

## Quiz 7

1. It is known that a school has 900 students. A network is drawn with 900 vertices, each representing a student in the school. For one week (Monday to Friday), the stall(s) that each student bought food item from during lunch break was recorded. At the end of each day, an edge is added between two vertices in the network if the two corresponding students bought food from a common stall that day. Edges are added accumulatively from day to day, that is, Tuesday's edges are added on to the edges already drawn at the end of Monday, but edges between the same two vertices are not repeated later in the week once it has been drawn earlier.

It is known that Bobby bought a cup of coffee from a particular drink stall on Wednesday, like 309 others from the school.

Which of the following statements is/are true?

- (I) Bobby's degree at the end of Wednesday is greater than or equal to his degree at the end of Tuesday.
- (II) Bobby's degree at the end of Thursday is less than 3 times his degree at the end of Wednesday.

A) Only (I)

B) Only (II)

C) Both (I) and (II)

D) Neither (I) nor (II)

ANSWER: Both statements are TRUE. (I) is true because a vertex's cannot decrease from one day to the next. (II) is true because Bobby is adjacent to at least 309 other vertices. But since Bobby's degree (at any point of time) is at most 899, his degree at the end of Thursday is less than 3 times of his degree at the end of Wednesday.

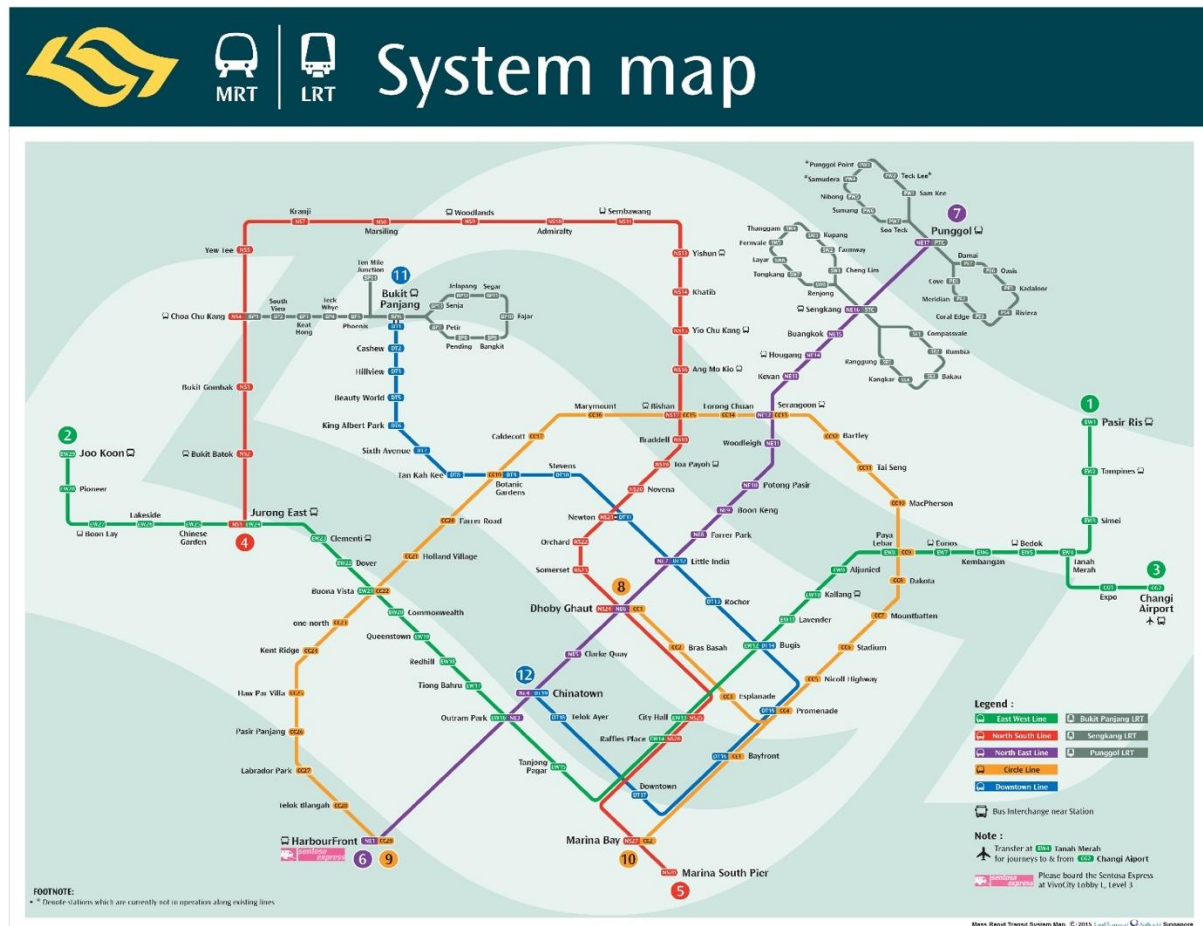
2. (There was an unintended error in this question and was not marked as a result.)

