

GOOD LUCK ON THE EXAM EVERYONE!!!

Announcements

- HW#1 has been graded
- HW#2 is up and this homework is done individually. Due Mon, 3/1
 - get the .mlx file from Blackboard
 - submit assignment as PDF to Gradescope
- Monday, 3/1/21 is the last day to drop a course without a W
- Exam #1 is today from 4:30-6 pm EST for everyone
 - 1 hr 15 min to complete, 15 min to upload
 - it is NOT due at 6:15 like your syllabus says
- * if you have questions while taking the exam, you can email (list of emails will be provided)
- * read the first page of the exam!!! It's attached here to the end of these notes

Review Quiz 2

Review Material

- While loops
- error checking
- vectorizing
- matrix multiplication

{ TYPE INTO THE CHAT IF THERE ARE OTHER SUBJECTS BESIDES THESE THAT YOU WANT TO GO OVER

IF YOU HAVE A QUESTION FROM ANY OF THE PRACTICE EXAMS, TELL US WHICH EXAM AND WHICH QUESTION IN THE CHAT

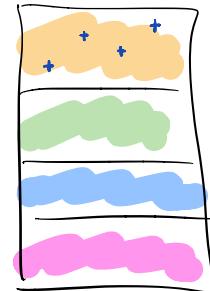
DON'T FORGET: CAMERA ON!
SMILE ☺

Ex. 1 : loading data, for loop, subplot

Write a script that will load data from myfile.dat into a matrix. Create a subplot in which every row is its own plot (i.e. the subplot will be the size of #rows x 1). Plot with blue plus signs. You do not necessarily know the length of the data file but you can assume that each row has the same number of values.

```
% load the data  
load myfile.dat  
  
% make the subplot  
[r, c] = size(myfile);  
for i = 1:r  
    subplot(r, 1, i)  
    plot(myfile(i, :), 'b+')  
end
```

3	9	6	12
15	8	7	6
4	3	7	8
5	6	7	10



Ex. 2: preallocating

You got a job in the R+D Department with the Red Sox analysing the pitchers. Last night's pitcher went seven full innings and you need to create a script that allows the user to input the number of pitches thrown per inning. The format of the program will be as follows:

INNING #1
Enter the number of pitches thrown:

INNING #2
Enter the number of pitches thrown:

etc. etc.

```
% Write the script below
vec = zeros(1,7);                                vec = [0 0 0 0 0 0]
for i = 1: length(vec)
    fprintf('INNING #%.d\n', i)
    vec(i) = input('Enter the number of pitches thrown: ');
    fprintf('\n')
end
```

Ex. 3 : While loop

Write a script that will

- (1) generate a random integer between 0 and 20
- (2) print these numbers until one is generated that is greater than 15
- (3) print how many attempts it took

% Write the script here

```
rani=randi([0,20]);
fprintf('The integer is %d\n', rani)
count = 1;
while rani <= 15
    rani=randi([0,20]);
    fprintf('The integer is %d\n', rani)
    count = count + 1;
end
fprintf('Yay, a %d! It took %d tries\n', rani, count)
```

} we did not do this
one together in
discussion. This is
extra :-)

Ex. 4: error checking + while loop

Write a script that prompts the user for an integer between 96 and 123 noninclusive, checks to make sure that number is in the correct range, and then prints the ascii equivalents in one line starting from 97 up until the user-entered integer.

% Write the script here

```
myint = input('Enter an integer between 96 and 123: ');

% this is the error-check
while myint <= 96 || myint >= 123
    myint = input('Error! Enter an integer between 96 and 123: ');
end

% print ascii equivalents
num = 97;
while num <= myint
    fprintf('%c ', char(num))
    num = num + 1;
end
fprintf('\n')
```

Ex. 5 : Vectorizing code

% vectorize this

```
mynum = 0;  
[r, c] = size(mat);  
sum(sum(mat))  
  
for i=1:r  
    for j=1:c  
        mynum = mynum + mat(i, j);  
    end  
end
```

% now unvectorize this

```
myvec = diff(vec)  
  
for i = 1:length(vec)-1  
    myvec(i) = vec(i+1) - vec(i);  
end
```

$$\begin{aligned} \text{vec} &= [2 \ 4 \ 5 \ 7 \ 10] \\ \text{diff(vec)} &= [2 \ 1 \ 2 \ 3] \end{aligned}$$

Ex. 6 : Matrix operations

1. Make a 3×4 matrix of random integers from 5 to 10. assign it to mat1.

$\text{mat1} = \text{randi}([5, 10], 3, 4);$

2. make a vector of 5 linearly spaced values from 1 to 10. assign this to vec1.

$\text{vec1} = \text{linspace}(1, 10, 5);$

3. delete the third element from vec1. this is the new vec1.

$\text{vec1}(3) = [];$

4. multiply mat1 and vec1 in such a way that you get a $\underline{\underline{3 \times 1}}$ column vector.

$\text{mat1} * \text{vec1}'$

$\begin{matrix} \text{mat1} & \text{vec1} & \text{vec1}' \\ 3 \times 4 & 1 \times 4 & 4 \times 1 \end{matrix}$

5. delete the second column of mat1. assign this to mat2.

