CA318
Labsheet #3

Question 1

Review the following graph heuristics, (shown in dotted red) and classify each graph according to the heuristics given here. Pick one classification from each list.

choose one from this classification

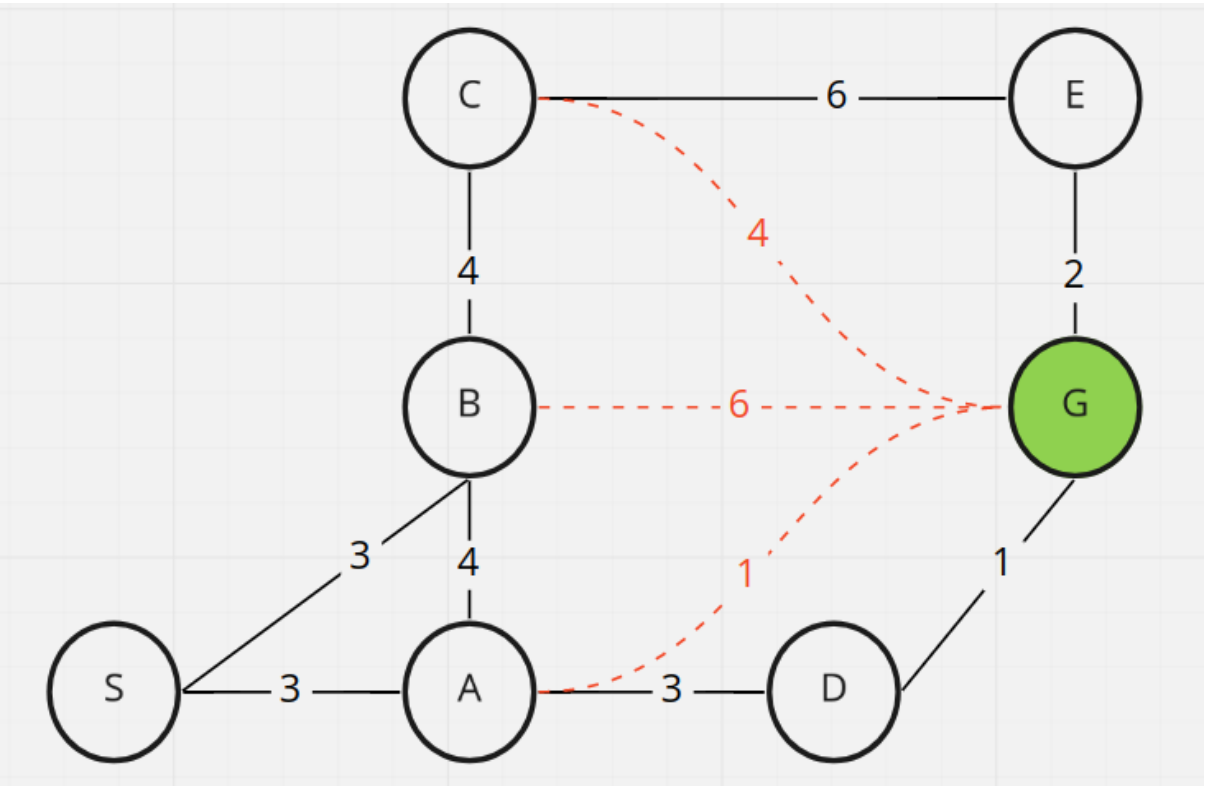
1. All admissible
2. Some admissible, some inadmissible
3. All inadmissible

