- Today's topics
  - Review of topics for Test 1
  - Characters and strings

- Announcements/Reminders:
  - Assignment 1b due tomorrow night 11:59pm
  - Test 1 in class on Wednesday

The `if` construct

if *boolean expression1*

statements to execute if expression1 is true

elseif *boolean expression2*

statements to execute if expression1 is false but expression2 is true

:

else

statements to execute if all previous conditions are false

end

Can have any number of elseif branches but at most one else branch

Generating random numbers

- `rand(m,n)` gives an m-by-n matrix of random values, each in interval (0,1)
- Generate a random number in the range (a,b)
- Generate a random integer in the range [a,b]

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- Generate a random number in the range (a,b)

  rand * (b-a) + a

- Generate a random integer in the range [a,b]

  floor (rand * (b-a+1) + a)

  ceil (rand * (b-a+1) + a-1)

Simulation problem:

- Ann and Bob take turns flipping an unfair coin—twice as likely to be heads than tails
- In one round, each player flips once
- Ann gets 1 point if she gets heads; Bob gets 2 points if he gets tails
- Game ends after the round in which at least one player gets 10 points. Display the final scores.

Simulation problem: Stop: pA >= 10 or pB >= 10

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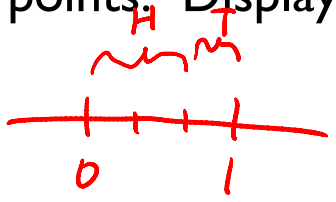


```
pA = 0; pB = 0;
while pA < 10 && pB < 10
    % 1 round: A flips; B flips; scoring
    r = rand.
    if r < 2/3
        pA = pA + 1;
    end
    r = rand;
    if r
        pB = pB + 2
    end
end
Display
```

Common loop patterns

Do something *n* times

```
for k= 1:1:n
    % Do something

end
```

Do something an indefinite number of times

```
%Initialize loop variables

while ( not stopping signal )
    % Do something

    % Update loop variables

end
```

`for` loop examples

```
for k= 2:0.5:3
     disp(k)
end
```

k takes on the values 2,2.5,3

Non-integer increment is OK

```
for k= 1:4
     disp(k)
end
```

k takes on the values 1,2,3,4

Default increment is 1

```
for k= 0:-2:-6
     disp(k)
end
```

k takes on the values 0,-2,-4,-6

"Increment" may be negative

```
for k= 0:-2:-7
     disp(k)
end
```

k takes on the values 0,-2,-4,-6

Colon expression specifies a *bound*

```
for k= 5:2:1
     disp(k)
end
```

The set of values for k is the empty set: the loop body won't execute

```
for k = 4:6
    disp(k)
    k= 9;
    disp(k)
end
```

Not a condition (boolean expression) that checks whether k<=6.

It is an expression that specifies values:

Built-in functions for creating/manipulating arrays

- Creation
  - zeros, ones, rand
  - linspace
- Manipulation
  - length
  - size

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#rows ↓ , # cols ←

```
zeros(3, 2)
```

```
x = linspace( 3 , 10 , 8 )'
```

3: starting, 10: end, 8: # of values

```
[nr, nc] = size(M)
```

```
a = [4 2 3; ones(2,3)]
```

Function header is the "contract" for how the function will be used (called)

You have this function:

```
function  [x, y] = polar2xy(r, theta)
% Convert polar coordinates (r, theta) to
% Cartesian coordinates (x,y).  Theta in degrees.
…
```

Code to call the above function:

```
% Convert polar (r1,t1) to Cartesian (x1,y1)
r1= 1;   t1= 30;
[x1, y1]= polar2xy(r1, t1);
plot(x1, y1, 'b*')
…
```

Write a function triSums to return the column sums of the largest lower left triangular part of matrix M (same number of elements on each side of the triangle; including the main diagonal if matrix is square)

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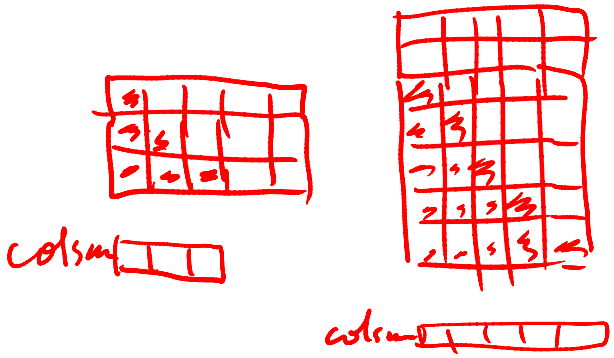
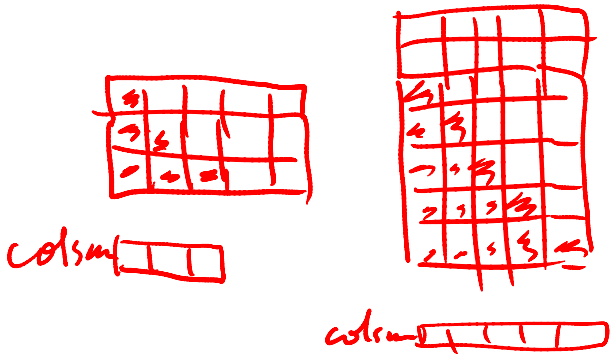
```
function colsum = triSums(M)

[nr, nc] = size(M)

colsums = zeros(
```



