Lab 11

ENED 1090: MODELS I
Week 11 Laboratory

Submit Week 12 during Lab

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INSTRUCTIONS

Complete each question below by typing your answer or copying from the output in MATLAB or Excel.

This assignment is to be completed outside of class. You will submit a digital copy to your TA during the lab session next week.

!!! **To receive points for this assignment, add your name to the filename. For example, if my name is Lin Yali, I will change the filename to**

Wk11_ened1090_laboratory_LinYali.doc

OBJECTIVES

For this assignment, students will demonstrate

- Arrays

For this assignment,: you will apply the instructions to MATLAB (or Octave).
Each problem will refer the Week 10 – If you are working on these programs, use the Data files that are provided on Blackboard.

How to use the data files:

1. *put the *.mat file in your current director.*
2. *create a new script, and complete your program header*
3. *add the **clear; clc; close all** commands*
4. *use the **load** command to import the *.mat file*
   a. *i.e. typing **load RandomNumberDistribution_randiData** will load the data for the first problem*
5. *happy programing the graph ☺*

FOR ALL PROBLEMS:

To receive full credit on each plot. You will need to include

- labels on x, y and z axis
- legend describing each curve (2D plot)
- labels on the colorbar (3D plot)
- title

PROBLEM 1

Consider the Statistics Problem from Wk 10: **RandomNumberDistribution**

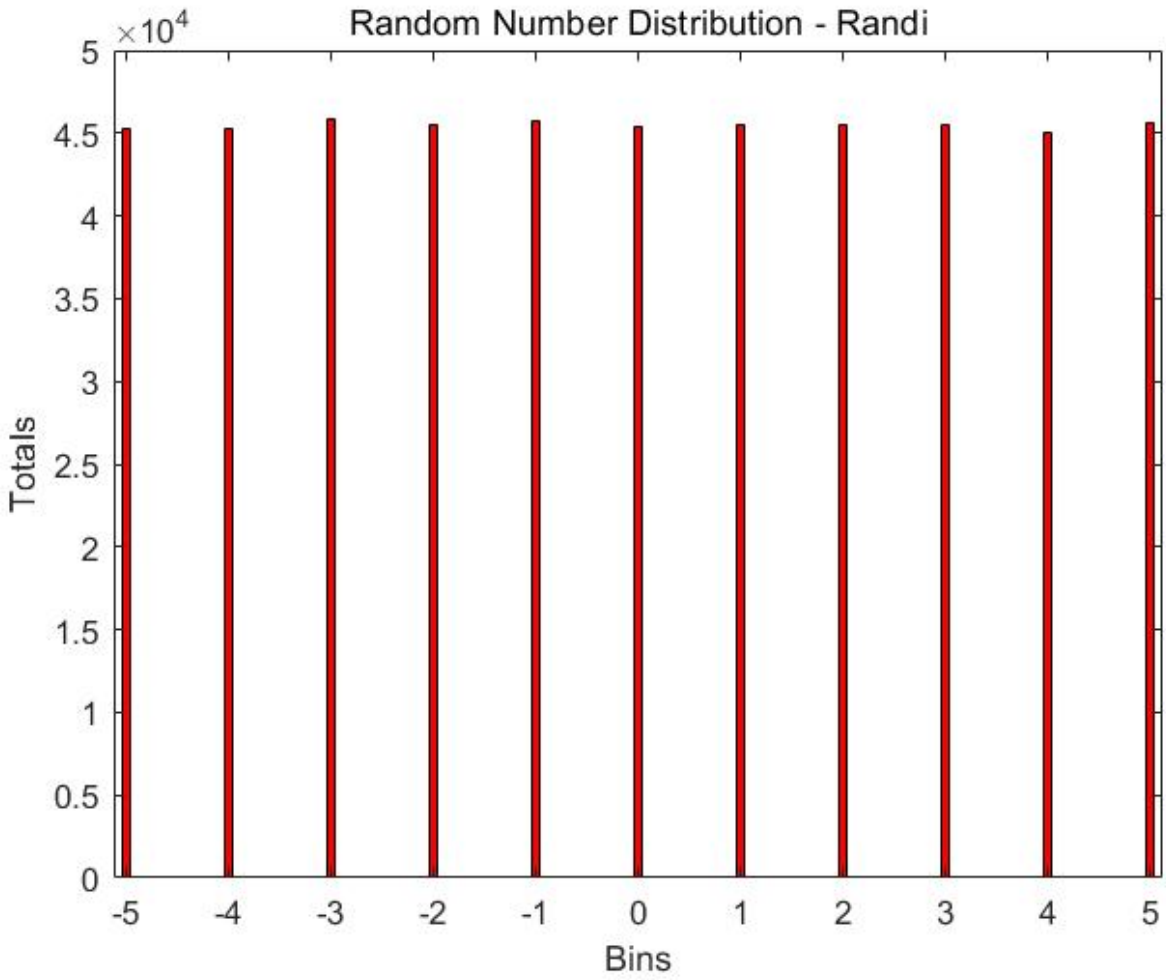
Using your program or the data files: **RandomNumberDistribution_randiData** and **RandomNumberDistribution_randnData**,

