CS1112 Exercise 5

You have until *Sunday, 9/25, at 9 pm* to complete this exercise. Complete Problems 1-5 during discussion section and chat with your classmates about your answers. Only Problems 6-10 need to be submitted, on MATLAB Grader (`https://grader.mathworks.com/`).

1. Implement a function `xSquared` that returns the square of a number. Which is correct?

   (a)
   ```
   function out = xSquared(x)
   % out is the square of x; x is a number.
   x = input('Type any real number: ');
   out = x*x;
   ```

   (b)
   ```
   function out = xSquared(x)
   % out is the square of x; x is a number.
   out = x*x;
   ```

2. Implement a function `myAbs` that returns the absolute value of a number. Which is correct?

   (a)
   ```
   function out = myAbs(x)
   % out is the absolute value of x; x is real a number.
   if x < 0
      x = -x;
   end
   fprintf('The absolute value of x is %.4f \n', x)
   ```

   (b)
   ```
   function out = myAbs(x)
   % out is the square of x; x is a number.
   if x < 0
      x = -x;
   end
   out = x;
   ```

3. Implement a function `xToTheN(x,n)` that returns the nth power of a number. Which is correct?

   (a)
   ```
   function y = xToTheN(x,n)
   % y is x^n where x and n are each a number.
   y = x^n;
   ```

   (b)
   ```
   function y = xToTheN(x)
   % y is x^n where x and n are each a number.
   n = input('Enter a positive number: ');
   y = x^n;
   ```

4. Given the correct function `xToTheN` from above, which script(s) below correctly compute(s) the nth power of a number and add(s) 2 to the result?

   (a) `y + 2`

   (b) `z = xToTheN(3,5);  z = z + 2`

   (c) `a = 1;  b = 2;  z = xToTheN(a,b) + 2`

   (d) `function y = xToTheN(3,5);  y = y + 2`

   (e) `z = xToTheN(3,5) + 2`

5. True or false: a function in MATLAB must return a value (or values).

The problems on this page are to be submitted on MATLAB Grader (`https://grader.mathworks.com/`). Do *not* use arrays.

6. Write a function `y = med3(a,b,c)` that returns the median of the three values a, b, and c. Practice writing conditional statements and boolean expressions on this question; do *not* use built-in functions.

7. Implement the following function so that it performs as specified

```
function [s,c] = trig(a)
% s and c are the sine and cosine of angle a.
% a is the measure of an angle in degrees, assumed non-negative.
```

   Write a function `showTrig` that makes effective use of `trig` to print a table of sine and cosine values for $0^o, 2^o, 4^o, \ldots, 30^o$. Function `showTrig` takes no argument and does not return any value (but it prints).

8. The following function produces a pretty good estimate of $\sin(x)$ if $|x| \leq 2\pi$:

```
function y = mySin0(x)
% y is an approximation of sin(x) where x is a radian measure
y= x;
for k= 1:8
    y= y + (-1)^k *x^(1+2*k) /factorial(1+2*k);
end
```

   The estimate is horrible if $|x|$ is large. Using the fact that the sine function is periodic, write a function `mySin1(x)` that produces a good sine approximation for any non-negative x. Make effective use of `mySin0`.

9. Consider the binomial coefficient

$$\left(\begin{array}{c} n \\ k \end{array} \right) = \frac{n!}{k!(n-k)!}$$

   We will call this value "n-choose-k". Implement the following function so that it performs as specified:

```
function d = digitsOfBinCoef(n,k)
% d is the number of digits required to write the binomial coefficient n-choose-k
% n and k are both non-negative integers, n<=100, and n>=k.
```

   Recall that if `x` houses a positive integer, then the value of `floor(log10(x))+1` is the number of base-10 digits that are required to write the value of `x`. Make use of built-in function `factorial`.

10. Last week, you wrote a script to produce ten lines of output: the nth line, where $n = 1, \ldots, 10$, displays the number of digits required to write down each of the binomial coefficients

$$\left(\begin{array}{c} n \\ 1 \end{array} \right), \left(\begin{array}{c} n \\ 2 \end{array} \right), \ldots, \left(\begin{array}{c} n \\ n \end{array} \right)$$

    Write a function `showDigitsOfBinCoefs` to solve this problem again, but now make use of function `digitsOfBinCoef` from above. Function `showDigitsOfBinCoefs` takes no argument and does not return any value.