School of Computer Science & Engineering

VIT, Vellore

CSI2003: Advanced Algorithms

FAT Lab Test G1 slot

Faculty: Dr. Lakshmanan K Winter 2020-21 Date of Exam: 02/06/2021

Instructions: 1. There are 2 questions and all need to be answered.

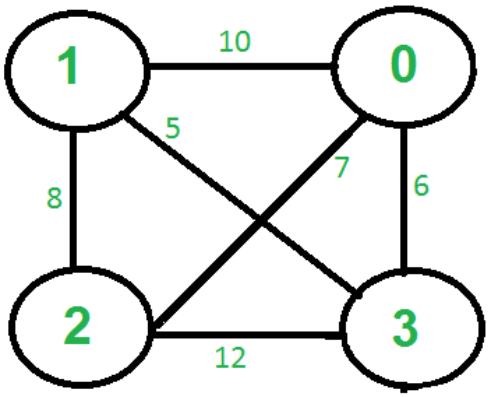
2. Program should be written in C/C++ only.

3. The program and the sample output (possibly with the screenshot image if time permits) should be uploaded as a single pdf file in VTOP before the lab hour ends. Late submissions will be summarily rejected.

4. Store the file name to be Reg.No._Midterm_AdvAlgo

Q1. A newly established bank in a city wants to open ATMs at several locations in the city. Assume that n locations are strategically picked by the factors of landmark, transport facility and population around the place. However , the bank do not have budget to open ATMs at all n locations and their budget allow to open ATMs for only at k locations (1<=k <n). The k places are chosen in such a way that the maximum distance from a place to reach to the nearest ATM should be minimized. The problem is NP-Complete. The question to you is the following. Given, the distance between each place and the k locations,(i) you need to write a program to check whether the given solution is optimum or not.(ii) Implement the following approximation algorithm and give the output of the k locations. Step 1: choose a location randomly from the chosen n locations. The remaining k-1 locations are chosen as follows. Step 2: Choose the i+1th location from the farthest of all already chosen i locations.

Example: In the given below graph, the vertices are the chosen n locations in a city and the edge represent the distance between the locations. For k=2, the optimum locations are (vertices) 2 and 3, since the maximum distance to reach from any other location is 6. If you change to other locations, say k=2 and 0, then the maximum distance to reach the nearest ATM (say from vertex 1) is more than 6.



Q2. A group of students are visiting a foreign university under a fellowship scheme. On arrival, a dinner party for student is arranged where some professors are invited. In order to have maximum interactions between students and professors, it is decided that no two professors should sit together in the long table. Given n and m as the sizes of students and professors respectively (n>=m), write a program to give the seating arrangement that will maximize the interaction. [Hint: Recall an algorithm that you studied in network flow graph and apply to this problem].

Example: Give n = 4 and m =3, the following seating arrangement will give the required solution.

S1 P1 S2 P2 S3 P3 S4. The arrangement P1 S1 P2 S2 P3 S3 S4 will not give the maximum interaction.