



Arithmetic Operators Variables and Expression

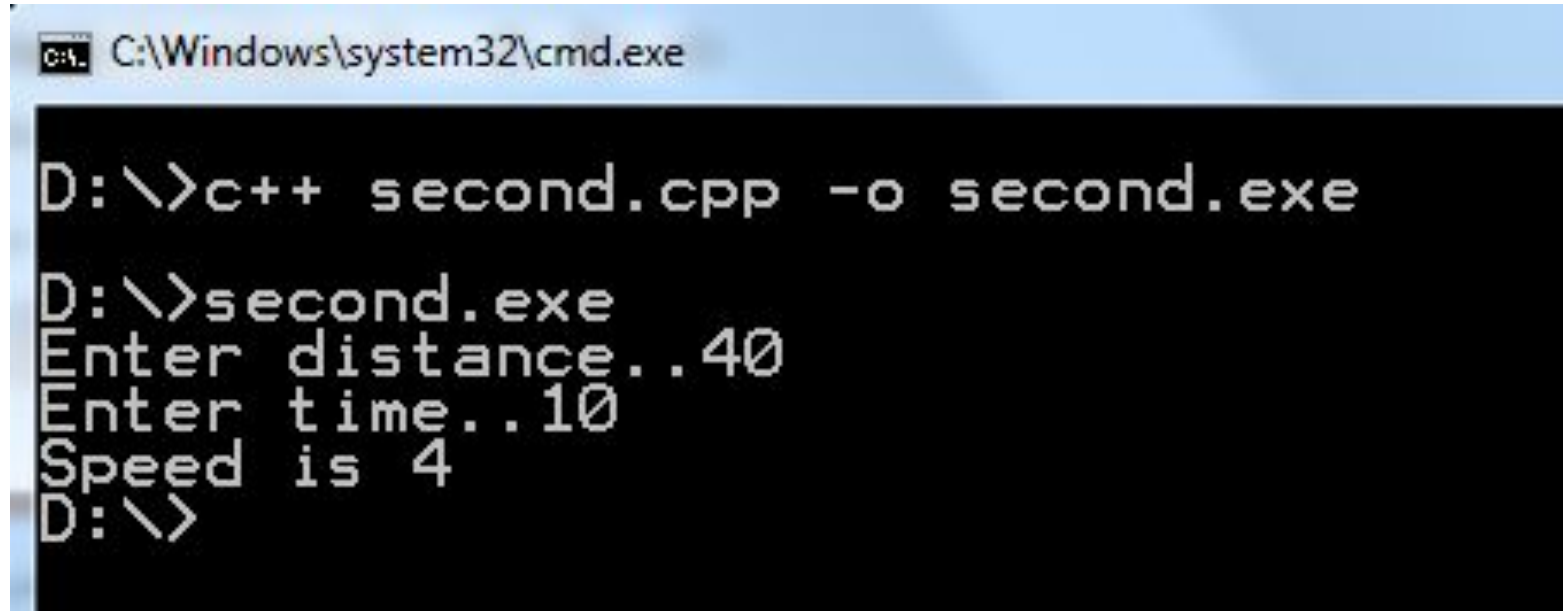


|| Vision of this week

We want to write a **Program** that takes **Distance** (in kilometers) travelled by a car in **Time** (hours) and calculates its **Speed** (kilometer/hour).

Vision of this week

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```
C:\Windows\system32\cmd.exe

