University of Waterloo
CS240, Spring 2014
Assignment 0

Due Date: Wednesday, May 14, at 9:15am

Please read `http://www.student.cs.uwaterloo.ca/~cs240/s14/guidelines.pdf` for guidelines on submission. For problems $1 - 5$, submit your solutions electronically as a PDF file using MarkUs. This assignment is worth up to 5 bonus marks, which will be added to your total mark for assignment 1.

A0 is designed to introduce you to LaTeX. We strongly encourage students to create all their assignment solutions using LaTeX, as it will strongly benefit both you and your markers. Learning LaTeX is a great asset to have for any course, and also especially for those of you planning to go into academia. LaTeX, like HTML, is best learned by example. To complete the problems below, open the LaTeX file used to make this PDF. Inside the file you will find the code used to write this file along with comments explaining the code to help you get through the assignment. If you get stuck there are also many on-line resources you can use. Searching for "fraction example LaTeX" is acceptable. Searching for "LaTeX proof of summation from 1 to n" is **not** acceptable. To compile the .tex file provided simply type "pdflatex a0.tex" in the school's Linux environment. LaTeX compilers are also free to download on-line. **Submit both a0.pdf and a0.tex to Markus**.

Problem 1 - Mathematics

In CS 240, you will be using many mathematical concepts. It is important to be able to typeset mathematics in your assignments. This will include sums, fractions, subscripts & superscripts, etc.
Example:

$$\bar{f}(n) := \sqrt{\sum_{i=0}^{\lg n} 4^i \left(\frac{n_0}{2^i}\right)^\theta}.$$

In order to practice this skill, write a proof showing:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

Base Case:

$$1 = \frac{1(1+1)}{2}$$

Induction Hypothesis:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

Induction Step:

$$\sum_{i=1}^{n+1} i = \frac{n(n+1)}{2} + n + 1 \tag{1}$$

$$= \frac{n(n+1) + 2n + 2}{2} \tag{2}$$

$$= \frac{n^2 + n + 2n + 2}{2} \tag{3}$$

$$= \frac{(n+1)(n+1+1)}{2} \tag{4}$$

Problem 2 - Trees

CS 240 introduces many tree data structures. Here is a balanced BST on 7 letters of the alphabet. Insert the letters of your first name into the tree (if your first name is shorter than 4 letters, insert your last name as well), starting with the first letter of your name. If you are inserting duplicate letters:

a) Find the largest index of the letter you are inserting.

b) Insert your letter, with an index one larger than the index you found.

c) When comparing to an equal value, follow the left branch.

For example, if you were to insert a 'M' into the tree below, it would be entered as M_1 and it would become the right child of I_0. Only show the resulting tree.
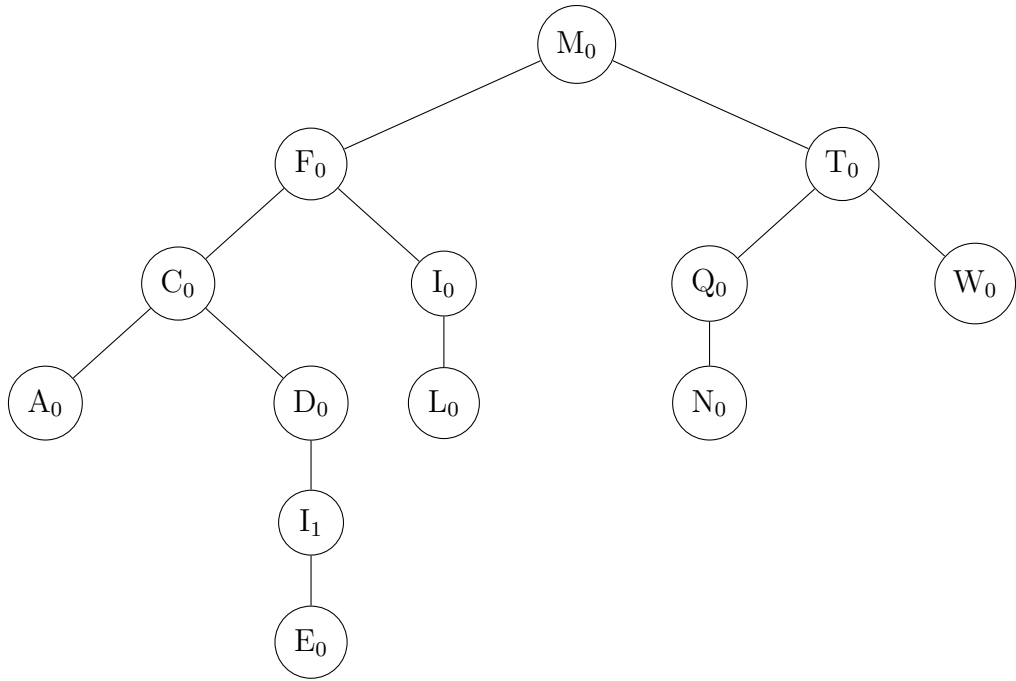
Problem 3 - Plots

