

ENGR 131B | Final Exam Practice Packet – MATLAB Portion  
Fall 2022

Final Exam reminders:

- The exam will be handwritten and closed note/closed book. You will NOT use a laptop or calculator.
- Recall that MATLAB is case sensitive. Your written exam work will be graded considering correct use of case, where applicable. Ensure that your writing is clear and unambiguous.

Suggestions for using this packet:

- Work problems first without looking up answers.
- Check your answers using MATLAB.
- Go back and look up information as needed.
- Do a thorough review of all MATLAB material covered in lectures, homework, and lab.
- This practice packet is representative of the TYPE of questions you will see. It is NOT inclusive of all topics that will be covered.
- This is not a “practice exam” but rather a pack of practice problems. The length of this packet may not represent the length of the exam.

1. What would be the output of the following line of code?

$(5*6 < 35) \ \& \ (3-2 > 5)$   
 $30 < 35 \quad 1 > 5$   
 $1 \quad \& \quad 0$   
Logical 0

2. Write one line of MATLAB code that will produce a 30-element vector between 2 and 55 with the elements equally spaced.

$Vec = linspace(2, 55, 30);$

3. Circle TRUE or FALSE as it relates to the code below:

```
title_1 = 'A Study in Scarlet'
title_2 = "The Sign of the Four"
name_1 = 'Sherlock Holmes'
name_2 = "Dr. Watson"
author = 'Doyle'
```

TRUE / FALSE:  $\frac{18}{15} \quad \frac{1}{5}$   $length(title\_1) > length(title\_2)$

TRUE / FALSE:  $\frac{15}{3} \quad \frac{5}{5}$   $length(name\_1) / 3 == length(author)$

TRUE / FALSE:  $\bigcirc \quad == \bigcirc$   $strcmp(name\_2, title\_2) == 0$

4. What will be the output of the snippet of code shown below? Be sure to show the output exactly as it will appear on the computer screen.

```
Snoopy = 0;

fprintf('Please help prepare Thanksgiving dinner.\n');

for Woodstock = 1:2:8
    while (Snoopy <=5)
        fprintf('Toast slices:  %i\n',Snoopy)
        Snoopy = Snoopy + 2;
    end
end
```

Please help prepare Thanksgiving dinner.  
Toast slices: 0  
Toast slices: 2  
Toast slices: 4

5. The Fibonacci sequence is the sequence of numbers where the subsequent number is the sum of the previous two numbers. The first five numbers of the Fibonacci sequence are: 1, 1, 2, 3, 5. The following function is attempting to create the first N numbers in the Fibonacci sequence. Describe the functional error in the code (ie. not related to a lack of commenting). If there are no errors, write "no errors". If MATLAB will not run this code, write "will not run" and describe why.

```
1 function x = Fibonacci(N)
2     x = zeros(1,N);
3     x(1) = 1;
4     for n=1:N-1
5         x(n+2)=x(n)+x(n+1);
6     end
7 end
```

~~The code will not run.~~ The second line should be deleted at the start of the function. the for loop should be part of a conditional statement, as the loop should only run if user requests more than 2 values.  
The code runs just incorrectly

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6. Your friend created a file called Station.txt summarizing data from her music app. The format of the text file is as shown in the box below. You have written code to help track her listening habits. Fill in the table of variable values for each iteration of the `while` loop that you have written in your code.

Station	Hrs	Thumbs_Up	Thumbs_Down
Styx	32	14	4
Beatles	24.5	31	6
Simon&Garfunkle		15.2	40 3
#			

```
in_data = fopen('Stations.txt','r');
header{1} = fscanf(in_data, '%s',1);
header{2} = fscanf(in_data, '%s',1);
header{3} = fscanf(in_data, '%s',1);
header{4} = fscanf(in_data, '%s',1);
k = 0;
while (fscanf(in_data, '%s', 1) ~= '#')
    k = k+1;
    time(k) = fscanf(in_data,'%f',1);
    t_up(k) = fscanf(in_data, '%i', 1);
    t_down(k) = fscanf(in_data, '%i', 1);
    total_time_listening = sum(time);
    total_t_up = sum(t_up);
    total_t_down = sum(t_down);
end
fclose(in_data);
```

total_time_listening	total_t_up	total_t_down
32	14	4
56.5	45	10
71.7	65	13

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7. Given the following vectors, write the appropriate line of MATLAB code to perform the indicated operations

Browns = [7, 13, 0, 9]

Guardians = [5, 4, 2, 10]

Cavaliers = [88, 75, 101, 92]

- a) Create a matrix called `points` that is comprised of the row vectors `Browns`, `Guardians`, and `Cavaliers`, in that order.

