

- Previous Lecture:
 - Intro to the course, “Computational senses”
 - Running a program in Matlab
- Today's Lecture:
 - Anatomy of a program
 - Variables, assignment, mathematical operations
 - Functions for input & output
- Announcements
 - Due to the fixed lab capacity, you **must attend the discussion section in which you are enrolled**
 - Consulting begins Wednesday in ACCEL Green Room (Carpenter Hall)

Lecture 2 2

Formula

- Surface area of a sphere? $A = 4\pi r^2$
- Have the cosine of some angle and want $\cos(\theta/2)$? $\theta \in [0, \pi/2]$

$$\cos(\theta/2) = \sqrt{\frac{1 + \cos(\theta)}{2}}$$

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```

% Example 1_1: Surface area of a sphere
% A: surface area of the sphere
% r: radius of the sphere

r= input('Enter the radius: ');
A= 4*3.14159*r*r;
fprintf('Surface area is %f!\n', A)
    
```

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A computer program

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Variable & assignment

- **Variable:** a named computer memory space for storing a value

r

A

- Valid names start with a letter, can contain digits
- **Use meaningful variable names!**

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Variable & assignment

- **Variable:** a named space for storing a value

r

- **Assignment:** putting a value into a variable
- Assignment operator: =
- An assignment statement: $r = 2 * 4.5$
- **Expression** on **right-hand-side (rhs)** is evaluated before the assignment operation

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Assignment

- **Expression** on **rhs** is evaluated before the assignment operation
- Examples:
 - `x= 2*3.14`
 - `y= 1+x`
 - `z= 4^2 - cos(y)`
- Question: can we reverse the order of the 3 statements above?

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Script execution

(A script is a sequence of statements, an "m-file")

```
% Quad1
% Solves x^2 + 5x + 6 = 0

a = 1;
b = 5;
c = 6;
d = sqrt(b^2 - 4*a*c);
r1 = (-b - d)/(2*a)
r2 = (-b + d)/(2*a)
```

Memory space

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Statements in a program are executed in sequence

```
% A program fragment ...
x= 2*3.14
y= 1+x
x= 5
% What is y now?
```

A: 6 B: 7.28 C: some other value, or error

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Input & output

- `variable = input('prompt')`
- `fprintf('message to print')`

```
r= input('Enter radius: ')

fprintf('Increase ')
fprintf('is %f inches\n', x)
fprintf('Position (%d,%d)\n', x,y)
```

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Substitution sequences
(conversion specifications)

- `%f` fixed point (or floating point)
- `%d` decimal—whole number
- `%e` exponential
- `%g` general—Matlab chooses a format
- `%c` character
- `%s` string

Examples: `%f` `%15.2f`

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Comments

- For readability!
- A comment starts with `%` and goes to the end of the line
- Start each program (script) with a **concise** description of what it does
- Define each important variable/constant
- Top a block of code for a specific task with a **concise** comment

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Example

Modify the previous program to calculate the increase in surface area (mile²) given an increase in the radius of a sphere.

Note: 1 mile = 5280 feet

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```
% Example 1_2: Surface area increase
% given an increase in the radius
```

```
r= input('Enter radius r in miles: ');
delta= input('Enter delta r in inches: ');
```

What's next?

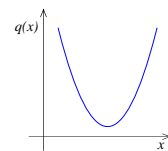
- So far, all the statements in our scripts are executed in order
- We do not have a way to specify that some statements should be executed only under some condition
- We need a new language construct...

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Consider the quadratic function

$$q(x) = x^2 + bx + c$$



on the interval $[L, R]$:

- Is the function strictly increasing in $[L, R]$?
- Which is **smaller**, $q(L)$ or $q(R)$?
- What is the **minimum value** of $q(x)$ in $[L, R]$?

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