Matlab Exercises_Recitation 3 — 2.086 Spring 2012

Recitation 3: Wednesday, 22 February / Friday, 24 February
MATLAB Exercises_Recitation 3 due: *Monday, 27 February 2012 at 5 PM by upload to Stellar*

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

`YOURNAME_MatlabExercises_Rec3`

which contains the completed scripts and functions for the assigned MATLAB Exercises_Recitation 3: 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. (a) Write a function with "signature"

   ```
   function [bern_rvs] = Bernoulli(n,theta)
   ```

   which returns a row vector `bern_rvs` of `n` independent random variables (more precisely, realizations of independent random variables) drawn from the Bernoulli probability mass function $f_X(x;\theta)$ for given $\theta \equiv$ `theta`. Note the inputs `n` and `theta` are scalars. Your function should take advantage of the MATLAB built-in `rand` — called as `rand(1,n)` to create a row vector.

   (b) Then write a script which calls your function `Bernoulli` for `n = 1000` and `theta = 0.25` and furthermore calculates and displays

   $$\texttt{frac\_one} = \frac{1}{\texttt{n}} \sum_{i=1}^{\texttt{n}} \texttt{bern\_rvs(i)} \ , \tag{1}$$

   which is simply the fraction of "one" entries in your random vector (realization). Of course `frac_one` should be roughly `theta`. Make sure to run your script for several different sets of inputs (`n`, `theta`) to `Bernoulli` in order to confirm that both the script and `Bernoulli` are working correctly.

2. (a) Write a function with "signature"

   ```
   function [x1pts,x2pts] = unif_over_rect(a1,b1,a2,b2,n)
   ```

   which provides the coordinates (`x1pts(i),x2pts(i)`), $1 \leq$ `i` $\leq$ `n`, of `n` random darts (more precisely, realizations of random darts) thrown at the rectangle `a1` $\leq x_1 \leq$ `b1`, `a2` $\leq x_2 \leq$ `b2`. (The lower left corner of the rectangle is `a1,a2`; the upper right corner of the rectangle is `b1,b2`.) You may assume that the darts are drawn from the bivariate uniform distribution over the rectangle and hence correspond to independent random variables `x1pts(i)` and `x2pts(i)`.

   Note that `x1pts` and `x2pts` should each be single-index row arrays of `length n` — two *separate* outputs. (In the next recitation we will consider double-index arrays.) The inputs `a1`, `b1`, `a2`, `b2`, and `n` are all scalars.

(*b*) Then write a script which calls `unif_over_rect` for `a1` $= -1$, `b1` $= 1$, `a2` $= -1$, `b2` $= 1$, `n` $= 2000$ and calculates and displays `frac_in_circ`, the fraction of darts that fall inside the unit circle (radius unity) centered at the origin. Of course `frac_in_circ` should be close to $\pi/4$.

2.086 Numerical Computation for Mechanical Engineers
Fall 2012