CS-2009: Design and Analysis of Algorithms

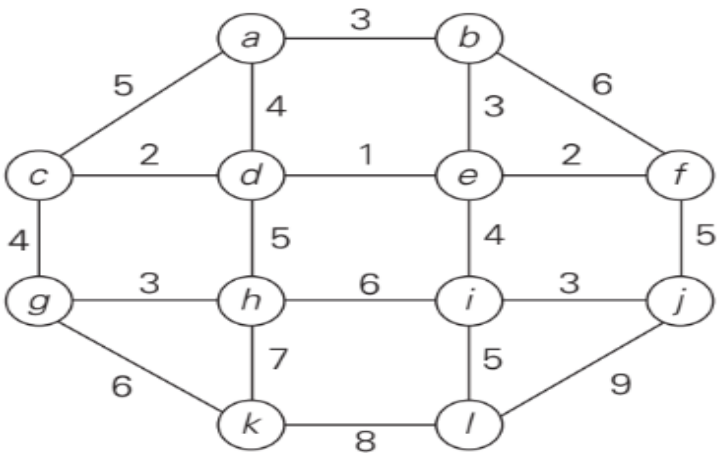
Assignment # 3

Submission Guideline:

- Your answers should be handwritten. You have to submit your assignment in both hard copy and soft copy.
- Mention your Name, Roll no and Section on front page.
- Submit your hard copy in A209F or A209E till 3pm (Monday 25 November).
- You have to submit soft copy on GCR.
- Use camscanner application to compile your assignment in a pdf format in a single file. Name it as your name and roll no and submit on GCR in due time.
- No late submissions will be accepted.

Q no. 1

Apply Prim's algorithm to the following graph.

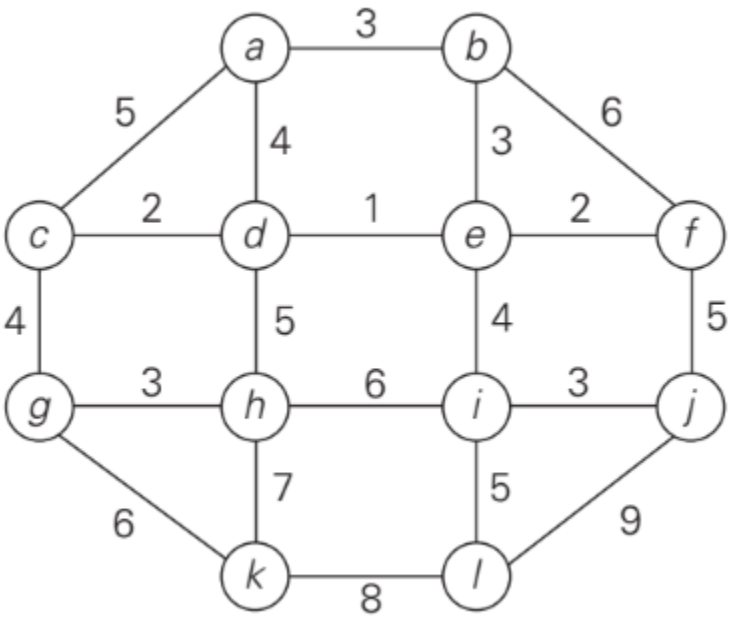


b. The notion of a minimum spanning tree is applicable to a connected weighted graph. Do we have to check a graph's connectivity before applying Prim's algorithm, or can the algorithm do it by itself?

c. Let T be a minimum spanning tree of graph G obtained by Prim's algorithm. Let Gnew be a graph obtained by adding to G a new vertex and some edges, with weights, connecting the new vertex to some vertices in G. Can we construct a minimum spanning tree of Gnew by adding one of the new edges to T ? If you answer yes, explain how; if you answer no, explain why not.