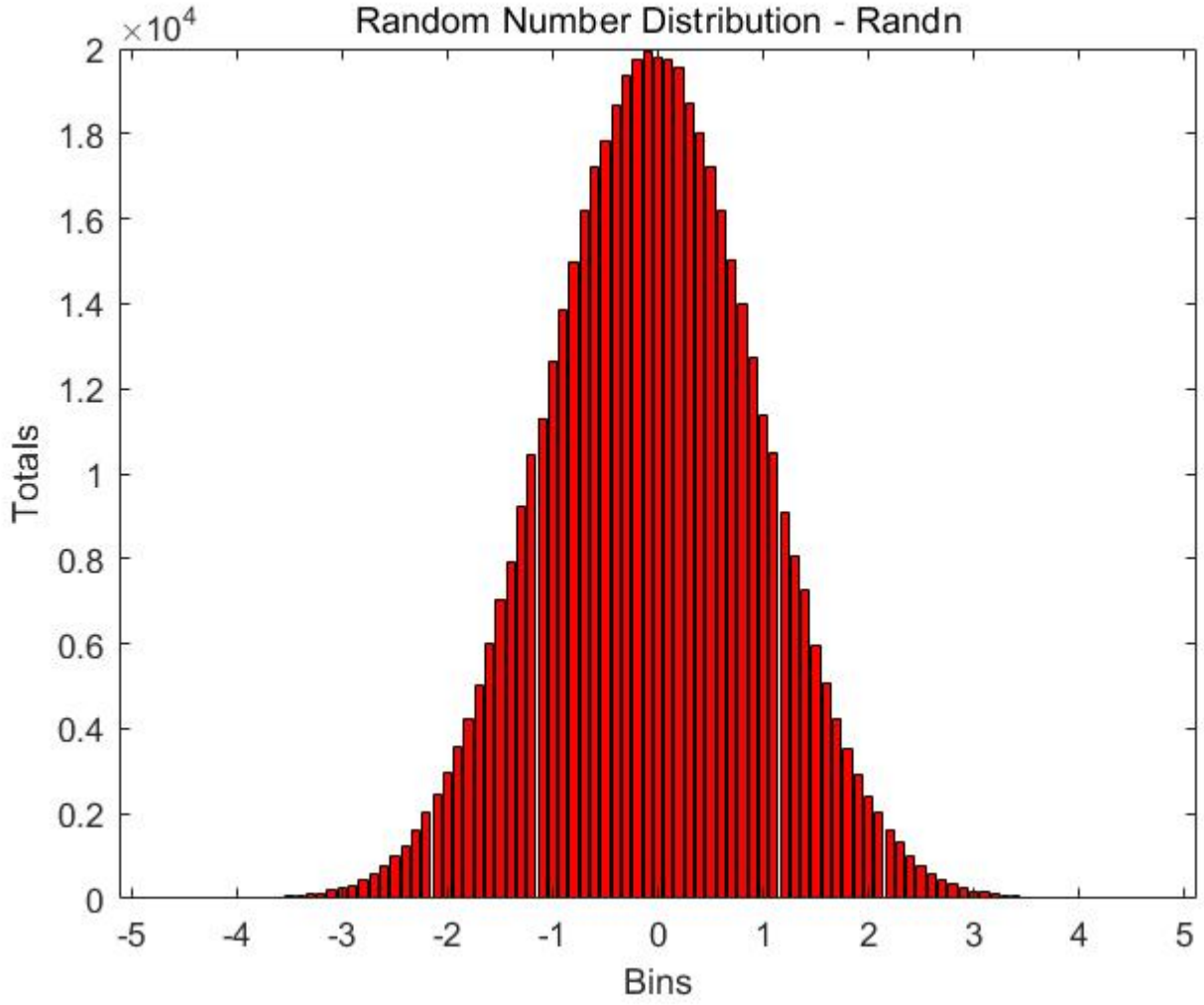
- Add a graph that gives a meaningful display to the problem.

