**4/10/18 – Tuesday**

**Numerical Methods - Spring '18**

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**Lab #2**

**Problem 1:**

Write a function in MATLAB that accepts a positive integer n and returns a column vector containing the first n Fibonacci numbers.

**My Solution:**

fib_recur.m

```
%A function that returns a column vector containing the first n Fibonacci
%numbers.
%Recursive Solution

function y=fib_recur(n)

if(n==0)
    y=0;
else
    y=[fib_recur(n-1);fib(n)];

end

function y=fib(n)
if n<3
    y(1:n)=1;
else
    y(n)=fib(n-2)+fib(n-1);
end

y=y(n);

end

end
```

fib_forloop.m

```
%A function that returns a column vector containing the first n Fibonacci
%numbers.
%For Loop Solution

function y = fib_forloop(n)
f1=1;
f2=1;
fibnew=f1+f2;
fibs=[f1;f2;fibnew];

for i=3:1:n-1
f1=f2;
f2=fibnew;
fibnew=f1+f2;
fibs=[fibs;fibnew];
end

y=fibs;
end
```

**Problem 2:**

Write a function that accepts a real number x and returns the Taylor approximation $e^x$ centered at x=zero to within 0.001 of the true value.

**My Solution:**

taylorapprox.m

```
%A function that returns the taylor approximation of  e^x centered at x=0 to within 0.001
%of the true value.
function y = taylorapprox(x)
taylorold=1;
n=1;
taylornew=taylorold+((x.^(n))./factorial(n));
error=.001;
while abs(taylorold-taylornew)>error
   taylorold=taylornew;
   n=n+1;
   taylornew=taylorold+((x.^(n))./factorial(n));
   y=taylornew;
end
end
```

**Problem 3:**

Write a function that inputs a value of k and a value n and plots the percentage of the carrying capacity of that population over n generations.

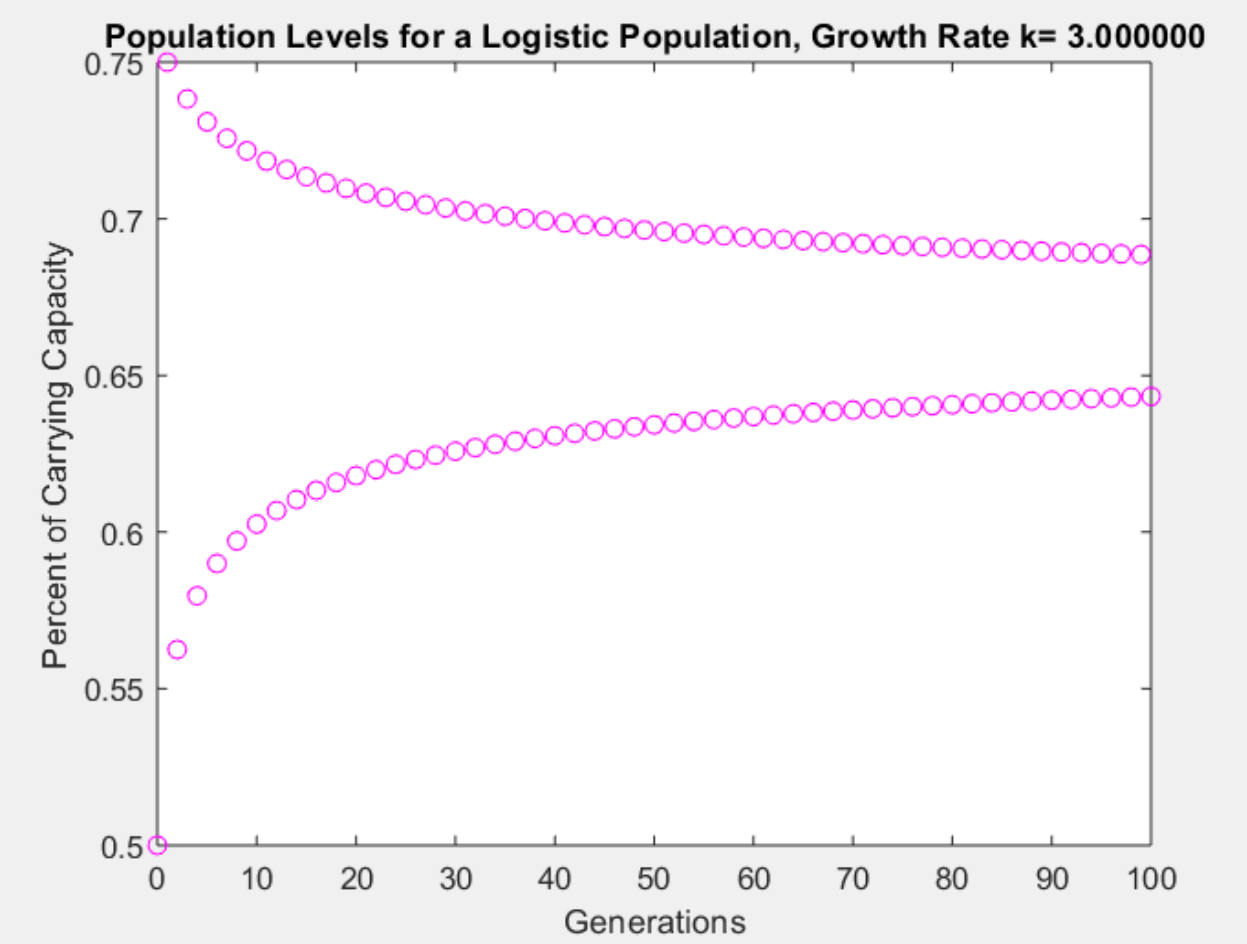
Logistic Sequence:

$$p_{n+1} = kp_n(1 - p_n); p_0 = 0.5$$

**My Solution:**

logistic_sequence.m

```
%A function that returns the graph of population levels for a logistic
%population of n generations given a constant of k and constant n.

function y=logistic_sequence(k,n)
if n < 0
disp('Sorry, n must be positive. Try again!')
end
if n>0
counter=0;
%Time period

t=[0:n];
pold=.5;
popvals=[pold];

while(counter<n)
    counter=counter+1;
    pnew=k.*pold.*(1-pold);
    pold=pnew;
    popvals=[popvals;pnew];
end

plot(t,popvals,'om')
str=sprintf('Population Levels for a Logistic Population, Growth Rate k= %f', k);
title(str)
xlabel('Generations')
ylabel('Percent of Carrying Capacity')

end
end
```


Population Levels for a Logistic Population, Growth Rate k= 3.000000
Percent of Carrying Capacity
0.75
0.7
0.65
0.6
0.55
0.5
0
10
20
30
40
50
60
70
80
90
100
Generations