and choose one from this classification

1. All consistent
2. Some consistent, some inconsistent
3. All inconsistent

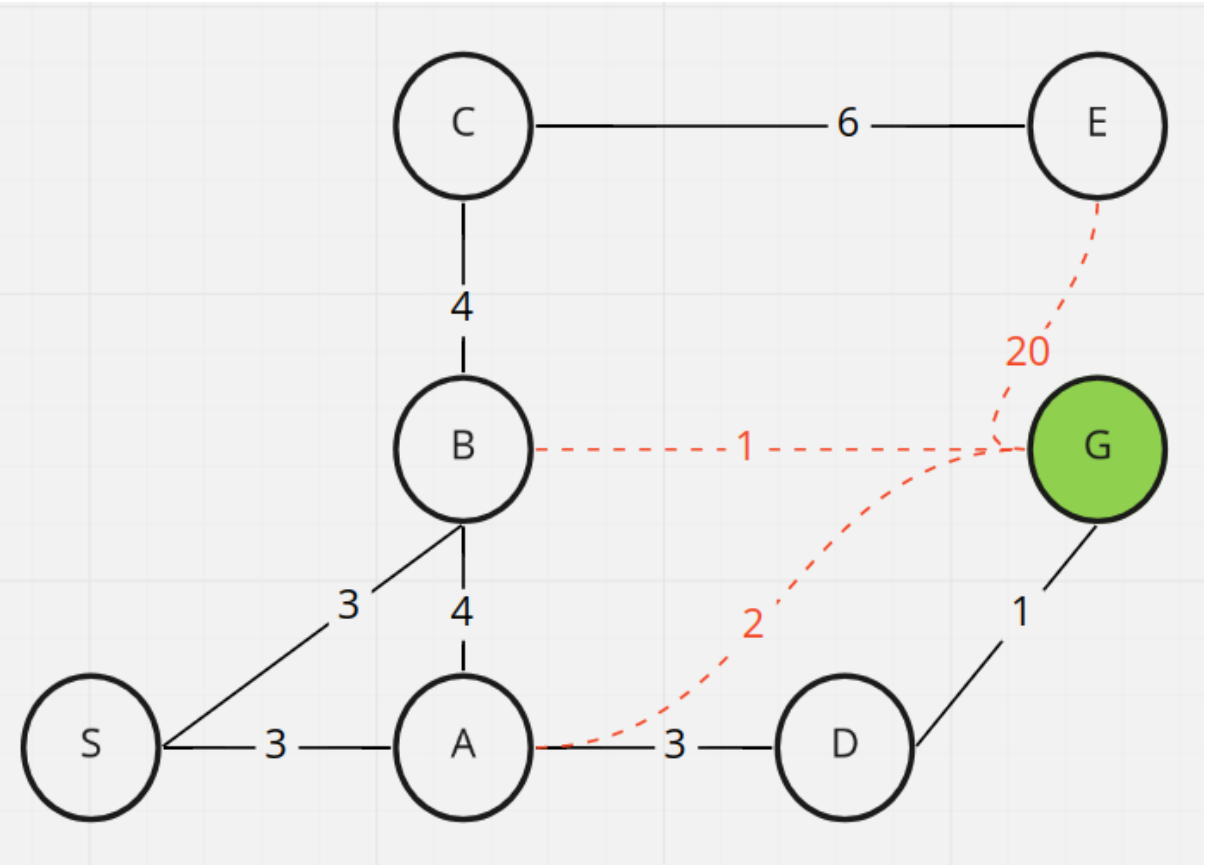
In each graph, show your calculations.

(a)



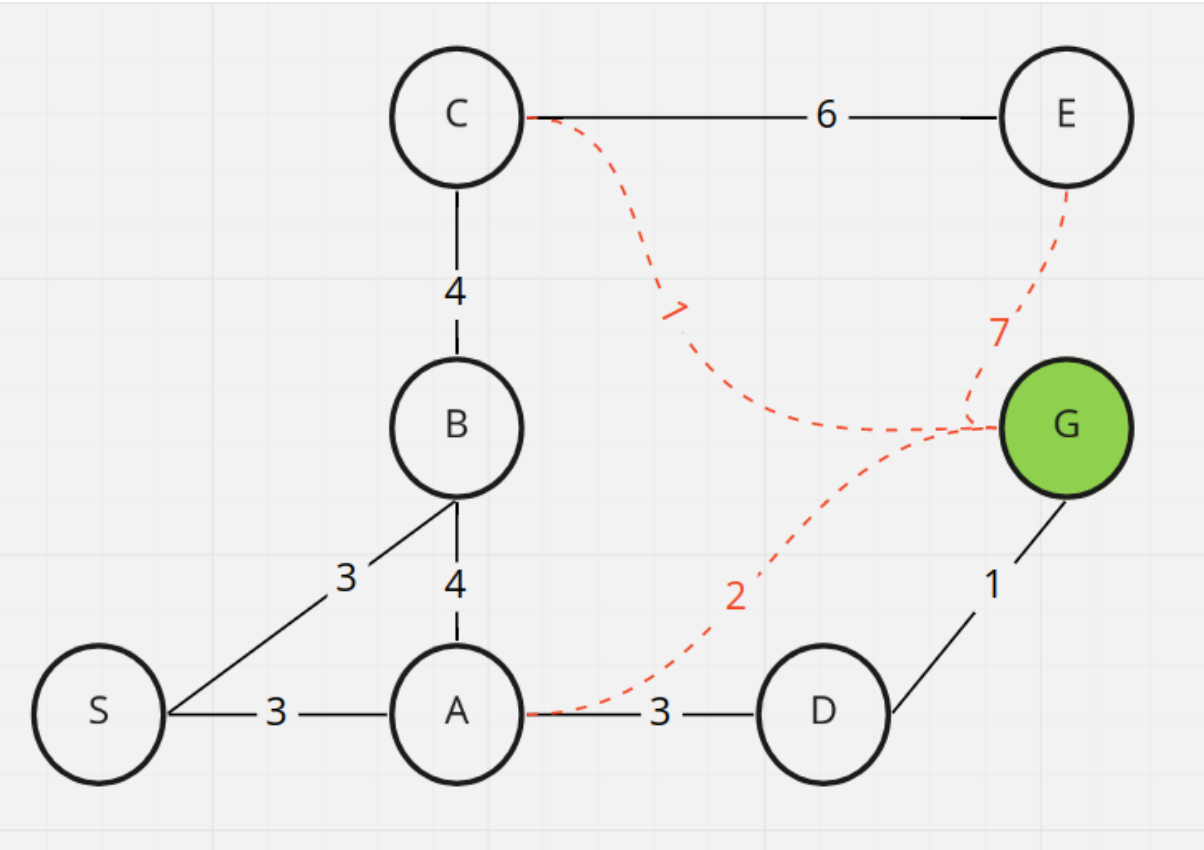
1. All Admissible
2. A-B: 5 > 4 => inconsistent
3. A-C: 3 < 8 => consistent
4. B-C: 2 < 4 => consistent
5. [= some inconsistent]