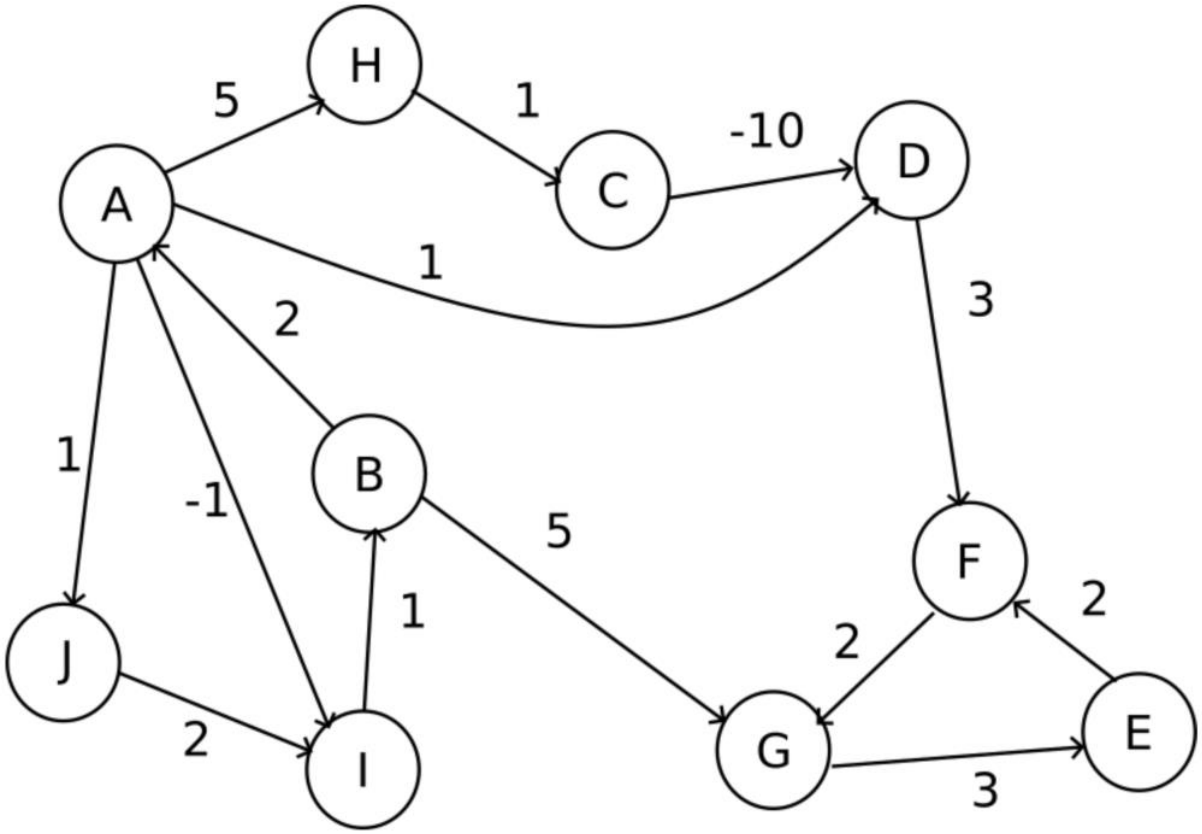
Q no 2

Apply Kruskal's algorithm to find a minimum spanning tree of the following graphs.



Q no.3

Appy Dijkastra and Bellmanford algorithm on the following graph using source as vertex A. Properly draw each step and iteration of the algorithms. At the end also construct path for each destination.



B. Can Dijkastra give correct result in negative weights graph? If yes, Show any negative weight graph where Dijkastra gives correct result.

Qno 4

Recall the definitions of a substring of a string. The longest common substring problem is as follows. Given two strings, find the longest common substring of the two strings. For example, if A="abcdefgyu" and B="bcdtyu", then the longest common substring of A and B is "bcd" of length 3. Devise a dynamic programming solution to find the longest common substring of two given strings. [Hint: Find the length of the longest common suffix for all substrings of both strings and store these lengths in a table.]

Write a psudocode and also implement dry run of your code on the following two strings.

A= abcdefefgh

B= bcdeggfefgg

Q no 5

The counting sums problem is to count the number of ways a number can be written as the sum of two or more positive integers. For example, we can write 6 as the sum of two or more positive integers in the following ways

5 + 1 = 6

4 + 2 = 6

4 + 1 + 1 = 6

3 + 3 = 6

3 + 2 + 1 = 6

3 + 1 + 1 + 1 = 6

2 + 2 + 2 = 6

2 + 1 + 1 + 2 = 6

2 + 1 + 1 + 1 + 1 = 6

1 + 1 + 1 + 1 + 1 + 1 = 6

Using a dynamic programming approach, write an algorithm to determine the number of ways 50 can be written as the sum of two or more positive integers. Also draw a dry run on your algorithm for number 10.