Referring to the previous question, it is further known that there are a total of 10 stalls in the canteen and every student had purchased a food item from at least one stall by the end of Friday. If Charles had purchased food items from all the 10 stalls by the end of Friday, which of the following statement(s) must be true?

- (I) Charles' degree centrality measure will be 1 at the end of Friday.
- (II) Charles' closeness centrality measure will be 1 at the end of Friday.
- (III) Charles' betweenness centrality measure will be 1 at the end of Friday.

A) Only (I)

- B) Only (I) and (II)  
 C) Only (II) and (III)  
 D) None of the statements are necessarily true.



3. Consider the MRT/LRT system map shown above.

Now draw a network with each MRT/LRT station as a vertex, such that two vertices in the network are adjacent if the two corresponding MRT/LRT stations are mutually reachable by MRT/LRT without having to change trains. What is the distance between the vertices HarbourFront and Dhoby Ghaut in the network?

- A) 1  
 B) 2  
 C) 3  
 D) 4  
 E) Cannot be determined with the information given.

**ANSWER:** Since the two stations are on the same (purple) line, the distance between them in the network is 1.

4. Referring to the same network described in the previous question, which of the following statements is/are true?

(II) The closeness centrality measure of Tanah Merah is smaller than the closeness centrality measure of Pasir Ris.

***NOTE: As stated at the bottom right corner of the system map, a commuter needs to transfer at Tanah Merah for journeys to and from Changi Airport.***

(II) The degree centrality measure of Buona Vista is greater than the degree centrality measure of Holland Village.

A) Only (I)

B) Only (II)

C) Both (I) and (II)

D) Neither (I) nor (II)

Answer: Statement (I) is true because Tanah Merah is adjacent to all the vertices that Pasir Ris is adjacent to (and in addition, Expo and Changi Airport). The distance from Tanah Merah to all other vertices in the network NOT ON THE GREEN LINE is the same as the distance from Pasir Ris to these vertices.

Statement (II) is true because Buona Vista is adjacent to all the vertices that Holland Village is adjacent to PLUS all other vertices on the GREEN LINE.

5. With reference to the discussion of the Bacon number of an actor, suppose the Bacon number of an actor A was initially computed to be 2. However, it was later discovered that there were some errors in the database. The errors were namely:

(I) There is a movie, not involving Kevin Bacon, that was omitted from the database.

(II) There is another actor Z, who was omitted from the database.

Suppose the errors are corrected. Which of the following statement is correct?

A) The Bacon number of actor A is now 1.

B) The Bacon number of actor A is still 2.

C) The Bacon number of actor A is now 3.

D) It depends, the Bacon number of actor A now could be 1,2 or 3.

Answer: The Bacon number of actor A cannot be bigger than 2 after the errors are corrected, since no edges were removed. It also cannot be 1 because the movie that was omitted did not involve Kevin Bacon.