CS 105

Additional Exercises

1. Given a vector, **write a function** that adds up all of the elements and returns the sum of the elements. Test your function by calling it using different vectors as input parameters (and observing the output)

   HINT: You can check this with the MATLAB built-in sum function

```
function s = sumVector(x)
    s=0;
    for i=1:length(x)
        s = s + x(i);
    end
```

2. **Write a script** that asks the user for M and N and create an M-by-N array of random numbers. The script then goes through all of the elements and sets any value that is less than 0.2 to 0 and any value that is greater than 0.2 to 1.

```
m = input('Enter the number of rows');
n = input('Enter the number of columns'):
X = rand(m,n);

for i=1:m
    for j=1:n
        if(X(i,j) < 0.2)
            X(i,j) = 0;
        elseif(X(i,j) > 0.2)
            X(i,j) = 1;
        end
    end
end
```

3. **Write a script** that determines how many random numbers it takes to add up to 20 (or more)

```
s= 0;
while(s < 20)
    s  = s + rand(1);
end
```

4. **Write a script** that determines how many random numbers it takes before a number between 0.8 and 0.85 occurs

```
n = rand(1);
count = 1;
while( (n <0.8) || (n > 0.85))
        n = rand(1);
        count = count + 1;
end
```

5. **Write a function** that takes as its input a number in Fahrenheit and returns the value in Celcius
   NOTE: C = 5/9(F-32)

```
function C = toCelcius(F)
        C = 5/9*(F-32);
```

6. Given an initial velocity v_0, an initial vertical location y_0, an initial horizontal location x_0, and an initial angle *theta*, we can compute the trajectory of an object at time *t* (in seconds) using the equations:

   $$y(t) = y_0 – 1/2gt^2 + (v_0 \sin(theta))t$$
   $$x(t) = x_0 + (v_0\cos(theta))t$$

   where $g=9.8\ m/s^2$

   Ask the user for the initial velocity (maybe test with 50.75 m/s), the initial vertical and horizontal positions (maybe test with $x_0=0$ and $y_0=0$), and an initial angle (maybe test with 5Pi/12 radians).

   Create 3 figures: t vs y, t vs x, and x vs y by varying the time t=0:0.1:10.

   NOTE: MATLAB has built in function sin and cos

```
v0 = input('Enter initial velocity: ');
x0 = input('Enter initial horizontal position: ');
y0 = input('Enter initial vertical position:  ');
theta = input('Enter initial angle:  ');

t = 0:0.1:10;
g = 9.8;
y = y0-1/2*g*t.^2 + (v0*sin(theta))*t;
x = x0+(v0*cos(theta))*t;

figure(1);
plot(t,y);
figure(2);
plot(t,x);
figure(3);
plot(x,y);
```

7. The Taylor Series for the exponential function is:

   $e^x = 1 + x + x^2/2! + x^3/3! + \ldots + x^n/n!$

   Write a **function** that takes as its input the number x and the number n and returns two things:

   - The approximation of e^x using Taylor expansion
   - The absolute error of this approximation (compare the approximation against the MATLAB function exp(x))

```
function [sum,e] = TaylorSeries(x,n)
    sum=1;
    for i=1:n
        fact=1;
        for y=i:-1:1
            fact = fact*y;
        end
        sum = sum + x^i/fact;
    end

    e = abs(sum-exp(x));
```

8. Write a **function** that given a vector it repeats each element once and return this vector.

   I.e. MyRepeater ([1,3,8]) returns [1,1,3,3,8,8]

```
function B = MyRepeater(A)
    B = [];
    for i=1:length(A)
        B(end+1) = A(i);
        B(end+1) = A(i);
    end
```

9. Write a **function** that given *a* and *b* computes a^b using a loop (without using the ^ operator)

```
function ex = myExp(a,b)
    ex = 1;
    for i=1:b
        ex = ex*a;
    end
```

10. Given the principal (p) and interest rate (r) we can compute the amount of money accumulated after M months as:

$$A=p(1+r/12)^{M}$$

Write a **script** that asks the user for the principal, interest rate, and number of months. It then plots m vs A for m=0:1:M.

```
p = input('Enter the principal: ');
r = input('Enter the interest rate: ');
M = input('Enter the number of months: ');


m = 0:1:M;
A = p*(1+r/12).^m;
plot(m,A);
```