(b)



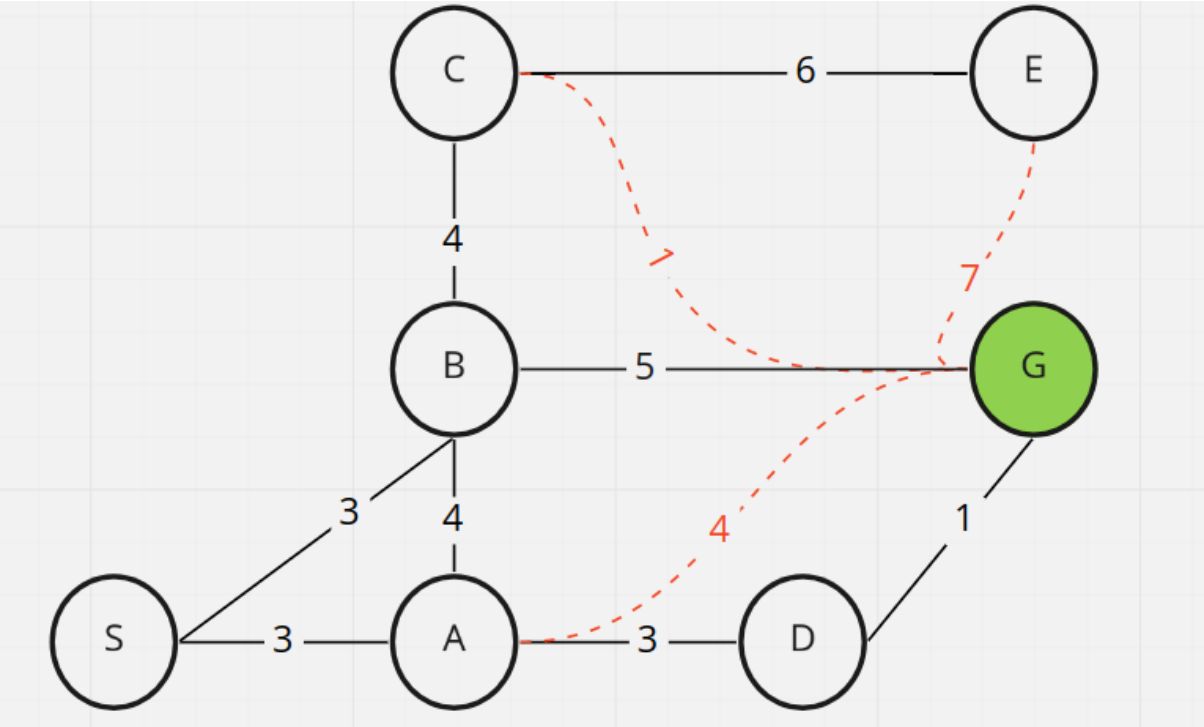
1. Some inadmissible (E)
2. A-B: 2-1 < 4 => consistent
3. B-E: 19 > 10 => inconsistent
4. A-E: 18 > 14 => inconsistent
5. [= some inconsistent]

(c)



1. All admissible
2. A-C: 2-1 < 8 => consistent
3. C-E: 6 < 10 => consistent
4. A-E: 5 < 14 => consistent
5. [= all consistent]

(d)

