NJIT

New Jersey's Science & Technology University

A. V. GERBESSIOTIS
OCT 12, 2015
MINI-PROJECT 2

CS 101
FALL 2015
70 POINTS

Mini Project 2: MATLAB Introduction (3 pages)

Rule 1. Read Handout 2; you submit an M-file `p2_WXYZ.m`, where `WXYZ` are the last 4 digits of your NJIT ID. Observe capitalization. Use an underscore _ instead of a dash -; **SUPPRESS output for all of your MATLAB commands.** If you submit a .mat file you get automatically a 0; if you submit a file with a different file-name than the one instructed, you also receive a 0.

Rule 2. Send an email (with subject line as specified in Handout 2) to
(a) the instructor `alexg+cs101@njit.edu`,
(b) the grader whose email address will be posted on the course Web-page, and
(c) to yourself to make sure that everything went fine with the transmission of your mail.

Rule 3. It is imperative that you fully conform to Rules 1 and 2. Testing will be done by running a MATLAB program; If you deviate from these rules points the program will give you 0 points or additinal points will get deducted. Observe variable names and capitalization or you may not get any points at all.
      Due Date: Before **noon time of Fri Oct 16, 2015**. (Penalties in Handout 1.)

1   Part A: Warm-up (10 points)

You will create a text-based M-file named (Rule 1) `p2_WXYZ.m` where `WXYZ` are as specified in Rule 1. **Always use semicolons to suppress output; 10 points will be deducted separately for every missing semicolon.**
A. First line. The first line of the M-file will contain in the form of a MATLAB comment the name of the file in question i.e. `p2_WXYZ.m` with the first character, the p, separated with two (2) spaces from the MATLAB comment symbol.
B. Second line. The second line would contain in the form of a MATLAB comment line your first or other given names in lower case (all characters), followed by your last name fully capitalized (all characters). Then include the last four digits of your id, eg `WXYZ`. Exactly two (2) space characters inbetween any two of the words or the comment indicator of MATLAB or `WXYZ`.
C. Third line. The third line will be empty. (Note the difference between an empty line like this and an empty comment line.)
The remaining lines of the MATLAB file are described in the following questions 1 through 14. Pay attention to the details. Variables have names starting with a v followed by a number. Do not change names or capitalization. Grading will be done automatically for most problems.

2 Part B: Vectors and Matrices (60 points)

1. Create MATLAB row vector variable `v11` that is assigned the values $1/2, 1/3, 1/4, 1/5, \ldots, 1/1000$ in that order (it is a sequence of 999 terms).

2. Create row vector `v10= [1:3:80]`, and then create MATLAB variable `v12` whose value(s) is(are) the elements of v10 after 1 is subtracted from each one of the latter's values.

3. For the same vector `v10`, create a MATLAB row vector variable `v13` whose value is the cube of each one of the elements of v10.

4. For the same vector `v10`, create a MATLAB row vector variable `v14` whose value is the fifth-root of each one of the elements of v10.

5. Create a MATLAB row vector variable `v15` whose value is $0, 1/2, 2/3, 3/4, 4/5, \ldots, 999/1000$.

6. Use the colon operator to create row vector variable `v16` such that

$$v16 = \begin{bmatrix} 25 & 21 & 17 & 13 & 9 & 5 & 1 & -3 \end{bmatrix}.$$

7. Using the colon operator as needed, create vector variable `v17` such that

$$v17 = \begin{bmatrix} 10 \\ 22 \\ 35 \\ 49 \\ 64 \end{bmatrix}$$

Hint: Explore the use of cumsum or cumprod...

8. Create column vector variable `v18` such that it includes all the numbers from -1 to 1 of the appropriate step increment so that

$$\text{transpose}(v18) = \begin{bmatrix} -1.0000 & -0.7500 & \ldots & 0.7500 & 1.0000 \end{bmatrix}.$$

9. Create a MATLAB variable `v19` that computes using MATLAB functions the number of 2s of matrix `3*ones(400,400)+2*eye(400)-1`.

Use only vector operations do not input matrix elements explicitly in the remainder. You may define auxiliary variables starting with `abcd_WXYZ_` and then using a single digit of your choice: be reminded that `WXYZ` are the last four digits of your NJIT ID. You will be penalized for the use of such variables however if you use one too many. You are not allowed to use MATLAB `reshape`, if you are tempted to or functions NOT covered in class.

10. Create matrix variable `v20` such that it is a 20×20 matrix of 20s. (You are not allowed to type 20 more than twice counting also the one in `v20`.)

$$
v20 = \begin{bmatrix} 20 & \cdots & 20 \\ \vdots & & \vdots \\ 20 & \cdots & 20 \end{bmatrix}
$$

11. Create matrix variable `v21` such that it is a 11×11 matrix of the numbers from 1 to 121 in column major order as shown below. (You may not use more than two times the colon operator.)

$$
v21 = \begin{bmatrix} 1 & 12 & \cdots & 111 \\ 2 & 13 & \cdots & 112 \\ \vdots & \vdots & \vdots & \vdots \\ 10 & 21 & \cdots & 120 \\ 11 & 22 & \cdots & 121 \end{bmatrix}
$$

12. Create matrix variable `v22` such that it is a 11×11 matrix of the numbers from 1 to 121 in row major order as shown below. (You may not use more than two times the colon operator.)

$$
v22 = \begin{bmatrix} 1 & 2 & \cdots & 11 \\ 12 & 13 & \cdots & 22 \\ \vdots & \vdots & \vdots & \vdots \\ 111 & 112 & \cdots & 121 \end{bmatrix}
$$

13. Create matrix variable `v23` such that it is initialized to the row-vector `v16`, and then use a single assignment statement to change at once the following three of its values as shown:

$$
v23(1) = 250 \quad , v23(4) = 130 \quad , v23(7) = 10
$$

14. Create matrix variable `v24` such that it is set to the sum of the values of the elements of `v11` plus 1 minus the log of the number of elements of vector `v11` incremented by 1 (note: you take the log after you increment by one). The result is an approximation to the value of Euler's constant γ which is approximately $0.5772156649\ldots\ldots$ (do not expect more than 2-3 decimal digits of precision though...)

Grading. Most (but not all) of the grading would be performed by a program `p2_chck.m` which is an M-file. To use it (when you have access to it), read the directions at the top of it. Our M-file does most but not all of the grading: it won't check lines 1-5. The grader will do it! But your actual grade would be within 10 points or so of the reported grade.