

IE102 Spring 2017 Homework V - Due: May 5, Friday 13:30

IMPORTANT: READ BEFORE YOU START WORKING ON THE HOMEWORK

Information on Homework V

- Homework V is 3%. Make sure that you review course material before you start. Homework assignment will be conducted in groups of 2. We randomly form the groups. You can find your group member and his/her contact information at the course website. **If you cannot reach your group member by all means, indicate this on the cover page of your submission.**
- Grading Policy: The homework grades will not be only based on the correctness of the answers provided, but on the perceived degree of effort on the returned assignment. There exists no motive for the students to copy the answers from someone else, since even without obtaining the correct answers one can obtain full credit. The grading scale for each question is 2 points (full effort), 1 point (some effort), and 0 (no effort or completely wrong answer).
- Academic Dishonesty (taken from IE102 Course Information): **Academic misconduct is not tolerated, and violations will be treated in accordance with the university policy.** For assignments: Discussion of the course material and working in groups are effective ways of learning. However, this does not mean that you can copy the assignment from one of your friends. You can discuss with your friends, but you should be alone, without any written solution in front of you, when you actually prepare your assignment. It is extremely important to understand the value of this exercise in the process of learning. Any violation of the above understanding will result in measures outlined in the student rules and regulations.
- Submission Information: An assignment submission box will be placed in front of office EA327 on the morning of the submission date and will be removed at the time of the deadline. You need to put your assignment in the designated box before the submission deadline. **Submission via e-mail is NOT accepted.**

Contact TA Ömer Burak Kinay or Okan Dükkancı if you have questions related to this HW:

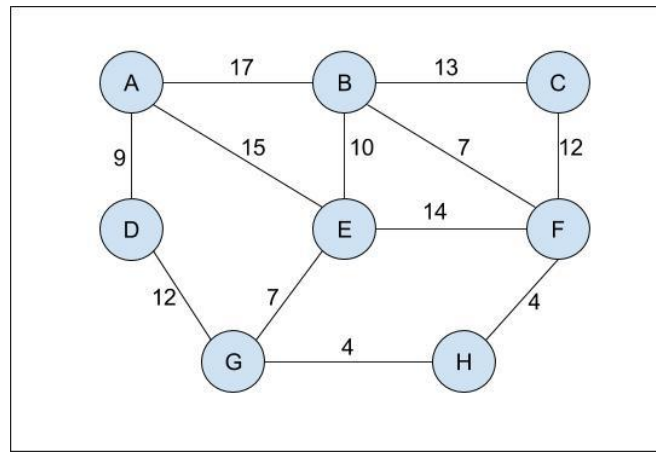
omer.kinay@bilkent.edu.tr

okan.dukkanci@bilkent.edu.tr

There will be an office hour prior to the submission deadline.

Question 1)

Due to the civil war in Syria, in the last couple of years, lots of Syrian refugees have fled to Turkey and most of these refugees live in the refugee camps located in different regions of Southeastern Turkey. To cater to these refugees, the Turkish government decides to open distribution centers (DCs) in some of these refugee camps. While deciding the location of the DCs, the government wants to ensure that the distance between a refugee camp and a DC should not exceed a predetermined limit that is called "allowable distance", so they can easily cater to these refugee camps. The network that shows the location of the refugee camps (A...H) is given below. The numbers on the arcs represent the distance between two refugee camps.

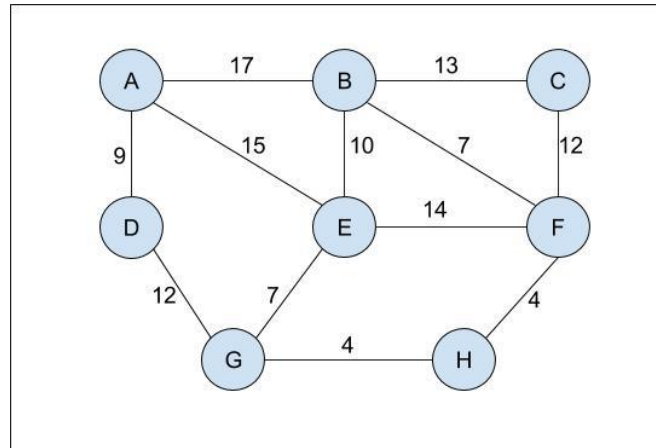


The main aim of the government is to open minimum number of DCs to serve the refugee camps.

- If the allowable distance is equal to 23 km, is there a feasible solution with only one DC? If yes, please indicate the locations in which a DC will be opened.
- If the allowable distance is equal to 20 km, is there a feasible solution with only one DC? If yes, please indicate the locations in which a DC will be opened. Find the feasible solutions with two DCs. Please indicate the combinations of two DC locations (Hint: Construct a 0/1 cover matrix).
- In order to evaluate the locations to open DCs, find the value of the following criteria; the total sum of the distances, the worst distance and twice coverage (whether a refugee camp is covered twice by opened DCs or not) for each combination found in part b.
- Based on the values found in part c, please indicate the combination(s) which are not dominated by other combinations. In order to do that, first you need to scale the values found in part c in Common Units (Hint: The range of each criterion should be between the minimum and maximum values found in part c).
- If the weight of each criterion equals to each other, which combination (among the combinations which are not dominated) do you select?

Question 2)

Consider the same problem introduced in Q1. This time the government would like to develop an electrical infrastructure for these refugee camps (A...H). The network is shown below:



- Suppose that the government wants to ensure full connectivity of all refugee camps. Nonetheless, they want the total length of the electrical wire minimized. Find this value and illustrate the corresponding minimum length electrical grid. Use the appropriate algorithm that is covered in class. Shows steps of the algorithm explicitly. (Hint: You may think this problem as a minimum spanning tree (MST) problem).
- Suppose that the government is considering building partial connectivity electrical infrastructure for these refugee camps. It is known that the government has sufficient funds for connecting at most 4 camps. To be able to minimize the risk of voltage drops in the infrastructure, they want the network to have mean intercamp distance minimized. Use the appropriate algorithm that is covered in class to find a grid of 4 camps that has the minimum mean intercamp distance. Show steps of the algorithm explicitly (Hint: Average length of the segments in the MST corresponds to the mean intercamp distance).