Matlab Exercises_Recitation 6 — 2.086 Spring 2012

Recitation 6: Wednesday, 14 March / Friday, 16 March
MATLAB Exercises_Recitation 6 due: *Monday, 19 March 2012 at 5 PM by upload to Stellar*

Format for upload: Students should upload to the course Stellar website a folder

`YOURNAME_MatlabExercises_Rec6`

which contains the completed scripts and functions for the assigned MATLAB Exercises_Recitation 6: all the scripts should be in a single file, with each script preceded by a comment line which indicates the exercise number; each function `.m` file should contain a comment line which indicates the exercise number.

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1. Write a script which

   (*i*) creates the 2×2 matrices

   $$A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}, \qquad B = \begin{bmatrix} 4 & \frac{1}{2} \\ 2 & 3 \end{bmatrix}, \qquad C = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix};$$

   (*ii*) creates the 2×2 matrices

   $$\begin{aligned} \texttt{prod\_matr} &= A\,B\,C\,, \\ \texttt{prod\_matr\_rev} &= B\,A\,C\,, \\ \texttt{diff\_prod\_matr} &= \texttt{prod\_matr} - \texttt{prod\_matr\_rev}\,; \end{aligned}$$

   (*iii*) creates the 2×2 matrices

   $$\begin{aligned} \texttt{transp\_prod} &= (A\,B\,C)^{\mathrm{T}}\,, \\ \texttt{prod\_transp\_rev} &= C^{\mathrm{T}}\,B^{\mathrm{T}}\,A^{\mathrm{T}}\,, \\ \texttt{diff\_transp\_rule} &= \texttt{transp\_prod} - \texttt{prod\_transp\_rev}\,. \end{aligned}$$

   Note that you should need only a single line of MATLAB to create each of the 2×2 matrices above.

2. We define, for a given integer m, $h = 1/(m-1)$; $x_i = (i-1)h$, $1 \le i \le m$; the $m \times 2$ matrix X,

   $$X = \begin{pmatrix} 1 & x_1 \\ 1 & x_2 \\ \vdots & \vdots \\ 1 & x_m \end{pmatrix}, \tag{1}$$

   and the $m \times 1$ vector Y,

   $$Y = 0.1 \begin{pmatrix} \sin \pi x_1 \\ \sin \pi x_2 \\ \vdots \\ \sin \pi x_m \end{pmatrix}. \tag{2}$$

Note $X_{i1} = 1$, $1 \le i \le m$, $X_{i2} = x_i$, $1 \le i \le m$, and $Y_i = 0.1 \sin(\pi x_i)$, $1 \le i \le m$.

(i) Create a function

```
function [res_sq] = eval_res_sq(m,v)
```

which for inputs `m` (a scalar) and $v =$ `v = [v1; v2]` (a column 2-vector) returns the scalar `res_sq` given by

$$\texttt{[res\_sq]} = Y^{\mathrm{T}}Y - 2\,v^{\mathrm{T}}X^{\mathrm{T}}Y + v^{\mathrm{T}}\,X^{\mathrm{T}}X\,v$$

for X and Y defined (within your function) by equations (1) and (2), respectively. Note you should only need a single MATLAB line to define each of $[x_i,\ 1 \le i \le m]$, X, and Y.

(ii) Write a script which evaluates your function `eval_res_sq` for inputs `m = 20` and `v = [1;1]`.

2.086 Numerical Computation for Mechanical Engineers
Fall 2012