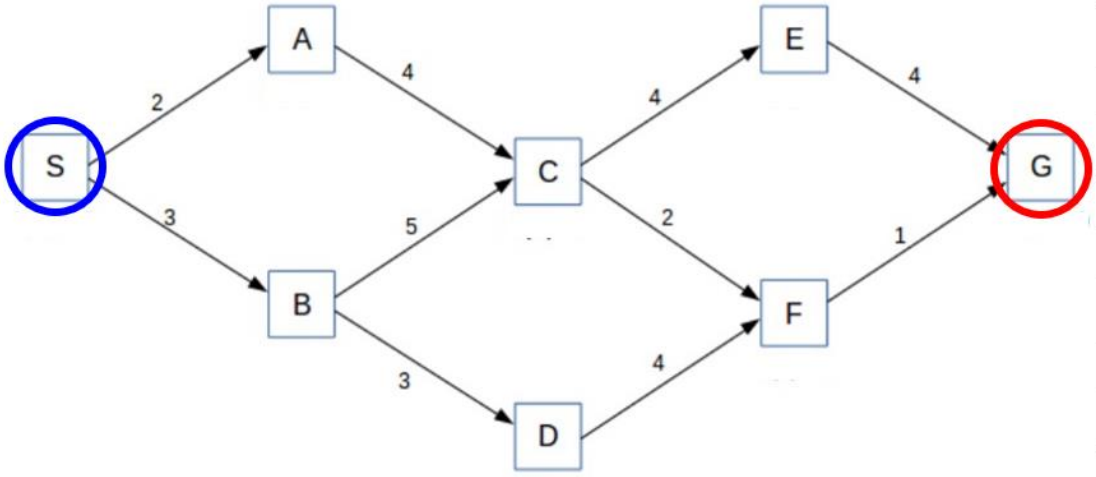
Q1 (2.5pts) Consider the following graph. The initial state is **vertex S**, and the goal state is **vertex G**. The heuristic table is shown aside the graph. **Ties are broken in alphabetical order**.



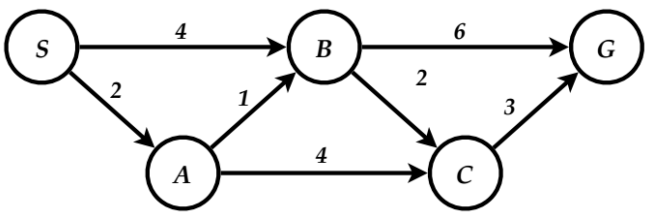
Vertex	Heuristic
S	6
A	5
B	3
C	3
D	4
E	3
F	1
G	0

For each of the following search strategies, state the order in which states are expanded and the path returned. Vertices should be presented in their exact order. *Note that:*

- *The path returned will not be accepted if the list of expanded states is wrong.*
- *We apply early stopping for BFS, DFS, and GBFS.*

Algorithm	**List of expanded states in exact order**	**Path returned**
Uniform cost search (0.5pt)	S A B C D F G	S A C F G
Breadth-first search (0.5pt)	S A B C D E	S A C E G
Depth-first search (0.5pt) avoid repeating any state on the current path	S A C E	S A C E G
GBFS (0.5pt)	S B C F	S B C F G
A* (0.5pt)	S B A C F G	S A C F G

Q2 (0.5pt) Consider the following graph, whose initial state is **vertex S** and goal state is **vertex G**. The aside table shows two heuristics. Which of the two heuristics is **inconsistent**? Explain your answer.



	S	A	B	C	G
H1	3	0	4	0	0
H2	7	4	5	2	0

Both. At B – C and S – A. E.g., H1(B) = 4 > H1(C) + cost(B,C) = 2, H2(B) = 5 > H2(C) + cost(B,C) = 4.

IN-CLASS EXERCISE (I2)

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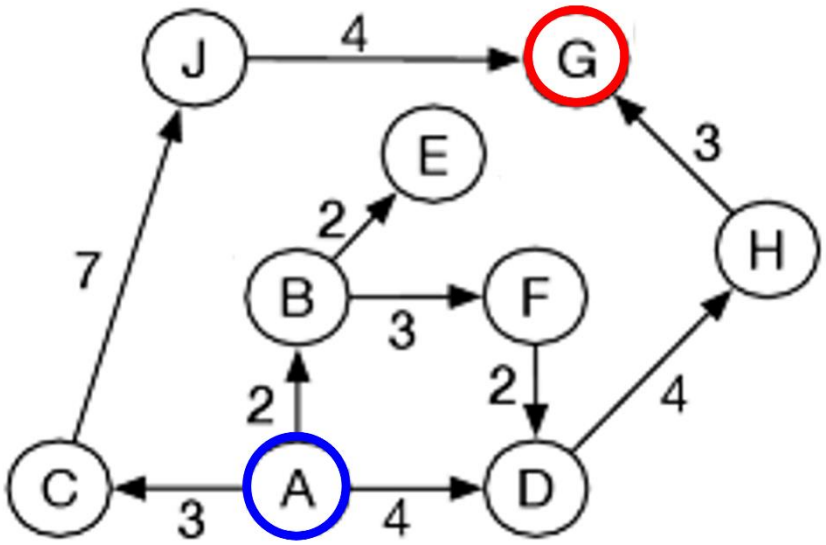
Q1 (2.5pts) Consider the following graph. The initial state is **vertex A**, and the goal state is **vertex G**. The heuristic table is shown aside the graph. **Ties are broken in alphabetical order**.