Some suggestions:

- **Make sure you add close all; at the beginning of your code**

Copy an **image** of the graph for the two types of random numbers


Random Number Distribution - Randi
×10^4
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Totals
-5
-4
-3
-2
-1
0
1
2
3
4
5
Bins


Random Number Distribution - Randn
×10^4
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Totals
-5
-4
-3
-2
-1
0
1
2
3
4
5
Bins

Copy the code *of just your plot block*.

```
%% RandomNumberDistribution
% Name : Horace
% Date : 17 Nov 2018
% Description : a demonstration on plotting methods

%% CODE
clear; clc; close all;

load RandomNumberDistribution_randiData.mat

figure(1)
bar(bins,[total N-sum(total)],'r')
xlabel('Bins')
ylabel('Totals')
title('Random Number Distribution - Randi')

clear;

load RandomNumberDistribution_randnData.mat

figure(2)
bar(bins,[total N-sum(total)],'r')
xlabel('Bins')
ylabel('Totals')
title('Random Number Distribution - Randn')
```

Bonus (+5 Points)

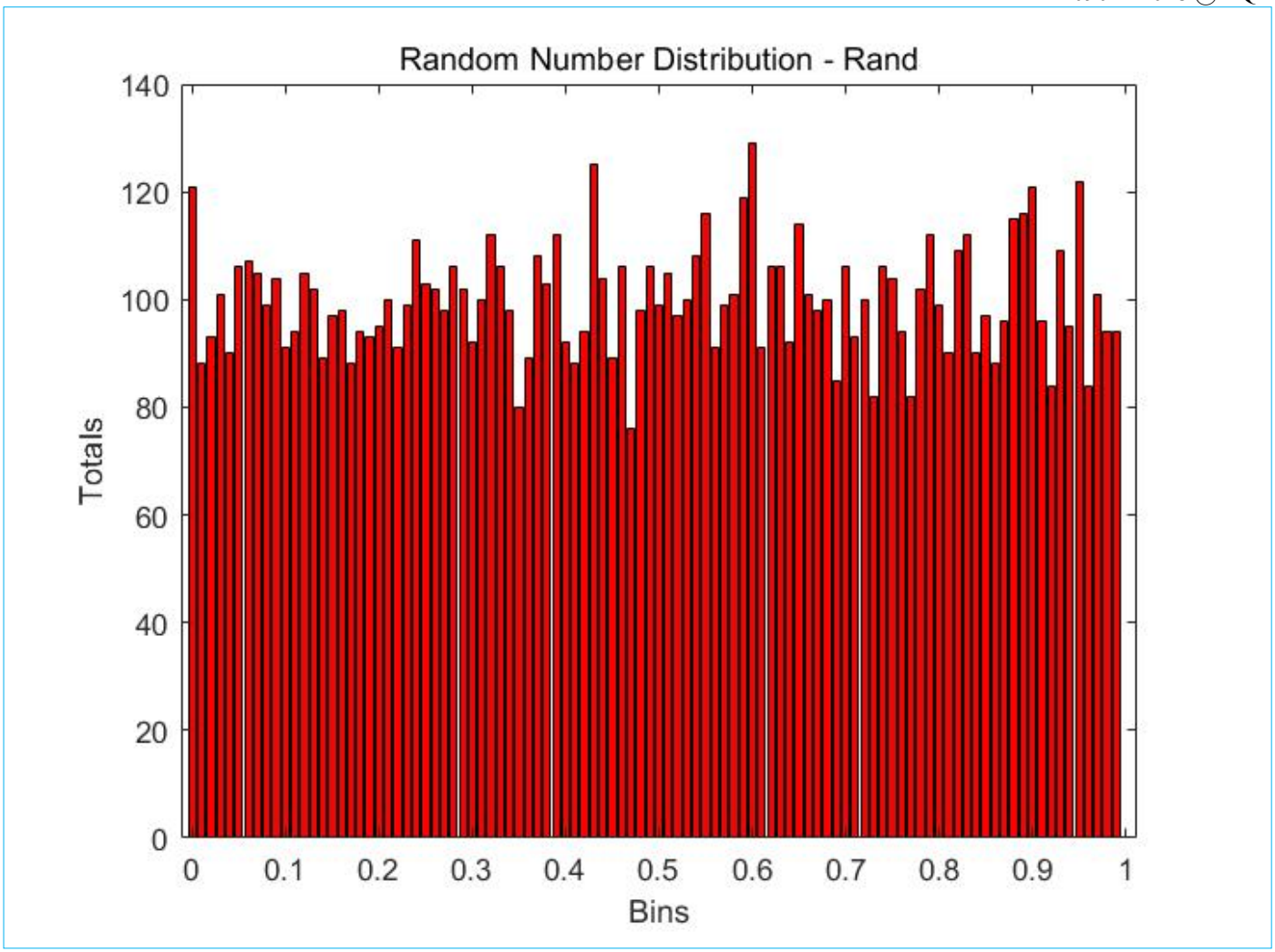
A final random number generator in MATLAB is the **rand** function.

- Modify your code to include a new option for **numbers = rand(1,N)**

Based on your graph for this command, what does **rand** do?

Get a random matrix of 1 rows and N columns less than 1.

Copy an **image** of the graph for this third case.



