CMPE 597: Spec. Topics Graph Algorithms
Homework 1 (due Nov. 9th)

Problem 1
Prove that the clique problem remains NP-complete for regular graphs. Note that a regular graph is an undirected graph in which all vertices have the same degree.

Problem 2
Show that the following variation of 3SAT, called 1-in-3SAT, is NP-complete. The input is the same as the one for 3SAT. The problem is to determine whether there exists a satisfying assignment such that in every clause *exactly* one of the variables is true.

Problem 3
Using depth first traversal, generate all elementary cycles of a given

- directed graph and

- undirected graph.

For directed graphs, use the *strongly connected components* algorithm to decompose the problem into smaller possible components if possible and find cycles in these components. For undirected graphs, use the *bi-connected components* algorithm to decompose the problem into smaller components if possible and find cycles in these components.

You can assume the following input format for the graph:

```
n m
u1 v1
u2 v2
u3 v3
.. ..
um vm
```

Here, n is the number of vertices, m is the number of edges and the rest of the pairs of numbers on each line are the edges.

Problem 4
Given a directed graph, find strongly connected components of this graph and show the strongly connected components with a different color using the

Udraw software (http://www.informatik.uni-bremen.de/uDrawGraph/en/index.html).
Give screen-dumps of uDraw. You can assume the input format given in
problem 3 for the directed graph.