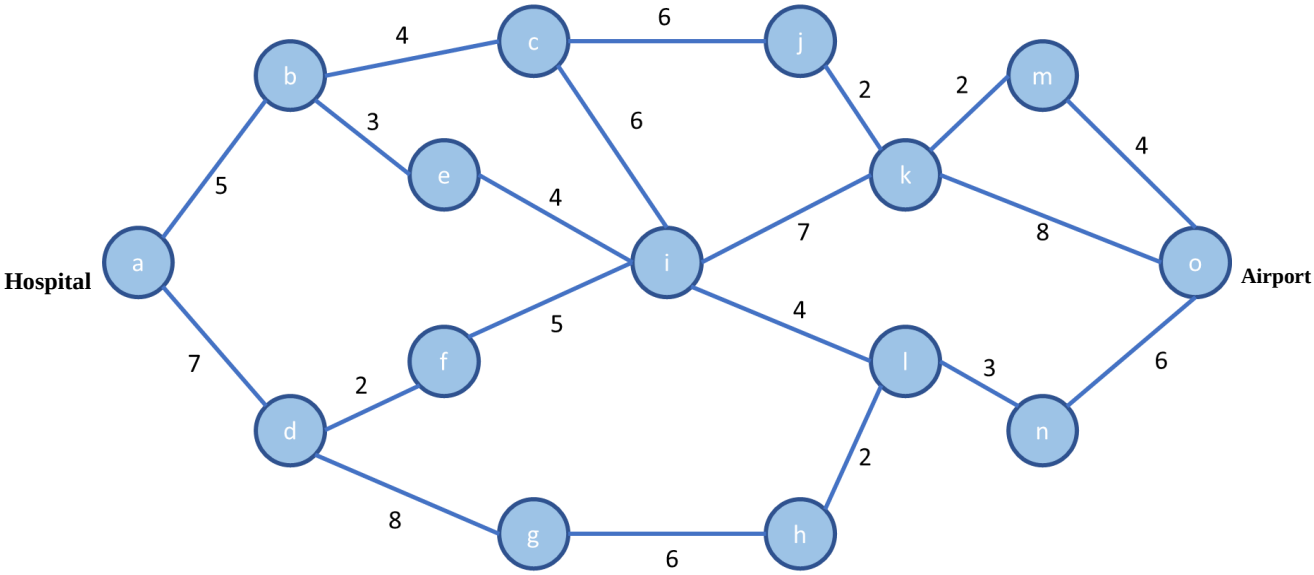
(S2-19_DSECLZG519)
(Data Structures and Algorithms Design)
Academic Year 2019-2020

Assignment 2 – PS11 - [Hospital Emergency] - [Weightage 13%]

1. Problem Statement

Manipal hospital and the Bangalore traffic police are working together on a critical mission: to deliver a heart required for a transplant from the Hospital to the airport. From there it will be flown to Chennai where the recipient patient is being prepped for the surgery.

Given the urgency and criticality of this mission, the Bangalore traffic police has agreed to set up a traffic free and signal free corridor for the ambulance carrying the organ to reach the airport in the quickest possible time. The police IT department has a layout of the Bangalore map with roads and junctions / signals between the hospital and the airport. (the length in kilometres of the road is indicated by the weightage of each connecting line and the junction / signal is indicated by the nodes). Now they need your help in finding the best possible route with the shortest distance that the ambulance should use.



Your job is to help the Bangalore traffic police with the following queries.

1. Which is the shortest route to reach the airport from the hospital? The hospital and airport nodes should be taken as an input and is not fixed to the nodes mentioned in the graph above.

2. How long would it take for the ambulance to reach the airport if the ambulance travels at an average speed of 80 km/hr.

Requirements:

1. Formulate an efficient algorithm to perform the above task.
2. Provide a description about the design strategy used
3. Analyse the time complexity of the algorithm and show that it is an “efficient” one.
4. Implement the above problem statement using Python 3.7

Sample Input:

Input should be taken in through a file called “**inputPS11.txt**” which has the fixed format mentioned below using the “/” as a field separator:
<node 1> / <node 2> / <distance in km>

Ex:

a / b / 5
b / c / 4
a / d / 7
…

Hospital Node: a

Airport Node: o

Note that the input data shown here is only for understanding and testing, the actual file used for evaluation will be different.

Sample Output:

Shortest route from the hospital 'a' to reach the airport 'o' is [a, b, c, j, k, m, o]
and it has minimum travel distance 23km
it will take 17:15 minutes for the ambulance to reach the airport.

Note that the output data shown here is only for understanding and testing, the actual file used for evaluation will be different. The output need not match the sample input provided earlier.

The output should be written to the file **outputPS11.txt**

2. Deliverables

- Word document **designPS11_<group id>.docx** detailing your algorithm design and time complexity of the algorithm.
- **[Group id]_Contribution.xlsx** mentioning the contribution of each student in terms of percentage of work done. Download the Contribution.xlsx template from the link shared in the Assignment Announcement.
- **Zipped AS2_PS11_HospEmerg_[Group id].py package folder** containing all the modules classes and functions and the main body of the program.
- **inputPS11.txt** file used for testing
- **outputPS11.txt** file generated while testing

3. Instructions

a. It is compulsory to make use of the data structure(s) / algorithms mentioned in the problem statement.
b. Use only native data types like lists and tuples in Python. Use of libraries like graph, numpy, pandas library etc. is not allowed. The purpose of the assignment is for you to learn how these data structures are constructed and how they work internally.
c. It is compulsory to use Python 3.7 for implementation.
d. Ensure that all data structure insert and delete operations throw appropriate messages when their capacity is empty or full.
e. For the purposes of testing, you may implement some functions to print the data structures or other test data. But all such functions must be commented before submission.
f. Make sure that your read, understand, and follow all the instructions
g. Ensure that the input, prompt and output file guidelines are adhered to. Deviations from the mentioned formats will not be entertained. If your program fails to read the input file used for evaluation, your program will not be evaluated.
h. The input, prompt and output samples shown here are only a representation of the syntax to be used. Actual files used to test the submissions will be different. Hence, do not hard code any values into the code.
i. Run time analysis is provided in asymptotic notations and not timestamp based runtimes in sec or milliseconds.

4. Deadline

a. The strict deadline for submission of the assignment is 6th Sep, 2020.
b. The deadline has been set considering extra days from the regular in order to accommodate any challenges you might face. No further extensions will be entertained as comprehensive exams will commence in the subsequent weeks.
c. Late submissions will not be evaluated.

5. How to submit

a. This is a group assignment.
b. Each group has to make one submission (only one, no resubmission) of solutions.
c. Each group should zip all the deliverables in one zip file and name the zipped file as below "ASSIGNMENT2_[G1/G2/…].zip" and upload in CANVAS in respective location under ASSIGNMENT Tab.
d. Assignment submitted via means other than through CANVAS will not be graded.

6. Evaluation

a. The assignment carries 13 Marks.
b. Grading will depend on
    a. Fully executable code with all functionality
    b. Well-structured and commented code
    c. Accuracy of the run time analysis and design document.
c. Every bug in the functionality will have negative marking.
d. Use of only native data types and avoiding libraries like numpy, graph and pandas will get additional marks.
e. Source code files which contain compilation errors will get at most 25% of the value of that question.

7. Readings

Text book: Algorithms Design: Foundations, Analysis and Internet Examples Michael T. Goodrich, Roberto Tamassia, 2006, Wiley (Students Edition). Chapters: 7.1, 7.2, 7.3