PROBLEM 2
Consider the Biology Problem from Wk 10: **PredatorPrey**

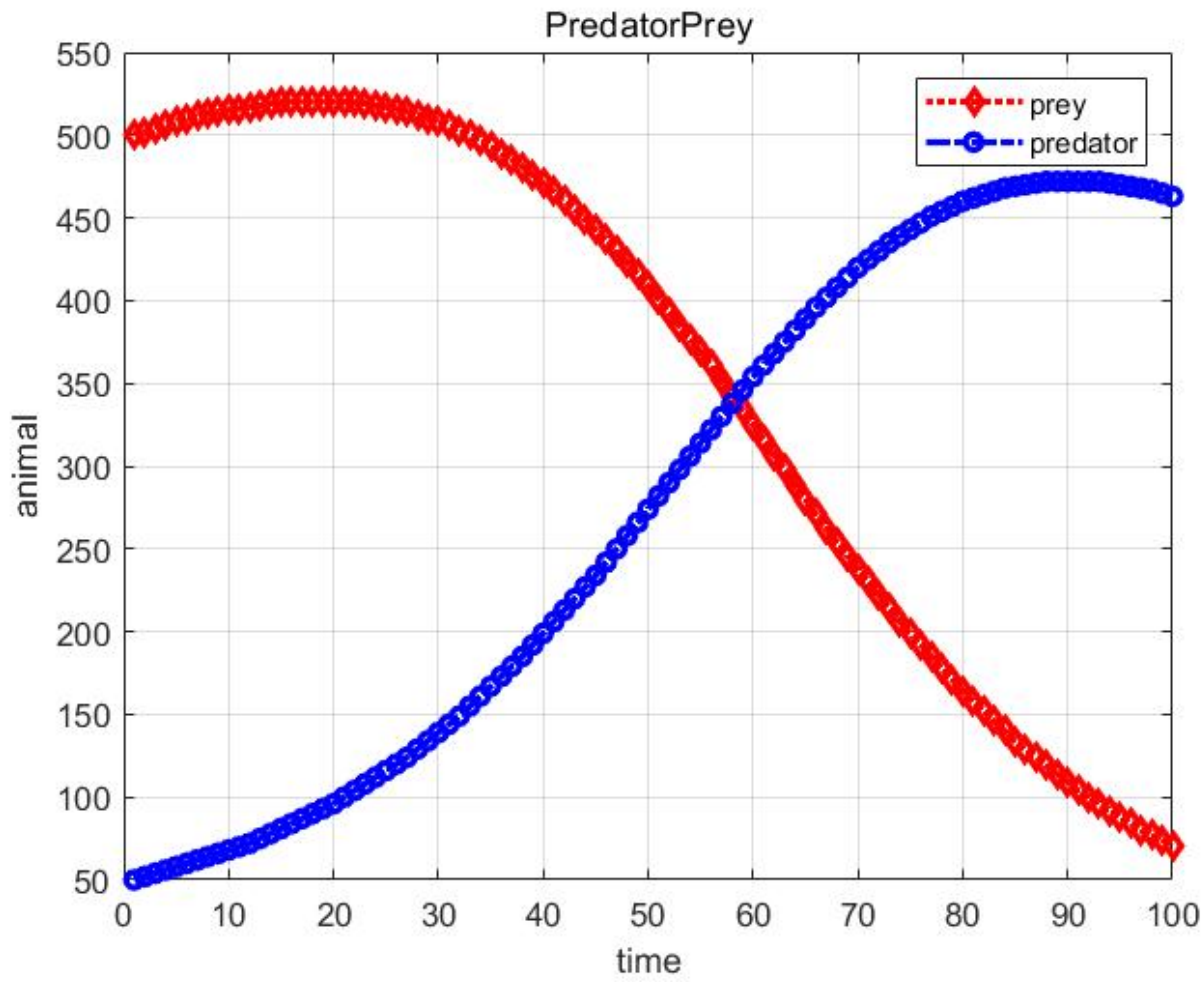
Using your program or the data files: **PredatorPrey_Data**,

- Add a graph that gives a meaningful display to the problem.

Some suggestions:

- **Make sure you add close all; at the beginning of your code**

Copy an **image** of the graph showing the population of the two species over time



Increase the number of years in the simulation and try different values of A, B, C, and D.

- What is the effect of A, B, C, and D, on the survival of the two animals?

As A increase and B decrease, the survival of the prey gets higher;
As C increase and D decrease, the survival of the predator gets lower.