`points = [Browns; Guardians; Cavaliers];`

- b) Change the zero in `Browns` to 14.

`Browns(3) = 14;`

- c) Extract the middle two values from `Cavaliers` and store them in the vector `road_trip`.

`road_trip = Cavaliers(2:3);`

- d) Divide each value in `Cavaliers` by the corresponding value in `Browns`.

`Cavaliers ./ Browns`

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8. Write the figure number below each plot that corresponds to the MATLAB code.

```
a = 1:20  
b = linspace(20, 1, 20)  
c = a ./ b  
e = 1:length(c)  
  
for d = 1:length(b)  
    e(d) = e(d) * 5  
end  
figure(1)  
plot(b, a)  
figure(2)  
plot(c, a)  
figure(3)  
plot(d, a)  
figure(4)  
plot(e, a)
```

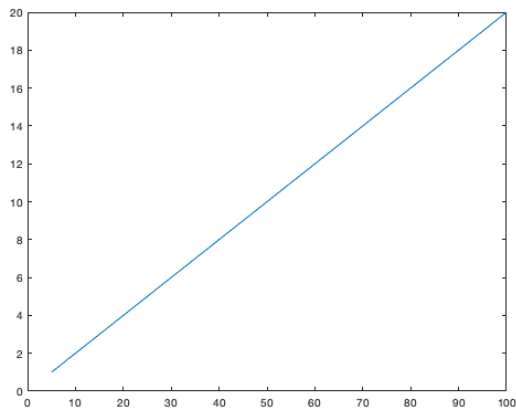


Figure 4

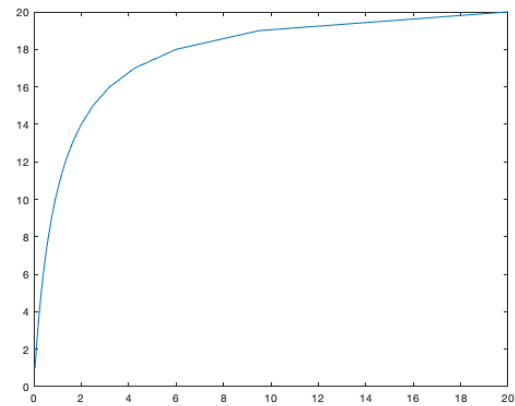


Figure 2

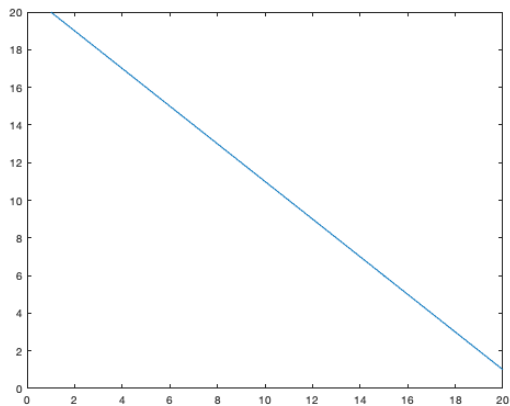


Figure 1

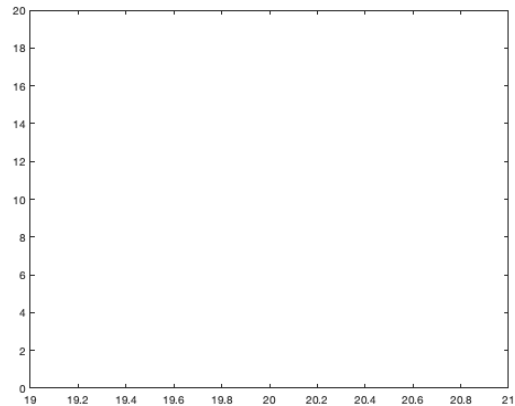


Figure 3

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9. The MATLAB code below analyzes a data file of numbers that are always increasing, but not uniformly, to determine how many values there are between 25% of the final value and 75% of its final value. Does the code as written execute as intended? If it does, write 'Yes'; if it does not, describe the error.

```
1  load('NewFile.mat'); %contains a vector called values
2
3  final = values(end); %find end value and set range
4  bottom = .25*final;
5  top = .75*final;
6
7  for c = 1:length(values) %find edges of range
8      if (values(c+1) >= bottom) & (values(c) < bottom)
9          start = c; c+1
10     end
11     if (values(c+1) >= top) & (values(c) < top)
12         ending = c;
13     end
14 end
15
16 range = ending - start %present # of values
```

10. The code below is supposed to go through a list of exam scores to find the highest exam score and the percentage of students with that score. Does the code as written execute as intended? If it does, write 'Yes'; if it does not, describe the error.

```
1  load('datafile.mat') %contains vector exams
2
3  [top, high_score] = max_info(exams); function outputs are flipped
4  percent = 100 * how_many/length(exams);
5
6  fprintf('Top score on exam: %i.\n', high_score);
7  fprintf('Percent of class with score: %.2f.\n', percent);
8
9  function [top, number] = max_info(data)
10     number = 0;
11     top = max(data);
12
13     for k = 1:length(data)
14         if data(k) == top
15             number = number + 1;
16         end
17     end
18
19 end
```