Vertex	Heuristic
A	7
B	5
C	9
D	6
E	3
F	5
G	0
H	3
J	4

For each of the following search strategies, state the order in which states are expanded and the path returned. Vertices should be presented in their exact order. *Note that:*

- *The path returned will not be accepted if the list of expanded states is wrong.*
- *We apply early stopping for BFS, DFS, and GBFS.*

Algorithm	**List of expanded states in exact order**	**Path returned**
Uniform cost search (0.5pt)	A B C D E F H J G	A D H G
Breadth-first search (0.5pt)	A B C D E F J	A C J G
Depth-first search (0.5pt) avoid repeating any state on the current path	A B E F D H	A B F D H G
GBFS (0.5pt)	A B E F D H	A D H G
A* (0.5pt)	A B E D F H G	A D H G

Q2 (0.5pt) *An inconsistent heuristic is also inadmissible*. Is the given statement TRUE or FALSE? If true, explain why. If false, give a counter example.

False. An inconstent heuristic still may be admissible. Counter example: refer to the heuristic function H1 in Q2 in the previous page.

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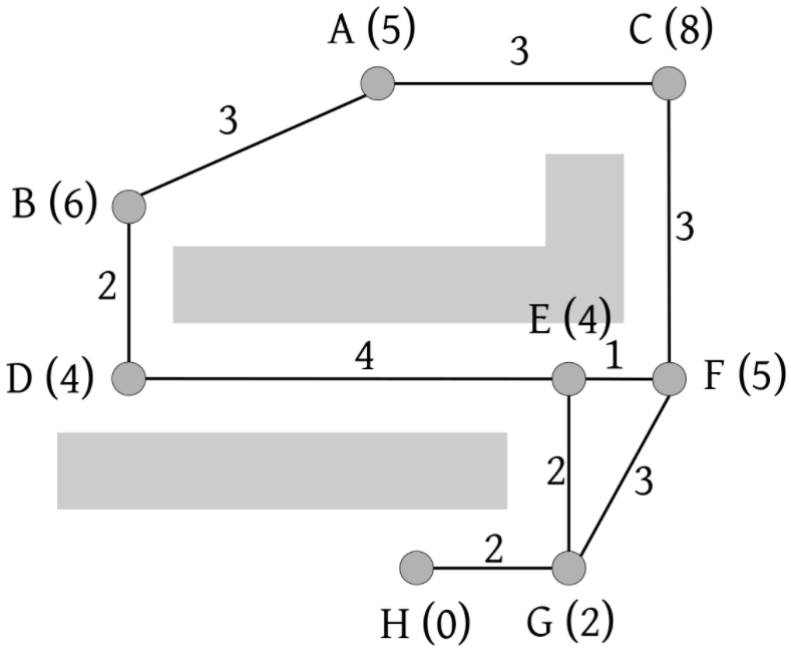
.Q1 (2.5pts) Consider the following graph. The initial state is **vertex A** and the goal state is **vertex H**. For each state, its heuristic value is written aside (in the parentheses). **Ties are broken in alphabetical order**



For each of the following search strategies, state the order in which states are expanded and the path returned. Vertices should be presented in their exact order. *Note that:*

- *The path returned will not be accepted if the list of expanded states is wrong.*
- *We apply early stopping for BFS, DFS, and GBFS.*

Algorithm	**List of expanded states in exact order**	**Path returned**
Uniform cost search (0.5pt)	A B C D F E G H	A C F G H (A C F E G H acceptable)
Breadth-first search (0.5pt)	A B C D F E G	A C F G H
Depth-first search (0.5pt) avoid repeating any state on the current path	A B D E F C G	A B D E F G H
GBFS (0.5pt)	A B D E G	A B D E G H
A* (0.5pt)	A B D C F E G H	A C F G H (A C F E G H acceptable)

Q2 (0.5pt) In the 8-puzzle problem, between the Hamming distance heuristic and the Manhattan distance heuristic, the latter one is a dominant heuristic. Explain why.

The two heuristic are both admissible. The Manhattan distance heuristic evaluates any state with a value that is always greater or equal to that of the Hamming distance (since it is the number of tiles to travel).