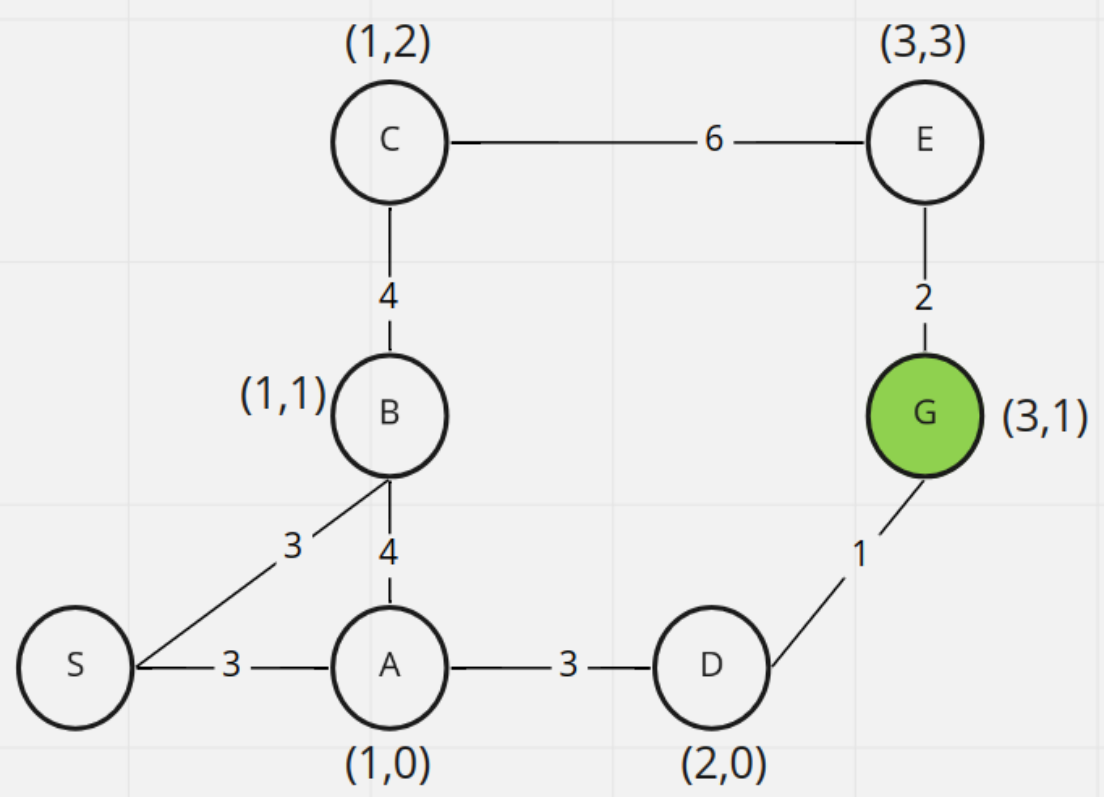


1. All admissible
2. A-C: 4-1 < 8 => consistent
3. C-E: 6 <= 6 => consistent
4. A-E: 3 < 14 => consistent

[= all consistent]

Question 2

Consider the following graph in 2-dimensional Euclidean space. Each node (except the start) has the (x,y) coordinates alongside.



Using the formula from the lecture for Euclidean distance in 2 dimensional space:

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Compute the heuristic distance to G for each node **A,B,C,D,E** using the table here and test each to ensure it is admissible :

Node Pair	**Heuristic Distance**	**Admissible?**
A-G	sqrt((1-3)^2 + (1-0)^2) = 2.236068	yes
B-G	sqrt((1-3)^2 + (1-1)^2) = 2	yes
C-G	sqrt((1-3)^2 + (2-1)^2) = 2.236068	yes
D-G	sqrt((2-3)^2 + (0-1)^2) = 1.414214	yes
E-G	sqrt((3-3)^2 + (3-1)^2) = 2	yes

Question 3

Consider the following definitions for Admissible and Consistent Heuristics:

$$\textit{Admissible:}\ |H(x,G)| \leq D(x,G)$$
$$\textit{Consistent:}\ |H(x,G) - H(y,G)| \leq D(x,y)$$

Write a plain english definition of each of these without the use of mathematics

Admissible: “the heuristic distance to the goal must always be less than or equal to the actual distance ”

Consistent: “Given two nodes x and y, the heuristic distance from x to the goal minus the heuristic distance from y to the goal must be less than or equal to the actual distance from x to y”

Question 4

Your friend has asked you to explain how the use of the **Already Extended List** in A* Search enables the algorithm to find the optimal solution.

What do you say?

The **Already Extended List** does not enable the algorithm to find the optimal solution. It enables the algorithm to find the optimal solution more quickly by eliminating re-evaluation of already extended nodes.