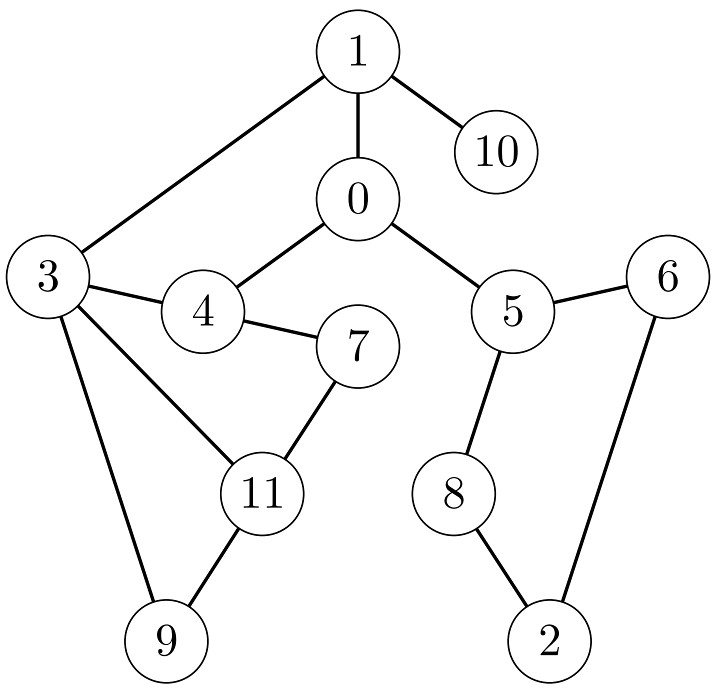
CSC 106 - SPRING 2016
THE PRACTICE OF COMPUTER SCIENCE
ASSIGNMENT 5
UNIVERSITY OF VICTORIA

Due: Tuesday, March 29th, 2016 at 11:00am.

Submit your answers on paper to the CSC 106 drop box on the second floor of ECS. Answers must be well formatted and legible or they will not be marked. Answers which include research from the internet or paper sources must cite all sources used (using the work of others without proper citation is considered plagiarism). All diagrams in your solutions must be clearly labelled and explained.

Question 1: Basic Traversals [16 marks]
Consider the 12-vertex graph G below.



(a) Consider the vertex numbered with the **last digit of your student number**. Starting from that vertex, perform a DFS traversal and draw the resulting DFS tree. At each step, choose the **lowest numbered** unvisited vertex if there are multiple choices for which vertex to visit next.

(b) Perform a BFS traversal, starting at the same vertex as in part (a), and draw the resulting BFS tree.

Question 2: Problem Solving [20 marks]
Consider the following list L of English words.

$L =$ `bash, bath, cape, caps, case, cash, cats, dame, date, dice, dime, fate, hats, haze, hazy, late, lazy, mace maps, mare, mars, math, mats, maze, mice`

A **word ladder** is a sequence of words in L such that each word in the sequence differs by exactly one character from the previous word. For example,

`mice` → `mace` → `mare` → `mars` → `mats` → `cats`

is a word ladder from `mice` to `cats`. For given start and end words, there may be multiple word ladders in a particular word list. For example, both of the below sequences are word ladders from `math` to `cash`.

`math` → `mats` → `cats` → `caps` → `cape` → `case` → `cash`

`math` → `bath` → `bash` → `cash`

(a) The problem of finding word ladders can be solved with graphs, by creating a graph with a vertex for each word in the list and an edge connecting words which differ in one letter. Draw the graph corresponding to the word list above.

(b) Consider the problem of finding the **shortest** word ladder between two words W_1 and W_2. How could the graph representation described in part (a) be used to solve this problem? What algorithms are necessary?

(c) Using the graph you constructed in part (a), find a word ladder from `lazy` to `late`.

Interesting (but difficult) project topic: Write a program which reads a list of words, as well as start and end points for a word ladder, then prints out the shortest possible word ladder.

Question 3: More Problem Solving [24 marks]
A CSC 106 instructor is planning their schedule for the end of the term and wants to complete each of the following tasks:

(L)	Take the teaching team out for lunch
(C)	Make cookies
(E)	Invigilate the exam
(F)	Submit the final grades
(G)	Buy groceries
(K)	Clean the kitchen
(M)	Mark the exam
(O)	Hold office hours
(P)	Process grade corrections
(R)	Mark the project submissions
(S)	Sleep

Only one task can be performed at a time, and there are some restrictions on when certain tasks can be performed:

- The grades cannot be submitted until after the exam and projects are marked and all grade corrections have been processed.
- The exam cannot be marked until after it is given, so task (E) must occur before task (M).
- Sleeping is not permitted until all other tasks are finished.
- The kitchen must be cleaned before buying groceries or making the cookies.
- Office hours must be held before the exam and before grade corrections are processed.
- Grade corrections must be processed before the exam.
- The cookies must be baked before the exam marking starts (to ensure that the instructor is in a good mood while marking).
- The exam must be marked before the instructor takes the teaching team out for lunch.

(a) Describe how this problem (and other problems of this type) can be modelled with a graph.
(b) Draw the graph corresponding to the particular instance of the problem above.
(c) Which graph algorithm can be used to find an ordering of tasks that respects the restrictions?
(d) Give an ordering of all of the tasks above which respects the restrictions.