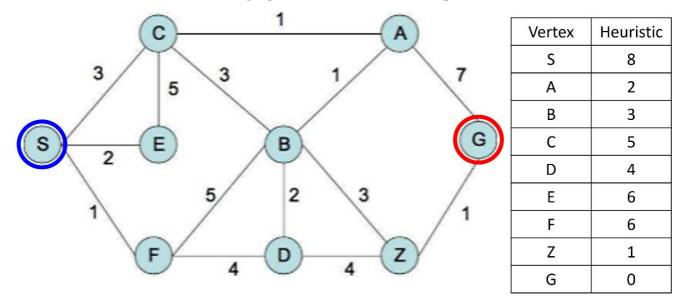
	Duration: 15 mins	
		Date: 28/02/2023
		Score: <u>/ 3</u>
Student ID:	Student name:	

Question 1 (2pts) 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**.



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 without spaces in between, e.g., SABC)

Note that the path returned will not be accepted if the list of expanded states is wrong.

Algorithm	List of expanded states in exact order	Path returned
Uniform cost search (1pt)		
Iterative deepening search	Level 0:	
(0.5pt)	Level 1:	
	Level 2:	
Graph-search GBFS (0.5pt)		

Question 2 (1pt) Explain why the following statement is TRUE (or FALSE).	
If $h_1(s)$ is a consistent heuristic and $h_2(s)$ is an admissible heuristic, $h_3(s) = \min(h_1(s), h_2(s))$ must be consistent.	

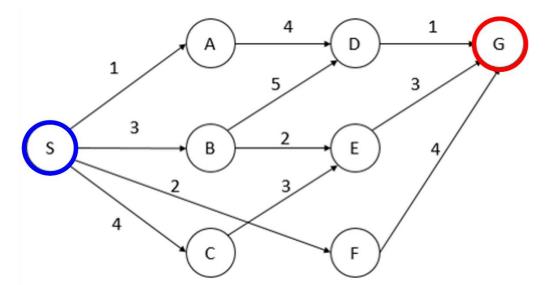
	Duration: 15 mins		Date: 28/02/
			Score:
Student ID:	Student name:		•••••
	llowing graph. The initial state is vertex S , a e the graph. Ties are broken in alphabetic		l state is vert
(c)—	1 (A)	Vertex	Heuristic
		S	8
3/5	3 1/	Α	2
		В	3
(S) (E)	(G)	С	5
2		D	4
	5/ 2 3	E	6
1\ -/		F	6
(F)	(z)	Z	1
	4 0 4 0	G	0
turned. Vertices should be pres	strategies, state the order in which states sented in their exact order without spaces in ot be accepted if the list of expanded states is List of expanded states in exact order	between, wrong.	
Graph-search A* (1pt)			
Depth-first search (0.5pt) void repeating any state on the current path			
Breadth-first search (0.5pt)			
	following statement is TRUE (or FALSE). heuristics, then their average f(s) = 0.5g(s) + 0.	5h(s) must	also be admis

Duration: 1	5 mins	

Date: 28/02,	/2023
Score:	/ 3

Student ID: ____Student name: ____

Question 1 (2pts) 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
Α	5
В	3
С	5
D	1
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 without spaces in between, e.g., SABC) *Note that the path returned will not be accepted if the list of expanded states is wrong.*

Algorithm	List of expanded states in exact order	Path returned
Uniform cost search (1pt)		
Iterative deepening search	Level 0:	
(0.5pt)	Level 1	
	Level 2:	
Graph-search GBFS (0.5pt)		

Question 2 (1pt) I	s tree-search A*	guaranteed to	be optimal w	ith a consistent	heuristic func	tion? Justify
your answer.						

	Duration: 15 mins	5 .	20/02/2021
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Student ID:	Student name:		
	lowing graph. The initial state is vertex S , a e the graph. Ties are broken in alphabetic	_	te is vertex G .
	4 1	Vertex	Heuristic
1 A		S	6
1	5 3	А	5
3 ~		В	3
(s)	$\frac{2}{}$ (E) 4/	С	5
2	3	D	1
4		E	2
* \C	E V	F	3
		G	0
eturned. Vertices should be pres lote that the path returned will no	strategies, state the order in which states ented in their exact order without spaces in ot be accepted if the list of expanded states is	between, e.g., wrong.	SABC)
Algorithm	List of expanded states in exact order	Path ref	turned
Graph-search A* (1pt)			
Depth-first search (0.5pt)			
avoid repeating any state on the current path			
Breadth-first search (0.5pt)			
Question 2 (1pt) Is graph-search A	* guaranteed to be optimal with an admissi	ble heuristic fu	nction? Justify

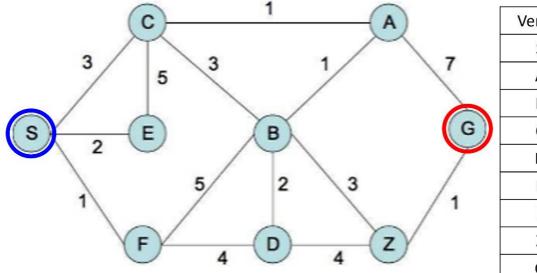
SOLUTION

Duration: 15 mins

Date: 28/02/	2023
Score.	/3

Student ID:	Student name:	

Question 1 (2pts) 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	8
Α	2
В	3
С	5
D	4
Е	6
F	6
Z	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 without spaces in between, e.g., SABC) *Note that the path returned will not be accepted if the list of expanded states is wrong.*

Algorithm	List of expanded states in exact order	Path returned
Uniform cost search (1pt)	S F E C A B D Z G	S C A B Z G
Iterative deepening search	Level 0: S	S C A G
(0.5pt)	Level 1: S C E F	
	Level 2: S C A B E E C F B D	
Graph-search GBFS (0.5pt)	S C A	S C A G

Question 2 (1pt) Explain why the following statement is TRUE (or FALSE).

