CS1112 Exercise 5 Name: ______________________ NetID: ______

When you complete the exercise, show your solutions to your discussion instructor, who will record that you have completed the exercise. If you do not finish this exercise in class, you have until *Wednesday, 2/26, at 9pm* to get your exercise checked off during *consulting hours* or during *TAs' office hours*.

1. Short answers

(i) 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;
```

(ii) 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.
out = x*x;
fprintf('The square of x is %.4f \n', out)
```

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

(iii) 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;
```

(iv) 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`

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

Do *not* use arrays.

2. Write a function `y = Mid3(a,b,c)` that returns the middle of the three values a, b, and c. Practice writing conditional statements and boolean expressions on this question; do *not* use built-in functions.

3. 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 positive).
```

Write a script that uses `Trig` to produce a table of sine and cosine values for $0^o, 1^o, \ldots, 90^o$.

4. Implement the following function so that it performs as specified:

```
function x = IsPythag(a,b,c)
% x has the value of 1 if a triangle with sides a, b, and c is
% a Pythagorean triangle and 0 otherwise.
% a, b, and c are positive integers.
```

5. 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).
y= x;
for k = 1:8
    y= y + (-1)^k * x^(1+2*k) / factorial(1+2*k);
end
```

It 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 x. Make effective use of `MySin0`.

6. Consider the binomial coefficient

$$\begin{pmatrix} n \\ k \end{pmatrix} = \frac{n!}{k!(n-k)!}$$

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
```

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`.

7. Last week, you did an exercise to produce ten lines of output where the nth line displays the number of digits required to write down each of the binomial coefficients

$$\begin{pmatrix} n \\ 1 \end{pmatrix}, \begin{pmatrix} n \\ 2 \end{pmatrix}, \ldots, \begin{pmatrix} n \\ n \end{pmatrix}$$

Write a script `showDigitsOfBinCoefs` to solve this problem again, but now make use of function `digitsOfBinCoef` from above.