D:\>c++ second.cpp -o second.exe

D:\>second.exe
Enter distance..40
Enter time..10
Speed is 4
D:\>
```

Uses of Variables



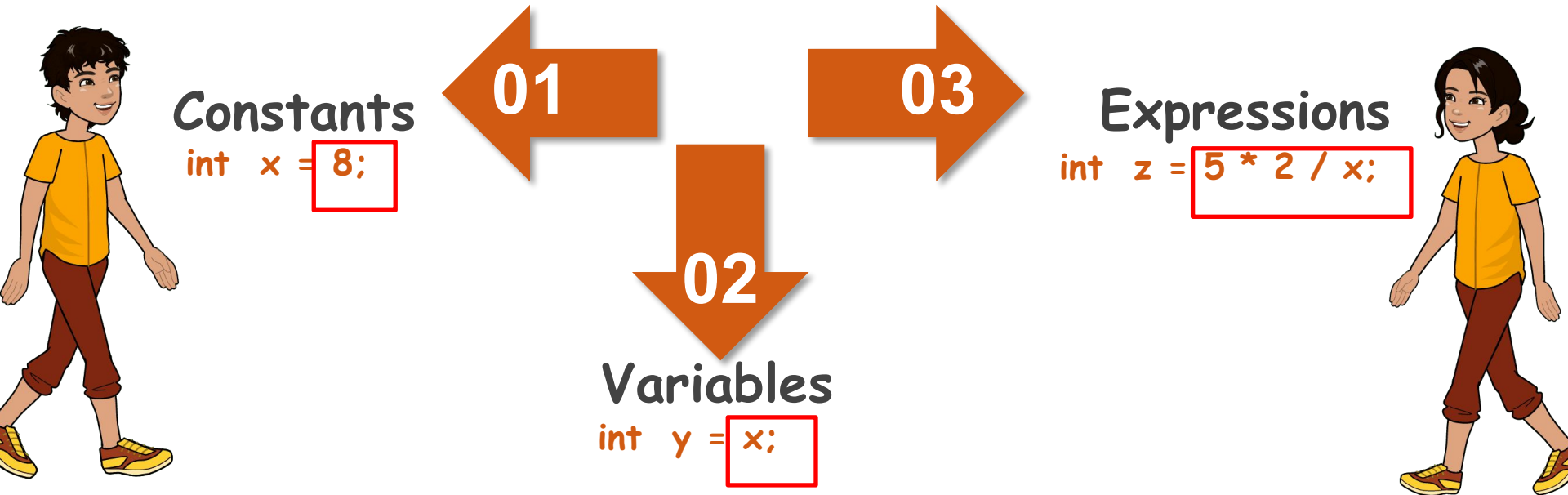
Once the variables are declared and memory is reserved, we can have multiple uses of these variables.

- We can **assign values to these variables** according to their data types
- We can **retrieve values from these variables**
- We can apply different **mathematical (addition, multiplication, subtraction)** and other operations (we will see those in next lecture) on these variables.



|| Uses of Variables: Assignment

We can **Assign** a value to variable using **Assignment Operator**.



Uses of Variables: Retrieval

Here, we are **Retrieving** the value of variable x and assigning that value to variable y

```
int X = 3;
```

```
int Y = X;
```



Memory



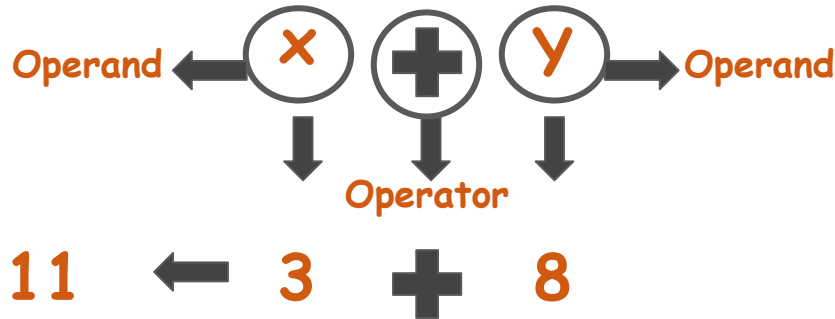
Operations on Variables: Addition

Apply mathematical operation on Variables