If $h_1(s)$ is a consistent heuristic and $h_2(s)$ is an admissible heuristic, $h_3(s) = \min(h_1(s), h_2(s))$ must be consistent.

FALSE. $h_2(s)$ may be smaller than $h_1(s)$, and thus $h_3(s) = \min(h_1(s), h_2(s)) = h_2(s)$ is only admissible.

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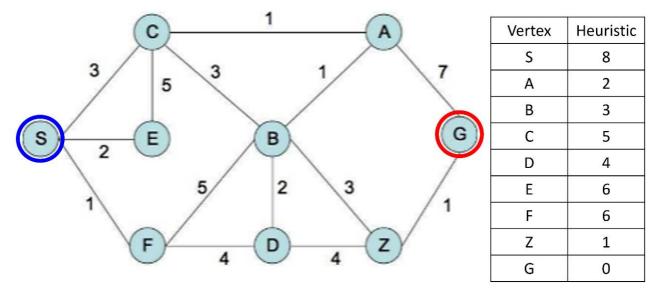
Duration: 15 mins

Date: 28/02/	2023
C	/ 2

Score: /3

Student ID:	Studen	t name:

Question 1 (2pts) 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**.



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 without spaces in between, e.g., SABC) *Note that the path returned will not be accepted if the list of expanded states is wrong.*

Algorithm	List of expanded states in exact order	Path returned
Graph-search A* (1pt)	S F C A B E D Z G	S C A B Z G
Depth-first search (0.5pt)	S C A	S C A G
avoid repeating any state on the current path		
Breadth-first search (0.5pt)	SCEFA	S C A G

Question 2 (1pt) Explain why the following statement is TRUE (or FALSE).

If g(s) and h(s) are two admissible heuristics, then their average f(s) = 0.5g(s) + 0.5h(s) must also be admissible.

TRUE. Let $C^*(s)$ be the optimal path from s to goal. Since g(s) and h(s) are admissible, $g(s) <= C^*(s)$ and $h(s) <= f^*(s)$. Thus, $f(s) = 0.5g(s) + 0.5h(s) <= 0.5C^*(s) + 0.5C^*(s) <= C^*(s)$. Therefore, f(s) is admissible

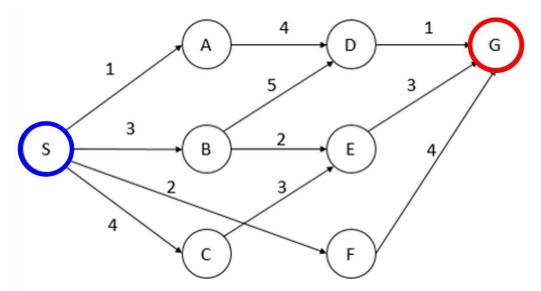
Duration: 15 mins

Date:	28/02/2023

Score: /3

Student ID:	Studen	name:

Question 1 (2pts) 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	
А	5	
В	3	
С	5	
D	1	
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 without spaces in between, e.g., SABC)

Note that the path returned will not be accepted if the list of expanded states is wrong.

Algorithm	List of expanded states in exact order	Path returned
Uniform cost search (1pt)	S A F B C D E G	S F G (S A D G acceptable)
Iterative deepening search	Level 0: S	S F G
(0.5pt)	Level 1: S A B C F	
	Level 2: S A D B D E C E F	
Graph-search GBFS (0.5pt)	S B D	S B D G

Question 2 (1pt) Is tree-search A* guaranteed to be optimal with a consistent heuristic function? Justify your answer.

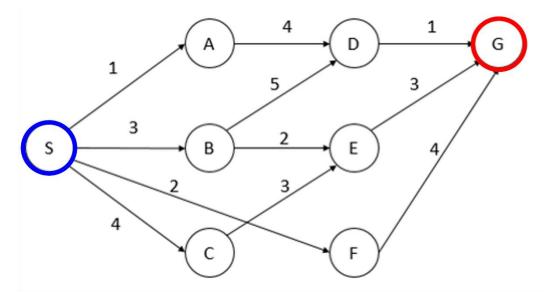
YES. Tree-search A* is optimal with an admissible heuristic. Furthermore, a consistent heuristic is definitely an admissible heuristic. Thus, tree-search A* is optimal with a consistent heuristic.

Duration: 15 mins

Score: /3

Student ID: ____Student name: ____

Question 1 (2pts) 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	
Α	5	
В	3	
С	5	
D	1	
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 without spaces in between, e.g., SABC)

Note that the path returned will not be accepted if the list of expanded states is wrong.

Algorithm	List of expanded states in exact order	Path returned
Graph-search A* (1pt)	S F A B D G	S F G (S A D G acceptable)
Depth-first search (0.5pt)	S A D	S A D G
avoid repeating any state on the current path		
Breadth-first search (0.5pt)	SABCF	S F G

Question 2 (1pt) Is graph-search A* guaranteed to be optimal with an admissible heuristic function? Justify your answer.

NO. Graph-search A* is optimal with a consistent heuristic. Furthermore, an admissible heuristic is not always a consistent heuristic. Thus, graph-search A* is not guaranteed to optimal with an admissible heuristic.