$\text{mat2} = \text{mat1};$
 $\text{mat2}(:, 2) = [];$

6. Given the following arrays, perform the multiplication specified. If it cannot be done, state why.

$$A = \begin{bmatrix} 2 & 4 \\ 4 & 6 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 3 & 5 \\ 9 & 6 & 3 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 6 \\ 2 & 3 \\ 4 & 1 \end{bmatrix} \quad D = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

$\cancel{A * D}$

$$\begin{bmatrix} 2(5) + 4(7) & 2(6) + 4(8) \\ 4(5) + 6(7) & 4(6) + 6(8) \end{bmatrix} \Rightarrow \begin{bmatrix} 38 & 44 \\ 62 & 72 \end{bmatrix}$$

$A . * D$

$$\begin{bmatrix} 2(5) & 4(6) \\ 4(7) & 6(8) \end{bmatrix} \Rightarrow \begin{bmatrix} 10 & 24 \\ 28 & 48 \end{bmatrix} \quad \text{can only use the "dot" if dimensions are exactly the same.}$$

$\cancel{A * B}$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \begin{bmatrix} 2(1) + 4(9) & 2(3) + 4(6) & 2(5) + 4(3) \\ 4(1) + 6(9) & 4(3) + 6(6) & 4(5) + 6(3) \end{bmatrix} \Rightarrow \begin{bmatrix} 38 & 30 & 22 \\ 58 & 48 & 38 \end{bmatrix}$$

$\cancel{A * C}$

$\times \underline{\underline{\text{not possible}}}$

2×3
 $B \cdot C$

dimensions match \rightarrow this is possible!!!

$$B = \begin{bmatrix} 1 & 3 & 5 \\ 9 & 6 & 3 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 6 \\ 2 & 3 \\ 4 & 1 \end{bmatrix}$$

let's rewrite this in a nicer way:

$$\begin{bmatrix} 1 & 3 & 5 \\ 9 & 6 & 3 \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 4 \\ 4 & 3 & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 1(1) & 3(2) & 5(4) \\ 9(1) & 6(3) & 3(1) \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & 6 & 20 \\ 54 & 18 & 3 \end{bmatrix}$$

not $q_0()$ is not the same as transpose

2×2
 $C \cdot D$

$$\begin{array}{ll} \textcircled{1} & \boxed{1} \\ \textcircled{2} & \boxed{2} \\ \textcircled{3} & \boxed{3} \end{array} \quad \begin{array}{ll} 1(5) + 6(7) & 1(6) + 6(8) \\ 2(5) + 3(7) & 2(6) + 3(8) \\ 4(5) + 1(7) & 4(6) + 1(8) \end{array} \Rightarrow \begin{bmatrix} 47 & 54 \\ 31 & 36 \\ 27 & 32 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 6 \\ 2 & 3 \\ 4 & 1 \end{bmatrix} \quad D = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

2×2
 $D \cdot B$

$$B = \begin{bmatrix} 1 & 3 & 5 \\ 9 & 6 & 3 \end{bmatrix} \quad D = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

let's make this nicer ...

$$\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} \cdot \begin{bmatrix} 1 & 3 & 5 \\ 9 & 6 & 3 \end{bmatrix} \Rightarrow \begin{array}{lll} \textcircled{1} & \boxed{1} & \boxed{2} \\ \textcircled{2} & \boxed{3} & \boxed{3} \end{array} \quad \begin{bmatrix} 5(1) + 6(9) & 5(3) + 6(6) & 5(5) + 6(3) \\ 7(1) + 8(9) & 7(3) + 8(6) & 7(5) + 8(3) \end{bmatrix}$$
$$\Rightarrow \begin{bmatrix} 59 & 51 & 43 \\ 79 & 69 & 59 \end{bmatrix}$$

ENG EK 125 Spring 2021
Exam # 1
February 19, 2021

Name: Read this! It's for your benefit!

INSTRUCTIONS:

You have 1 hour and 15 minutes in which to complete this exam, and then another 15 minutes to upload. There are 8 problems on a total of 9 pages (including this one). Make sure that you have all pages! Read through all of the questions carefully, and make sure that you understand the instructions. Note: on programming problems, you will be graded on programming style as well as program correctness. You do not, however, have to write comments unless the problem indicates in some way that you should. Pay attention to formatting, including of plots (labels, titles, etc.). Do not do any more than is asked. If not specified, you may use either the programming method or more efficient built-in functions. For any problem in which sample data is given, remember that it is sample data only - your solution must be general, and must work for any data that is in the specified format.

{ If you have questions, you may ask by email: Prof. Attaway: sa@bu.edu, Leah: ltgaeta@bu.edu, Kailyn: kailynt@bu.edu, Sam: krasnoff@bu.edu, Brian: bmacomb@bu.edu (only until 5:30). } ← email us if you have questions during the exam

Please note that follow-up questions to this exam may be asked individually.

→ Using MATLAB or other references is not recommended, as it will likely take you too much time and you will run out of time. The exam is intended to test your knowledge of the material.

we really
don't recommend
using MATLAB
for this exam

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