CS1112 Discussion Exercise 5

Do not use arrays.

1. Write a function \( y = \text{Mid3}(a, b, c) \) that returns the middle of the three values \( a, b, \) and \( c \).

2. Complete the following function so that it performs as specified

   ```matlab
   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 \( \text{Trig} \) to produce a table of sine and cosine values for \( 0^\circ, 1^\circ, \ldots, 90^\circ \).

3. Complete the following function so that it performs as specified:

   ```matlab
   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.
   ```

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

   ```matlab
   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 \( \text{MySin1}(x) \) that produces a good sine approximation for any \( x \). Make effective use of \( \text{MySin0} \).

5. Consider the binomial coefficient

   \[
   \binom{n}{k} = \frac{n!}{k!(n-k)!}
   \]

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

   ```matlab
   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 \( \text{floor} \left( \log_{10}(x) \right) + 1 \) is the number of base-10 digits that are required to write the value of \( x \). Make use of built-in function \( \text{factorial} \).

6. Last week, you did an exercise to produce ten lines of output where the \( n \)th line displays the number of digits required to write down each of the binomial coefficients

   \[
   \binom{n}{1}, \binom{n}{2}, \ldots, \binom{n}{n}
   \]

   Write a script \( \text{showDigitsOfBinCoefs} \) to solve this problem again, but now make use of function \( \text{digitsOfBinCoef} \) from above.