A. Graph algorithms. You may find the following Wikipedia article useful:

## https://en.wikipedia.org/wiki/Distance\_(graph\_theory)

- 1. [Writing] What is the eccentricity of a vertex in a graph? Illustrate with an example.
- 2. [Writing] What is the radius of a graph? Illustrate with an example.
- 3. [Writing] What is the diameter of a graph? Illustrate with an example.

(10 marks)

- 4. [Algorithm Design] Provide detailed algorithmic solution to compute the *three* properties. You may use functions such as BFS, DFS, and Dijkstra.
- 5. [Complexity Analysis] What are the computational complexities of the three solutions? (30 marks)

B. You are given a data file containing pairs of the names of UOIT faculty instructors. It can be obtained at:

## http://db.science.uoit.ca/share/instructor-pair.txt

Each pair has shared at least one course in common since 2014.

From the file, construct a *bidirectional* graph. The vertices are the instructors, and an edge exists between x and y if they have shared a course. Namely, either (x, y) appears in the file or (y, x) appears in the file.

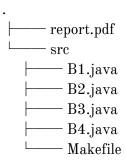
Create the adjacency matrix of the graph G. You must short the adjacency list alphabetically.

- 1. [Program] Use BFS to list all the instructors which are connected (directly or indirectly) to "Ken Pu".
- 2. [Program] Use DFS to list all the instructors which are connected to "Ken Pu".
- 3. [Program & Writing] How many connected components are there? With the help of Google, describe what each connected component represents.
- 4. [Program & Writing] For each connected component, measure the number of vertices and the radius of each component. Tabulate your results. Can you gain some insight into the components?

(60 marks)

## Submission:

You must submit a directory with the following structure



If you use Python, all \*.java files should be \*.py files respectively. You are free to include other files for the sake of code organization.

You must include a Makefile with at least the following targets defined:

make B1

make B2

make B3

make B4

make clean