```
int x = 3;  
int y = 8;  
int z = x + y;
```

3	x
8	y
11	z

Memory



Arithmetic Operators:

Here is a list of **Arithmetic Operators** that can be used.



Operator	Meaning	Example
+	Addition	$8+2=10$
-	Subtraction	$8-2=6$
*	Multiplication	$8*2=16$
/	Division	$8/2=4$
%	Modulus	$8\%2=0$



Expressions

An **Expression** is a combination of **Variables**, **Constants** and **Operators**.

For Example

- $8 + 9$ is an expression
- $X/2 - 1$ is also an expression



Expressions

It consists of

- One or more Operands
- Zero or more Operators

For Example:

$X + 10 - Y$



Operands



Operations on Variables: Expression

Expression containing only Constants and Operators

$$2 + 10 + 8$$



Operations on Variables: Expression

Expression containing combination of Variables, Constants and Operators



$$27 \leftarrow \underset{\substack{\downarrow \\ 5}}{\text{X}} + 10 + \underset{\substack{\downarrow \\ 12}}{\text{Y}}$$



Expressions

We can write Expression using **Variables** and **Constants** and **Assign** these **Expressions** to some **Variables**.



int x = 3;

int y = 8;

int z = $y - x + 10$;



Memory

x
y
z



Expressions

Lets see some more examples



`int x = 3;`

`int y = 8;`

`int z = 2 * 25 + 7;`



Memory

x
y
z



Operations on Variables: Expression

$$Z = 10 + 10 * 5$$



Operations on Variables: Expression

$$60 = 10 + 50$$

$$Z = 10 + 10 * 5$$

$$100 = 20 * 5$$



Operations on Variables: Expression

$$Z = 60$$



$$Z = 10 + 10 * 5$$

~~$$Z = 100$$~~



Operations on Variables: Expression

$$Z = 60$$



$$Z = (10 + 10) * 5 \leftarrow$$

$$Z = 1000 * 5 \swarrow \searrow$$



Expression : Precedence Order

Here is the precedence order of **Arithmetic Operators**



Operator	Symbol	Precedence
Parentheses	()	1
Exponential	X^Y	2
Multiplication Division	$*$ $/$	3 3
Addition Subtraction	$+$ $-$	4 4

Expression: PEMDAS RULE

Simply, we can Remember the order of precedence through the PEMDAS Rule.



Rule	Operator	Symbol
P	Parentheses	()
E	Exponential	x^y
M	Multiplication	*
D	Division	/
A	Addition	+
S	Subtraction	-



Working Examples: Expressions

Lets see some working examples of Expressions



$$Z = 2 + 3 / 4$$



A diagram illustrating the order of operations for the expression $Z = 2 + 3 / 4$. An orange arrow points from the division operator ($/$) down to the division part of the result (0.75). Another orange arrow points from the addition operator ($+$) down to the addition part of the result (2.75).

$$Z = 2.75 \quad 0.75$$



Working Examples: Expressions

Lets see some working examples of Expressions



$$Z = 10 - 2 * 4$$


$$Z = 2 \ 10 - 8$$



Learning Objective

Write expression using **Arithmetic Operator, Variables, and constants** while following precedence rule.



Conclusion

- We can have multiple uses of variables
 1. Assign Values
 2. Retrieve Values
 3. Apply Mathematical Operations
- Assignment is done using **Assignment Operator**.
- There are 3 ways in which we can assign values to the variables
 1. Constants
 2. Variables
 3. Expressions
- An **Expression** is a combination of **Variables**, **Constants** and **Operators**.
- **Expressions** are evaluated with the **Precedence** order of **Operators**.
- The precedence order is given by **PEMDAS** Rule.



Self Assessment

1. Find **constant**, **variable** and **operator** from the following statements

Statement	Constant	Variable	Operator
Foo = 4 * result			
Var = 5 % 3			
X = num1 - num2			

2. Solve the following **Expressions** and write the answer.

Statement	Answer
Foo = 4 * 10 / 2	
Var = 5 % 3	
X = 5 - 2 + 62 - 2	



Self Assessment

3. **Evaluate** the following expressions and **Write** the answers.

No.	Expression	Answer
1	$2 / 1 + 5$	
2	$3 / 4 + (2 - 1)$	
3	$7 + (600 - 100) * 8$	
4	$500 * 400 / 4 + 10$	
5	$18 / 2 * 18 - 1$	