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11. Below is the outline of a MATLAB program that calculates and plots the distance fallen in each second by a free-falling object. Fill in the blanks with appropriate code, following the directions in the comments provided in the code. You may not modify any of the code that has been provided.

```
clear;
clc;

% In one line, ask the user to enter how many seconds the object will fall
% and store the result in the variable "period"
period = input('Please enter how many seconds the object will fall: ');

% Display the number of seconds entered
fprintf('Number of free fall seconds: %.1f \n', period);

g = 9.81; %value of acceleration due to gravity in m/s

% Use a loop to create a matrix of distance fallen for each second of free
fall

% Initialize the loop counter, "sec"
sec = 1;

while (sec <= period)

% Calculate the distance fallen at this time point using distance = 1/2gt^2
dist = (1/2)*g*sec^2;

% Write each time and corresponding distance to the matrix "Isaac"
Isaac(1, sec) = sec;
Isaac(2, sec) = dist;
sec = sec + 1;

end

% Plot the distance fallen as a function of time using the values in Isaac
plot(Isaac(1,:), Isaac(2,:));
```

12. Astronomers are using a new space telescope to conduct a random survey of locations in space. They will describe these locations with three coordinates:

- An azimuthal angle (how far below or above the horizon), phi, ranging from -90 to +90 degrees.
- A polar angle, theta, ranging from 0 to 360 degrees
- A radius, r, ranging from 0 to 100 light-years.

$$\text{var} = \text{min} + \text{rand}([1,100]) * (\text{max} - \text{min})$$

Write code to generate and store the coordinates for the first 100 random locations the telescope will be focused at. Then the code should choose one of those locations at random and display to the screen which observation it will be and what the coordinates are, like so:

The coordinates for observation #12 are phi = -56.774226 deg, theta = 66.640887 deg, and r = 43.512060 ly.

Note that you do not need to use all of the blank lines provided below.

```
azimuthal_phi = -90 + rand(1,100)*(40-(-40));  
polar_theta = 0 + rand(1,100)*(360-0);  
radius = 0 + rand(1,100)*(100-0);  
observation_num = randi([1,100]);  
  
fprintf('The coordinates for observation # %i are  
phi = %.6f deg, theta = %.6f deg, and r = %.6f ly',  
observation_num, azimuthal_phi(observation_num),  
polar_theta(observation_num), radius(observation_num))
```