CSE 102 – Computer Programming
HW 03
Last Submission Date: October 31, 2016 –11:00 PM

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1. Write two C programs for each part.
2. For each part write a separate function to perform the tasks of the part as explain below. In main function call these functions to test them.

1. **Part 1: (40 Pts)** In this part you will calculate the sinus of an angle using the Taylor expansion of the sinus function given below.

$$\sin(x) \approx x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \frac{x^{11}}{11!} + \ldots$$

Note that, in the approximation above x must be given in radians, but your code will accept the angle value in degrees from the user. The more terms you used in the calculation above the more precision you get. (For example: x is from 0 to 30.)

User Interface
In the given sequence, your program will:

- Take the angles from the user.
- Take the number of terms to be used in the calculation from the user.
- Output the calculated sinus value.

Implementation Details

- Write a function with the following prototype to perform all operations (by calling other user defined functions) in this part.
  int part1(void)
  This function should return 0 normally and a non-zero value on errors (e.g. in the case user enters a negative value for number of terms)
- You are **not** allowed to:
  - Use math.h library
  - Make any calculations in part1() function
- Perform all I/O operations (from/to file or console) in part1() function, call other user defined functions for calculations.

2. **Part 2: (60 points)**

You construct a mathematical function in terms of x (type: integer) . Users enter the elements of the function from keyboard after entering numbers of the elements. The elements can be elements showing in the below table with any constants (constants type: integer).
The program wants an user function of x and the value of x. The operation is always "+".

- Write a programming function that calculates the first derivative of this entering function.
- Using with call by value method to calculate the result of the function for entering x value. (your parameters are values).
- Using with call by references method to calculate the result of the function for entering x value. (your parameters are pointers).
- Print result of the functions.

Example:

Number of the elements is 2.
The first element entered: 23. e^x
The second element entered: x^3
The operation: +

Function (User created.): $y = 23.e^x + x^3$

$$\frac{dy}{dx} = 23.\ e^x + 3x^2$$

Result is 23 for **x= 0** (Call by value)
Result is 23 for **x= 0** (Call by reference)

Common Functions	Function	Derivative
Constant	c	0
Line	x	1
	ax	a
Square	x^2	2x
Square Root	√x	$(½)x^{-½}$
Exponential	e^x	e^x
	a^x	$\ln(a)\ a^x$
Logarithms	ln(x)	1/x
	$\log_a(x)$	1 / (x ln(a))
Trigonometry (x is in radians)	sin(x)	cos(x)
	cos(x)	−sin(x)
	tan(x)	$\sec^2(x)$

Inverse Trigonometry	$\sin^{-1}(x)$	$1/\sqrt{(1-x^2)}$
	$\cos^{-1}(x)$	$-1/\sqrt{(1-x^2)}$
	$\tan^{-1}(x)$	$1/(1+x^2)$
Rules	**Function**	**Derivative**
Multiplication by constant	cf	cf’
Power Rule	x^n	nx^{n-1}

- Only for part 2 You are allowed to:
  - Use math.h library

General:

1. Obey honor code principles.
2. **Read your homework <u>carefully</u>** and follow the directives about the I/O format (data file names, file formats, etc.) and submission format **<u>strictly</u>**. Violating any of these directives will be penalized.
3. Obey coding convention.
4. Do not forget to put the required **tags** in the main function.
5. Your submission should include the following file **<u>and NOTHING MORE</u>** (no data files, object files, etc):
   HW03_<student_name>_<studentSirname>_<student number>.c
   Do **NOT** compress the file you submit.
6. Do not use non-English characters in any part of your homework (in body, **file name**, etc.).
7. Deliver the printout of your work **until the last submission date**.