EECS 10: Assignment 3

October 6, 2006

Due Monday 10/16/2006 12:00pm

1 Homework Problem 1: Compute the natural logarithm function [20 points]

Write a program in C which computes the natural logarithm function. This function can be algebraically approximated using an infinite sum:

$$\log(x) = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}(x-1)^n = x-1-\frac{(x-1)^2}{2}+\frac{(x-1)^3}{3}-\frac{(x-1)^4}{4}\cdots \quad \text{for} \quad 0 < x < 2,$$

Your program must use only the four basic operations such as addition, subtraction, multiplication and division. Also, please follow the same programming style as discussed in lecture 5 for the cos() function (i.e. do not use any loops in your program).

The goal is to compute the logarithm value such that it has a precision of 3 decimal places. For example, if the value of ln (1.5) = 0.405465…, then your program must output ln (1.5) = 0.405xxxx
You should use as many terms from the above formula as necessary to just achieve the above mentioned precision for the three values given below.

When executed, your program should look like this:

```
Please enter the real value x:
Natural logarithm of x is approximately...
```

Compile your program and run it using the values 0.2, 0.3 and 0.5 as inputs.

You should submit `logn.c, logn.txt` and `logn.script` for this problem.

NOTE: For the `logn.txt`, you should explain how you achieved the requested precision. Be brief and precise. Do not use more than six sentences.

2 Homework Problem 2: Exercise 3.17, pg 92 [20 points]

You should submit `efficiency.c, efficiency.txt` and `efficiency.script`. Use the following cases as inputs:

1) Gallons = 100.0, Miles Driven = 5400
2) Gallons = 13.0, Miles Driven = 300
3) Gallons = 10.5, Miles Driven = 500
4) Gallons = -1, Miles Driven = 0.5

3 Bonus Problem: [5 points]

Extend the program implemented in Homework Problem 2 (Exercise 3.17) such that it also outputs mileage in European Format which is given as litres/100Km. (Km = Kilometer, 1 gallon = 3.78541 litres).

You can use the same files from Homework Problem 2 by simply adding your modification to the same source code (efficiency.c). You should explain both Problem 2 and 3 in the efficiency.txt file.

4 What to turn in

Submission for these files will be similar to last week's assignment. The only difference is that you need to create a directory called **hw3/**. Put all the files listed above in that directory and run the **/ecelib/bin/turnin** command to submit your homework.