Example: surface area of a sphere

% Example 1_1: Compute 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.
', A);

Anatomy of a program

• input
• calculation
• output
• comments

Definitions

• Algorithm: a set of procedures for solving a problem
• Program: an algorithm implemented in some language
• Variable: a named memory space for storing a value
• Assignment: the action of putting a value into a variable
• Expression: a combination of operators and operands (variables, constants) that evaluate to a value

Variables & assignment

A variable is a named memory space for storing a value. Think about it as a box to hold an item. Valid variable names begin with a letter and can contain digits. Always use meaningful variable names!

Assignment is the action of putting a value into a variable. The assignment operator is the symbol = but do not read this as “equal.” Some example assignment statements are

x= 2*3.1416
y= 1+x
z= 4^2 - cos(y)

In an assignment, the expression on the right hand side (rhs) is evaluated before the assignment operation. Therefore, any variable on the rhs must be initialized.

Statements are executed in sequence:

x= 2*3.14
y= 1+x
x= 5
% What is y now?
**Input & output statements**

Input:  \( \text{variable} = \text{input('prompt')} \)
Output: \( \text{disp('words to be displayed')} \)
        \( \text{fprintf('Value of x is } %f, \text{ not } %d\text{!', x, y)} \)

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**Some substitution sequences**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>%f</td>
<td>fixed point (or floating point)</td>
</tr>
<tr>
<td>%d</td>
<td>decimal—whole number</td>
</tr>
<tr>
<td>%e</td>
<td>exponential</td>
</tr>
<tr>
<td>%g</td>
<td>general—MATLAB chooses</td>
</tr>
<tr>
<td>%c</td>
<td>character</td>
</tr>
<tr>
<td>%s</td>
<td>string</td>
</tr>
</tbody>
</table>

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**Comments**

- Use comments for readability!
- Start each program 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
- A comment starts with the “\%” symbol and goes to the end of the line

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**Example: expanding sphere**

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

% Example 1_2: Explore how the surface area of a sphere % changes with an increase in the radius.

\[ r= \text{input('Enter radius } r \text{ in miles: ')}; \]
\[ \text{delta= input('Enter delta } r \text{ in inches: ')}; \]

\[ \text{fprintf('Increase in area } (\text{mile}^{2}) \text{ is } %f.\text{\n'}, \text{incr}); \]