CSE-321 (Fall 2014) Optional Homework for Extra Credit

1-) You are required to propose a polynomial-time heuristic algorithm for the MINIMUM MAXIMAL MATCHING problem defined below. Your solution should be a heuristic solution. Brute force solutions will not be evaluated. We will evaluate your solution according to its quality. You need to explain your algorithm and the rationale behind it; i.e., for each step, explain why you designed it that way. You need to write your algorithm as a pseudocode, explain the pseudocode together with your justifications for your design. In your report, you also need to make a formal computational complexity analysis of your algorithm (in terms of big-Oh etc. notation).

Subsequently, you need to write a (small) C/C++ program that implements your algorithm.

The method that you need to implement in your program takes as input a graph in the following form:

The header of the method is given below:

```
//A is the 2 dimensional array that represents the graph , m and n are the dimesions of A. If A[i][j]==1
// that means there is an edge between vertex i and j. If A[i][j]==0 that means there is no edge between i
// and j. Your function should return an 2d array of size nXn that represents the minimum maximal matching.
//n is the number of vertices
int[ ] minimumMaximalMatch(int [ ][ ] A,int n)
```

In addition to correctness, you also need to make a performance evaluation of your algorithm as follows:

First, generate 100 random network topologies with node degree of 4 and the number of nodes varying from 50 to 1000. Plot the results of your algorithm as a function of the number of nodes. Each point in your plot should correspond to the sample mean of 100 random network topologies randomly generated according to that particular setting.

Second, generate 100 random network topologies with 500 nodes and vary the node degree parameter in the range from 4 to 10. Again, plot the results of your algorithm as a function of the number of nodes. Each point in your plot should correspond to the sample mean of 100 random network topologies randomly generated according to that particular setting.

Show your results as Matlab figures and also as an Excel file attached to your report. The figure should be in your report, whereas the data should be as a separate Excel file.

In your report, make a discussion about the possible real-life applications of this problem. Your report and program are equally important and will be evaluated separately.

*Upload your source files and documentation to moodle and bring your report to room 108.

MINIMUM MAXIMAL MATCHING PROBLEM

A matching in a graph is a set of edges without common vertices, i.e., a set of pairwise non-adjacent edges. A maximal matching is a matching M of a graph with the property that if any edge not in M is added to M, it is no longer a matching; i.e., M is maximal if it is not a proper subset of any other matching in graph G. A minimum maximal matching is a maximal matching with minimum cardinality (minimum number of edges).