Lecture 07

Arrays, Matrices

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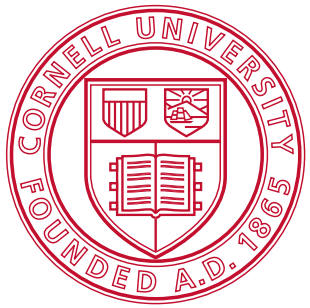

Cornell University

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Before we begin

HW2 Extended until midnight

HWe Due: July 22, 6pm

PP Project proposals

Arrays

Array

A variable to hold multiple values of the same type.

Example

```
x = [1, 2, 3, 4, 5, 6, 7];
y = ['a', 'b', 'c'];
z = 'abc';
```

Arrays - Indexing

Indexing

Specifying an element of an array by providing its location.

Example

```
a = [2, 3, 5, 7, 11, 13];
a(1)    % 2
a(2)    % 3
a(3)    % 5
a(6)    % 13

s = 'Cornell'
s(1)    % 'C'
s(4)    % 'n'
```

Operations with Arrays

Array opertors

.^	elementwise power raising
.*	elementwise multiplication
./	elementwise division

Example

```
a = [2 3 4 5];
b = [1 2 4 3];
c = a.*b; % c is [2 6 16 15]
d = a.^b; % d is [2 9 256 125]
e = a./b; % e is [2 1.5 1 1.6667]
f = a + b; % f is [3 5 8 8]
```

Colon (:) Notation

Colon (:)

creates a sequence of numbers with constants steps

Example

```
1:6
% [1 2 3 4 5 6]
1:2:6
% [1 3 5]
6:-2:1
% [6 4 2]
'a':'e'
% 'abcde'
'e':2:'k'
% 'egik'
```

Indexing with Colon

Parts of an array can be extracted by indexing with colon notation.

Example

```
a = [2, 3, 5, 7, 11, 13];
a(1:2)      % [2, 3]
a(1:2:5)    % [2, 5, 11]
a(6:-3:1)   % [13, 5]
a(1:3:end)  % [2, 7]
a(2:end-1)  % [3, 5, 7, 11]
```

2D Arrays (Matrices)

2D Array

holds multiple values indexed with two numbers.

Example

```
a = [ 1,  2,  3,  4;
      5,  6,  7,  8;
      9, 10, 11, 12 ];
```

Matrices - Comma vs. Semicolon

comma ,

seperates the columns

semicolon ;

seperates the rows

Example

```
a = [1, 2; 3, 4];
b = [1 2
     3 4];
c = [1, 2, ... % ??
     3, 4];
d = [1; 2;
     3; 4];
```

Matrices - Indexing

Indexing

Specifying an element of an array by providing its location.

Example

```
a = [ 1,  2,  3,  4;
      5,  6,  7,  8;
      9, 10, 11, 12 ];

% variable(row_index, column_index)
a(1,1)   % 1
a(2,1)   % 5
a(1,2)   % 2
a(2,3)   % 7
a(3,2)   % 10
```

Nested Loop

Example

```
a = [ 1,  2,  3,  4;
      5,  6,  7,  8;
      9, 10, 11, 12 ];

% Sum the entries of the matrix
s = 0;
for j = 1:3
   for k = 1:4
      s = s + a(j,k);
   end
end
```

Matrices - Size, Some Generators

size

returns an array with the number rows and columns

ones(m,n), zeros(m,n)

generates all 1's or all 0's

rand(m,n)

generates random numbers between 0 and 1