Copy the code *of just your plot block*.

```
clear; clc; close all;
load PredatorPreyData.mat
time = 1:100;
figure(1)
plot(time,P(1,:),':rd','lineWidth',2,'markerSize',5)
hold on
plot(time,P(2,:),'-.bo','lineWidth',2,'markerSize',5)
xlabel('time')
ylabel('animal')
title('PredatorPrey')
legend('prey','predator')
grid on
```

PROBLEM 3

Consider the Engineering Problem from Wk 10: **TemperaturePlate**

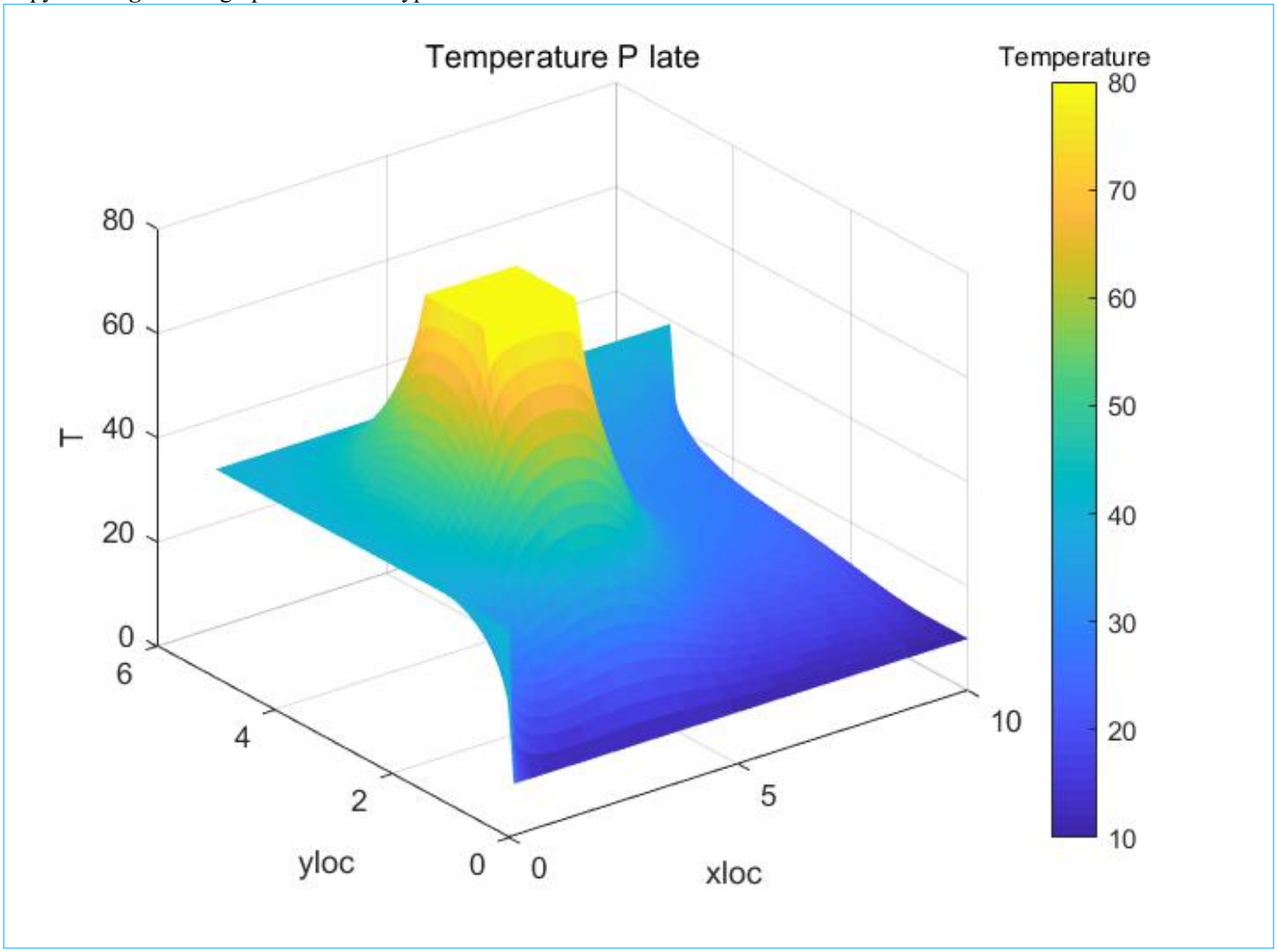
Using your program or the data files: **TemperaturePlate_Data**,

- Add a graph that gives a meaningful display to the problem.

Some suggestions:

- **Make sure you add close all; at the beginning of your code**

Copy an **image** of the graph for the two types of random numbers



Consider the two options for programing the y array

- y = YM:-L:0
- y = 0:L:YM

How does this statement affect your graph?

Using these two statements will get two graphs which are up-side-down to each other..

