MATH 128A, FALL 2018, WILKENING

Programming assignment 1: Due Tues, Sep 18

Combine the write-ups for parts 1 and 2 below in a single pdf file. Upload your code (e.g. if you used MATLAB: polyMinMax.m, nested_sqrt.m, and any code you wrote to generate the plots) as separate files in gradescope, so that we can download and run them if needed.

Part 1: Write a program to take 6 numbers a, b, c, d, e, f and find the locations x_{min} and x_{max} of the absolute extrema of the function

$$p(x) = cx^3 + dx^2 + ex + f$$

over the interval $[a, b]$. Use the appropriate version of the quadratic formula (which depends on the parameters c,d,e) to avoid unnecessary cancellation of digits. Report the extrema returned by your code for the following choices of parameters:

trial	a	b	c	d	e	f
1	-1	2	-1	2	-1	1
2	1	2	1	-2	-1	1
3	-2	1	4	8	-4	-2
4	-1	2	1	0	1	-3
5	-0.3	0.6	10^{-14}	9	-3	0
6	-1	2	0	0	0	1.7
7	0	3	-3	9	-10^{-14}	0
8	0	1	0	-2	3	-1

If you're using MATLAB, the suggested interface is to create a file called `polyMinMax.m` with first line

```
function rslt = polyMinMax(a,b,c,d,e,f)
```

where `rslt` is a row vector containing $[x_{\text{min}}, x_{\text{max}}, p(x_{\text{min}}), p(x_{\text{max}})]$. You can then use the driver routine `part1.m` in the directory `Programming Assignments/prog1` on bCourses to run the cases above. In your write-up, include the output of your code (i.e. x_{min}, x_{max}, $p(x_{\text{min}})$, $p(x_{\text{max}})$ for each case, reported to 6 digits of precision), and plots of $p(x)$ over $[a, b]$ for trials 3 and 7, with markers at the extrema.

Part 2: Write a code that takes an integer, n, and returns the nth term in the following sequence:

$$a_1 = 1, \quad a_2 = \sqrt{1+2}, \quad a_3 = \sqrt{1+2\sqrt{1+3}}, \quad a_4 = \sqrt{1+2\sqrt{1+3\sqrt{1+4}}}, \quad \ldots$$

The suggested interface is to create a file called `nested_sqrt.m` with first line

```
function a = nested_sqrt(n)
```

Evaluate a_n for $1 \le n \le 40$. Guess the limiting value of the sequence, $a = \lim_{n\to\infty} a_n$, and make a plot of $\ln(|a_n - a|)$ vs n. Also plot the line $y = 3 - (\ln 2)n$, treating n as a continuous variable. From the plot, what sequence β_n would you guess is appropriate here: $a_n - a = O(\beta_n)$?

Date: Revised: Sep 1, 2018.