

Topics: Two-dimensional array—matrix

Reading (ML): Sec 2.1–2.3, 2.7 (exclude matrix computation), Sec 6.3

Matrix creation, access, manipulation

```
m = [1 2 3 4; 5 6 7 8] % 2-by-4 matrix
[nr,nc] = size(m)
m = [m; zeros(1,nc)]
m = [m m]
m = [m; m]
v = 1:6
newm = [m v']
newm = newm'
m1 = rand(4,3) % 4-by-3 random matrix (uniform dist.)
tmp = m1(3,2) % cell in 3rd row, 2nd column
tmp = m1(3:4,:)
tmp = m1(:,2)
tmp = m1([1 4],:)
tmp = m1(:, [1 3])
tmp = m1([1 4],[1 3])
load matrix.dat % an ASCII data file called matrix.dat
load mmatrix % a MATLAB data file called mmatrix.mat
help save
```

Arithmetic and logical operations

```
elev = rand(4,3) % elevations on a map
elev = 8*elev
elev = elev + 10
elev > 16 % returns a logical array

% 1-d examples
vec = elev(1,:)

L = vec>16 % logical array indicating result from vec>16
vec16 = vec(L) % extract just the cells with values > 16

vec16 = vec(vec>16) % combine last two statements in one

I = find(vec>16) % get the indices where vec>16
vec16 = vec(I) % extract just the cells with values > 16

% 2-d examples
L16 = elev>16 % logical array (matrix)
elev16 = elev(elev>16) % VECTOR!!!

% extract values>16 and put back in matrix form
[ri,ci] = find(elev>16) % ri stores row index
% ci stores col index
for i = 1:length(ri)
    elev16(ri(i),ci(i)) = elev(ri(i),ci(i));
end
elev16
```

Example

Elevations of a rectangular area are stored in a matrix **elev**. Each cell contains the elevation at one location (x-y coordinate pair). All measurements in meter.

y=3	23	25	26	27
2	23	23	24	26
1	22	23	24	25
x=	1	2	3	4

Print the elevation at location (x=3m,y=1m).

What if the x range is [110,140] and y range is [110,130]?

y=130	23	25	26	27
120	23	23	24	26
110	22	23	24	25
x=	110	120	130	140

Print the elevation at location (x=130m,y=110m).