Copy the code *of just your plot block*.

```
clear; clc; close all;
load TemperaturePlateData.mat
figure(1)
surf(xloc,yloc,T,'edgeColor','none')
hold on
xlabel('xloc')
ylabel('yloc')
zlabel('T')
title('Temperature P late')
title(colorbar,'Temperature')
grid on
```

PROBLEM 4

Consider the Mathematics Problem from Wk 10: **TelescopePSeries**

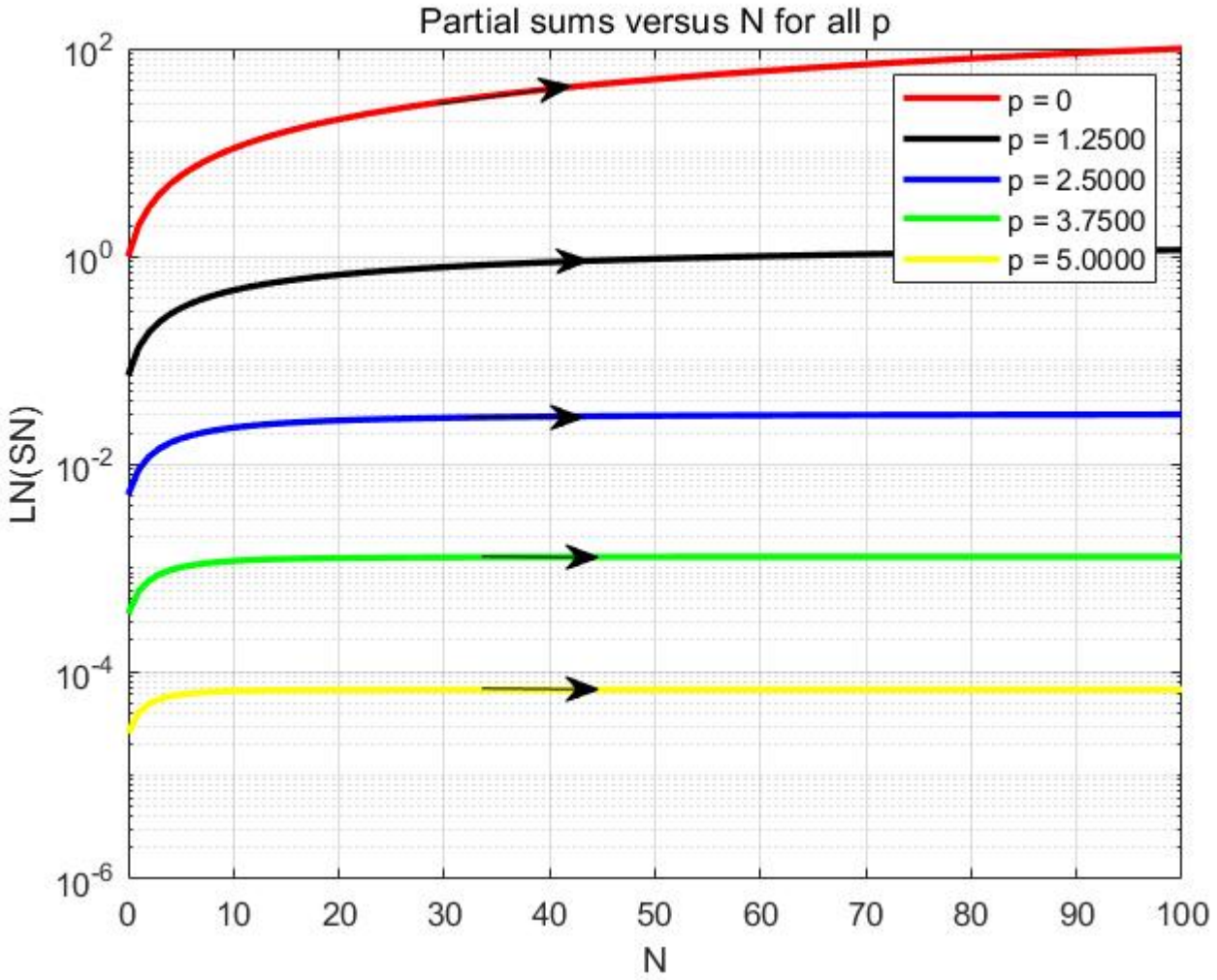
Using your program or the data files: **TelescopePSeries _Data**,