Write a function triSums to return the column sums of the largest lower left triangular part of matrix M (same number of elements on each side of the triangle; including the main diagonal if matrix is square)

```
function colsum = triSums(M)

[nr, nc] = size(M)
minD = min(nr, nc)
colsums = zeros(1, minD);

for c = 1: ~~nc~~ minD

    for r = ◯ : nr
        colsum(c) = colsum(c) +

    end

end
```



Other notes for the test (course)

- Read questions/instructions carefully
- Use Matlab syntax
- Do not use **`break`**, **`continue`**
- Do not use **`randi`**, instead use **`rand`**
- Many students make “index out-of-bounds” error

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```
% v vector
for k = 1 : length(v)-1
    y(k) = v(k) + v(k+1)
end
```

Characters & strings

- We have used strings already:
  - `n= input('Next number: ')`
  - `sprintf('Answer is %d', ans)`
- A string is made up of individual characters, so a string is a 1-d array of characters
- '`CS1112 rocks!`' is a character array of length 13; it has 7 letters, 4 digits, 1 space, and 1 symbol.

'C'	'S'	'1'	'1'	'3'	'2'	' '	'r'	'o'	'c'	'k'	's'	'!'

- Can have 2-d array of characters as well

'C'	'S'	'1'	'1'	'3'	'2'
'r'	'o'	'c'	'k'	's'	'!'

2×6 matrix

Matlab types: `char`, `double`, `uint8`, `logical`

There is not a type "string"! What we call a string is a *1-d array of chars*

```
a  'C' 'S' '1'

b = [3 9]

d = rand > .5
```

a is a 1-d array with type **`char`** components. We call **a** a "string" or "char array"

b is a 1-d array with type **`double`** components. **`double`** is the default type for numbers in Matlab. We call **b** a "numeric array"

d is a scalar of the type **`logical`**. We call **d** a "boolean value"

Single quotes enclose strings in Matlab

Anything enclosed in single quotes is a string (*even if it looks like something else*)

- `'100'` is a character array (string) of length 3
- `100` is a numeric value
- `'pi'` is a character array of length 2
- `pi` is the built-in constant 3.1416…
- `'x'` is a character (vector of length 1)
- `x` may be a variable name in your program

Strings are vectors

Vectors

- Assignment

```
v= [7 0 5];
```

- Indexing

```
x= v(3);     % x is 5
v(1)= 1;     % v is [1 0 5]
w= v(2:3);   % w is [0 5]
```

- : notation

```
v= 2:5;      % v is [2 3 4 5]
```

- Appending

```
v= [7 0 5];
v(4)= 2;     % v is [7 0 5 2]
```

- Concatenation

```
v= [v [4 6]];
                % v is [7 0 5 2 4 6]
```

Strings

- Assignment

```
s= 'hello';
```

- Indexing

```
c= s(2);     % c is 'e'
s(1)= 'J';   % s is 'Jello'
t= s(2:4);   % t is 'ell'
```

- : notation

```
s= 'a':'g';  % s is 'abcdefg'
```

- Appending

```
s= 'duck';
s(5)= 's';    % s is 'ducks'
```

- Concatenation

```
s= [s ' quack'];
                % s is 'ducks quack'
```

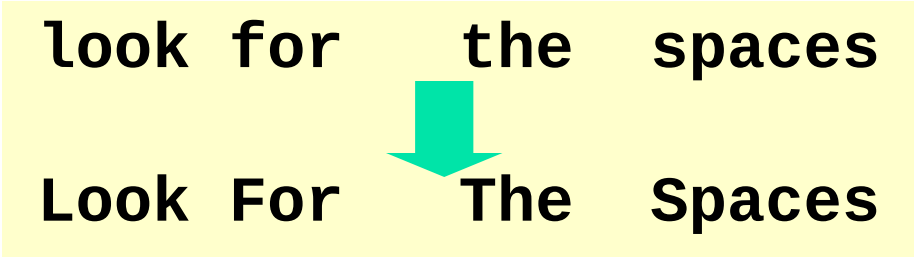
Some useful string functions

```
str= 'Cs 1112';

length(str)   % 7
isletter(str) % [1 1 0 0 0 0 0]
isspace(str)  % [0 0 1 0 0 0 0]
lower(str)    % 'cs 1112'
upper(str)    % 'CS 1112'

ischar(str)
  % Is str a char array? True (1)
strcmp(str(1:2),'cs')
  % Compare strings str(1:2) & 'cs'. False (0)
strcmp(str(1:3),'CS')
  % False (0)
```

Example: capitalize 1st letter

Write a function to capitalize the first letter of each word in a string. Assume that the string has lower case letters and blanks only. (OK to use built-in function **upper**)

```
function [str, nCaps] = caps(str)
% Post: Capitalize first letter of each word.
%    str = partially capitalized string
%    nCaps = no. of capital letters
% Pre: str = string with lower case letters & blanks only
```



See **caps.m**

ASCII characters

(American Standard Code for Information Interchange)

ascii code	*Character*	*ascii code*	*Character*
:	:	:	:
:	:	:	:
65	‘A’	48	‘0’
66	‘B’	49	‘1’
67	‘C’	50	‘2’
:	:	:	:
90	‘Z’	57	‘9’
:	:	:	: