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قسم علوم الحاسب

CS 215: Design and Analysis of Algorithms	**1437-1438 H, Second semester**
Course Project	**Due to: Sunday (May 14 , 2017)**

Telephone network is one of the network optimization problems. Diagram of any telephone network shows a graph whose vertices represent switches centers, and whose edges represent communication lines between two centers. The network lines have bandwidth and routing the phone call is always done via the highest bandwidth. In this project, you are about designing an algorithm that finds the maximum bandwidth of a path between any two switches centers.

Design and Analyze Algorithm:

Routing Algorithm is the algorithm of finding maximum bandwidth path in a graph. It is based on modification of ***Dijkstra's algorithm*** using a ***Heap structure***. Write a clear pseudocode of routing algorithm, then analyze and find its time complexity.

Implementation:

You are permitted to use any programing environment and language to do the following:

- Generate the graph ***randomly*** with no less than 50 vertices and each vertex has edges incident to about 25% of the other vertices. Randomly assign positive weights to edges in the graphs.
- Include max-heap structure for maximum, insert, and delete methods. Since the heap structure you implement will be used for a Dijkstra algorithm in the routing operation. To simplify implementation, you can follow the suggestion below:
    - Graph vertices are named by integers 1, 2, …., n.
    - Heap is declared as an array h[1..n], where each element h[i] saves the name of a vertex in the graph.
    - Vertex values are given in another array v[1..n]. Therefore, finding the value of a vertex h[i] in the heap, you can use v[h[i]].

- Implement proposed routing algorithm using generated graph and max-heap subroutines as described above.
- You can get befit of programming environment libraries e.g. graph, priority queue .. etc.
- Extra Credit (2 marks): visualize (draw) the original graph (randomly-generated graph) and resulting maximum path.

Summarized Video:

Use one of the movie maker tools to publish a summarized video from 6m up to 10 minutes. You should explain the algorithms that you are already studied in the lectures and used to complete this project in Arabic language step by step using your voice. Then, explain modification aspects you do in these algorithms to produce routing algorithm; target of this project.

Results:

Test routing algorithm on minimum three of graphs, randomly generated. For each generated graph, choose two vertices: one to be the source and the other to be the destination. Then shows if there is a path P and its weight w(P).

Documentation:

Use CS215 Project Report.docx template to write a report with 5 sections. First section includes Proposed Routing Algorithm pseudocode and its analysis. Second section presents source code. Third section shows screen shots of the results. Fourth section is the conclusion that summarizes what you do to complete this the project, what the benefits you gain and your suggestions of other optimization problems can use this algorithm as a solution. In last section, list all references and helps you used in completing this project even tools and libraries.

Collaboration:

You must work in groups of maximum 3 students. Group of one student is not allowed. You may get benefit of any resources. However, you must make note of your references of that resources in the report.

Submission:

You must submit source code, video, and report as described above. The final submission will be done electronically. Email to your instructor a compressed folder with the following naming schema: Group A-271: CS215 Project. The subject of your email must be the same as the folder name. It is preferred for video to be in one of cloud storage rather than attached to email. Due time will be on Sunday, May 14, 2017 – no later than 11:00 PM.

Evaluation:

Credit 10 marks; your work will be assessed for correctness, clarity, production, and completion. Any cheating case, all parties will be given zero for the assignment.