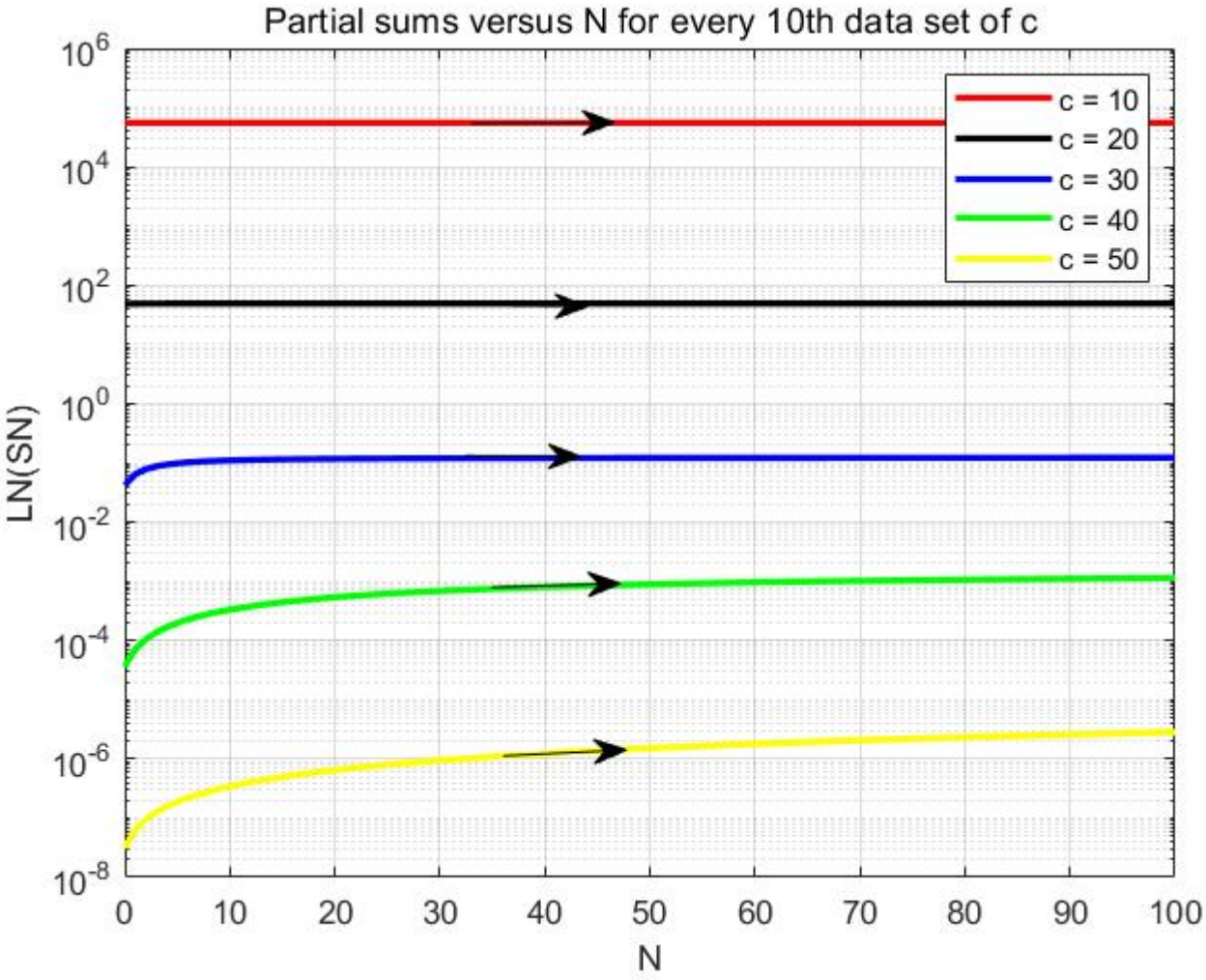
- Add graphs that gives a meaningful display to the problem
  - Using c(33), plot the partial sums versus N for all p
  - Using p(3), plot the partial sums versus N for every 10th data set of c
  - plot the partial sums versus c and p, for every 10th data set of N

