

CISC271
Fall 2005
Homework for week 1
in preparation for quiz 1
Solutions

This homework will give you some practice with using Matlab. You can use the built-in help to get information on some of the tools you will be using. For example type "help colon", "help linspace", "help norm" etc. in the Matlab

1. The following exercise illustrates how the "colon" works to initialize vectors in Matlab. Use the linspace function to create vectors identical to those obtained with the statements that follow. You can print out to compare or you can use Matlabs built-in norm function to test whether the difference between the two vectors is zero without printing the elements.

- (a) $x = 0:10$
- (b) $x = 0:0.2:10$
- (c) $x = -12:12$
- (d) $x = 10:-1:1$

Solution: Here is a script that includes the appropriate linspace commands. I computed the vector norm of the difference to determine whether the two are equivalent. In the case of b, the vector norm of the difference of x and y is not zero, due to roundoff error.

```
xb = 0:0.2:10
yb = linspace(0,10,51)
nb = norm(xb - yb)
xa = 0:10
ya = linspace(0,10,11)
```

```

na = norm(xa - ya)
xc = -12:12
yc = linspace(-12,12,25)
nc = norm(xc-yc)
xd = 10:-1:1
yd = linspace(10,1,10)
nd = norm(xd - yd)

```

2. Plot $\sin \theta$ versus θ for 60 points in the interval $0 \leq \theta \leq 2\pi$. Experiment by using different colours and shapes for the points and add some legends. NOTE: In a quiz situation I can ask you for the MATLAB for a basic plot but will not require that you memorize all the options.

Solution: This is a basic plot satisfying the requirements with an added legend. Try it to see the beautiful plot.

```

Theta = linspace(0,2*pi,60);
plot(Theta, sin(Theta),'.');
legend('sin(theta)')

```

3. Let $A = \text{magic}(n)$ for $n = 3, 4$, or 5 . What does $p = \text{randperm}(n)$; $q = \text{randperm}(n)$; $A = A(p,q)$; do to:
- (a) $\text{sum}(A)$
 - (b) $\text{sum}(A)$
 - (c) $\text{sum}(\text{diag}(A))$
 - (d) $\text{sum}(\text{diag}(\text{flipud}(A)))$
 - (e) $\text{rank}(A)$

Solution: Permuting rows and columns gives semi-magic squares, (see assignment 2). In all cases the sums of rows and columns are equal, however, the diagonals may or may not yield equal sums. The magic squares of size n when n is odd are non-singular, and have $\text{rank} = n$. Magic squares with n even are singular. See Moler section 1.4 for a detailed analysis. In any case permuting rows and columns has no effect on the rank of the matrix.