CS 240 also deals with many graphs and plots. Plot the following points below, the first one has already been done for you. Only show the resulting plot.
Points: (2,7), (7,1), (4,5), (1,3), (3,2), (6,6), (0,9), (9,8), (8,0), (5,4)
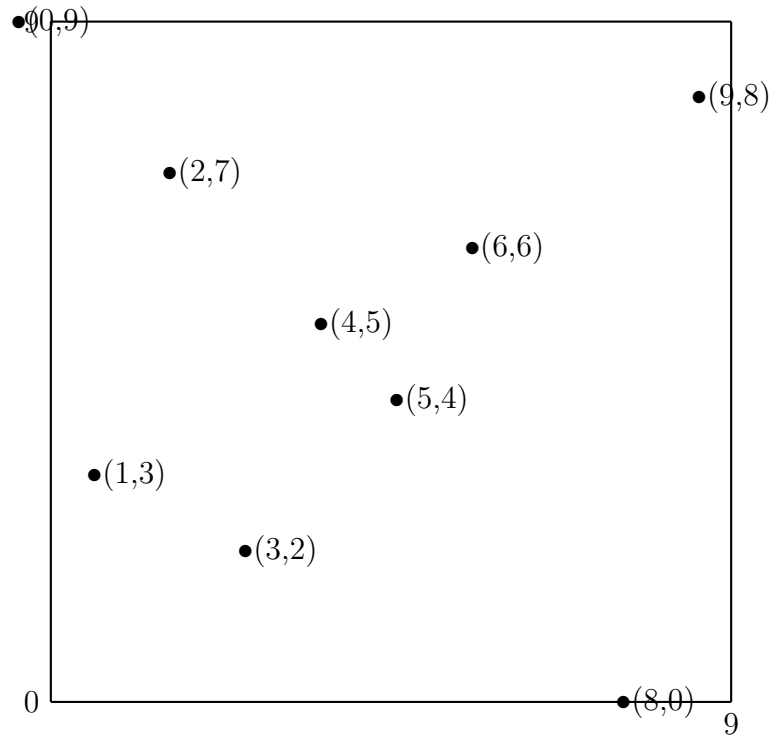
Problem 4 - Tables

Occasionally, you may want to present information in a table. In LaTeX you can easily present data in well structured tables. Fill in the rest of the table below with any animals you like.

Animal's Name	Avg. Weight	Longevity	Avg. Temperature	Conservation Status
Polar Bear	350-700kg	25 years	37°C	Endangered
Grizzly Bear	350-700kg	15 years	37°C	At Risk
Brown Bear	350-700kg	35 years	37°C	Endangered
Winnie the Pooh Bear	350-700kg	5 years	37°C	Mythical

Problem 5 - Images

You may find it too time consuming to do parts of your assignment in LaTeX, at which point you may want to include an image of your work. LaTeX also supports images. Please keep your image sizes small both for this assignment and future assignments; however, be sure

that your images can be easily read by your markers, or you run the risk of losing marks. For this question, include an image of each of the animals you entered in the table above.