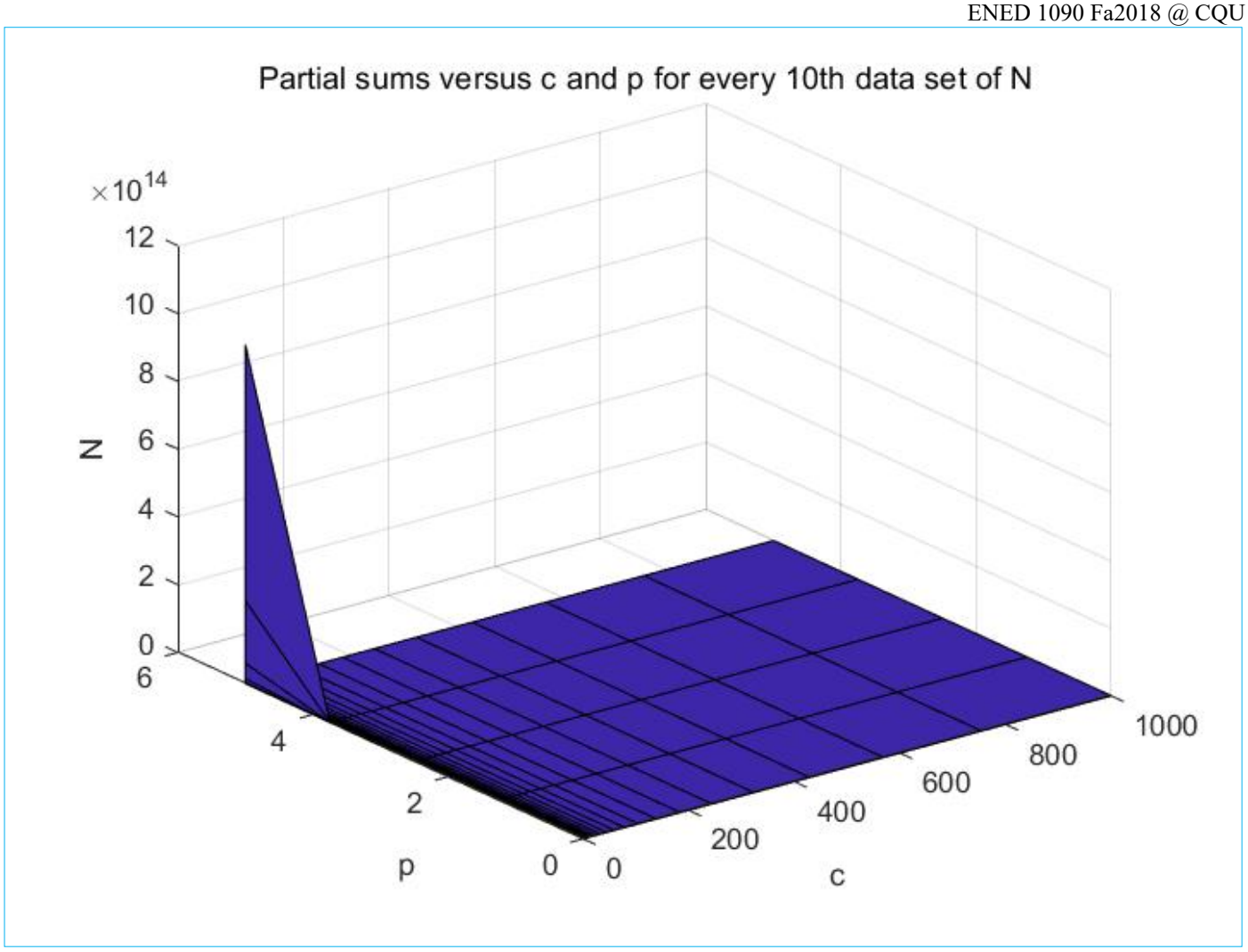
Some suggestions:

- **Make sure you add close all; at the beginning of your code**
- Consider using a semilog or a loglog plot
- Add an arrow to show the direction of increase c or p (for the first two plots)
- Depending on how you set up the array, you will need to use a **squeeze** command to create the plots – squeeze reduces the unit dimensions of a multi-dimensional array

Copy an **image** of each graph




Partial sums versus N for every 10th data set of c
LN(SN)
N
c = 10
c = 20
c = 30
c = 40
c = 50
10^6
10^4
10^2
10^0
10^-2
10^-4
10^-6
10^-8
0
10
20
30
40
50
60
70
80
90
100



Copy the code *of just your plot block.*

```
%% Code
clear;clc;close all;

load TelescopePSeriesData.mat

%Figure(1)
figure(1)
A = squeeze(SN(:,33,:));
semilogy(N,A(1,:),'-r','lineWidth',2)
hold on
semilogy(N,A(2,:),'-k','lineWidth',2)
semilogy(N,A(3,:),'-b','lineWidth',2)
semilogy(N,A(4,:),'-g','lineWidth',2)
semilogy(N,A(5,:),'-y','lineWidth',2)
xlabel('N')
ylabel('LN(SN)')
title('Partial sums versus N for all p')
legend('p = 0','p = 1.2500','p = 2.5000','p = 3.7500 ','p =
5.0000' )
grid on

%Figure(2)
```

```
figure(2)
B = squeeze(SN(3,:,:));
semilogy(N,B(10,:),'-r','lineWidth',2)
hold on
semilogy(N,B(20,:),'-k','lineWidth',2)
semilogy(N,B(30,:),'-b','lineWidth',2)
semilogy(N,B(40,:),'-g','lineWidth',2)
semilogy(N,B(50,:),'-y','lineWidth',2)
xlabel('N')
ylabel('LN(SN)')
title('Partial sums versus N for every 10th data set of c')
legend('c = 10','c = 20','c = 30','c = 40 ','c = 50' )
grid on

%Figure(3)
figure(3)
C1 = squeeze(SN(:,:,1));
C2 = squeeze(SN(:,:,11));
C3 = squeeze(SN(:,:,21));
C4 = squeeze(SN(:,:,31));
C5 = squeeze(SN(:,:,41));
C6 = squeeze(SN(:,:,51));
C7 = squeeze(SN(:,:,61));
C8 = squeeze(SN(:,:,71));
C9 = squeeze(SN(:,:,81));
C10 = squeeze(SN(:,:,91));
C11 = squeeze(SN(:,:,101));
surf(c,p,C1)
hold on
surf(c,p,C2,'edgeColor','none')
surf(c,p,C3,'edgeColor','none')
surf(c,p,C4,'edgeColor','none')
surf(c,p,C5,'edgeColor','none')
surf(c,p,C6,'edgeColor','none')
surf(c,p,C7,'edgeColor','none')
title('Partial sums versus c and p, for every 10th data set of N')
```