# Hierarchy of Operations

- Does 2 * x - 3 * y correspond to

  (2x)-(3y) or to 2(x-3y)?
- Similarly, does A / B * C

  correspond to

  A / (B * C) or to (A / B) * C?

# The hierarchy of commonly used operators

| Priority | Operators | Description |
|---|---|---|
| 1st | * / % | multiplication, division, modular division |
| 2nd | + - | addition, subtraction |
| 3rd | = | assignment |

Ex 1: Determine the hierarchy of operations and evaluate the following expression: i = 2 * 3 / 4 + 4 / 4 + 8 - 2 + 5 / 8

- Stepwise evaluation of this expression
- i = 2 * 3 / 4 + 4 / 4 + 8 - 2 + 5 / 8
- i = 6 / 4 + 4 / 4 + 8 - 2 + 5 / 8 operation: *
- i = 1 + 4 / 4 + 8 - 2 + 5 / 8 operation: /
- i = 1 + 1+ 8 - 2 + 5 / 8 operation: /
- i = 1 + 1 + 8 - 2 + 0 operation: /
- i = 2 + 8 - 2 + 0 operation: +
- i = 10 - 2 + 0 operation: +
- i = 8 + 0 operation : -
- i = 8 operation: +

Ex 2: Determine the hierarchy of operations and evaluate the following expression: kk = 3 / 2 * 4 + 3 / 8 + 3

- Stepwise evaluation of this expression is shown below:
- kk = 3 / 2 * 4 + 3 / 8 + 3
- kk = 1 * 4 + 3 / 8 + 3 operation: /
- kk = 4 + 3 / 8 + 3 operation: *
- kk = 4 + 0 + 3 operation: /
- kk = 4 + 3 operation: +
- kk = 7 operation: +

| **Algebric Expression** | **C Expression** |
| --- | --- |
| $a \times b - c \times d$ | a * b – c * d |
| $(m + n)\ (a + b)$ | (m + n) * (a + b) |
| $3x2 + 2x + 5$ | 3 * x * x + 2 * x + 5 |
| $\frac{a + b + c}{d + e}$ | ( a + b + c ) / ( d + e ) |
| $\left[\frac{2BY}{d+1} - \frac{x}{3(z+y)}\right]$ | 2 * b * y / ( d + 1 ) – x / 3 * ( z + y ) |

# Associativity of Operators

- Associativity can be of two types
  - Left to Right
  - Right to Left
- Consider the expression

  a = 4 / 2 * 5 ;

Ans: 10

- Consider one more expression

  a = b = 3 ;

Here both assignment operators have the same priority and same associativity (Right to Left).

Ans: a=3, b=3.

# Problem 1: Evaluate the expressions and show their hierarchy

(a) ans = 5 * b * b * x - 3 * a * y * y - 8 * b * b * x + 10 * a * y ;

(a = 3, b = 2, x = 5, y = 4 assume **ans** to be an int)

(b) res = 4 * a * y / c - a * y / c ;

(a = 4, y = 1, c = 3, assume **res** to be an int)

(c) s = c + a * y * y / b ;

(a = 2.2, b = 0.0, c = 4.1, y = 3.0, assume **s** to be an float)

(d) R = x * x + 2 * x + 1 / 2 * x * x + x + 1 ;

(x = 3.5, assume **R** to be an float)

# Solutions for (b) and (C ) part

(b) res = 4 * a * y / c - a * y / c ;

(a = 4, y = 1, c = 3, assume **res** to be an int)

*Answer:*

| | |
|---|---|
| res = **4 * 4** * 1 / 3 - 4 * 1 / 3 | operation: * |
| res = **16 * 1** / 3 - 4 * 1 / 3 | operation: * |
| res = **16 / 3** - 4 * 1 / 3 | operation: / |
| res = 5 - **4 * 1** / 3 | operation: * |
| res = 5 - **4 / 3** | operation: / |
| res = **5 - 1** | operation: - |
| res = 4 | |

(c) s = c + a * y * y / b ;

(a = 2.2, b = 0.0, c = 4.1, y = 3.0, assume s to be an float)

*Answer:*

| | |
|---|---|
| s = 4.1 + **2.2 * 3.0** * 3.0 / 0.0 | operation: * |
| s = 4.1 + **6.6 * 3.0** / 0.0 | operation: * |
| s = 4.1 + **19.8 / 0.0** | operation: / |
| Here we cannot Divide by 0 | |

Problem 2: Indicate the order in which following expressions would be evaluated

(a) g = 10 / 5 /2 / 1 ;

(b) b = 3 / 2 + 5 * 4 / 3 ;

(c) a = b = c = 3 + 4 ;

(d) x = 2 – 3 + 5 * 2 / 8 % 3 ;

(e) z = 5 % 3 / 8 * 3 + 4

(f) y = z = -3 % -8 / 2 + 7 ;

# Solutions for (e) and (f ) part

(e) $z = 5 \% 3 / 8 * 3 + 4 ;$

Evaluation order would be:

z = **5 % 3** / 8 * 3 + 4
z = **2 / 8** * 3 + 4
z = **0 * 3** + 4
z = **0 + 4**
z = 4

operation: %
operation: /
operation: *
operation: +
operation: =

(f) $y = z = -3 \% -8 / 2 + 7 ;$

Evaluation order would be:

y = z = **-3** % -8 / 2 + 7
y = z = -3 % **-8** / 2 + 7
y = z = **-3 % -8** / 2 + 7
y = z = **-3 / 2** + 7
y = z = **-1 + 7**
y = **z = 6**
y = 6

operation: -
operation: -
operation: %
operation: /
operation: +
operation: =
operation: =

# Problem 3: Convert the following algebraic expressions into equivalent C statements

(a) $$Z = \frac{(x+3)x^3}{(y-4)(y+5)}$$

(b) $$R = \frac{2v + 6.22\ (c+d)}{g+v}$$

(c) $$A = \frac{7.7b\,(xy+a)/c - 0.8 + 2b}{(x+a)\ (1/y)}$$

(d) $$X = \frac{12x^3}{4x} + \frac{8x^2}{4x} + \frac{x}{8x} + \frac{8}{8x}$$

# Solution for part ( c ) and (d)

(c) $$A = \frac{7.7b\,(xy + a)\,/\,c - 0.8 + 2b}{(x + a)\;(1\,/\,y)}$$

*Answer:*

A = ( ( 7.7 * b ) * ( x * y + a ) / c – 0.8 + 2 * b ) / ( ( x + a ) * ( 1 / y ) )

(d) $$X = \frac{12x^3}{4x} + \frac{8x^2}{4x} + \frac{x}{8x} + \frac{8}{8x}$$

*Answer:*

X = ( 12 * x * x * x / 4 * x ) + ( 8 * x * x / 4 * x ) + ( x / 8 * x ) + ( 8 / 8 * x )

What would be the output of the following programs:

(a)

```
main( )
{
int i = 2, j = 3, k, l ;
float a, b ;
k = i / j * j ;
l = j / i * i ;
a = i / j * j ;
b = j / i * i ;
printf( "%d %d %f %f", k, l, a, b ) ;
}
```

# What would be the output of the following programs:

(a)

```
main( )
{
int i = 2, j = 3, k, l ;
float a, b ;
k = i / j * j ;
l = j / i * i ;
a = i / j * j ;
b = j / i * i ;
printf( "%d %d %f %f", k, l, a, b ) ;
}
```

**Output**

**0 2 0.000000 2.000000**

(b)

```
# include <stdio.h>
int main( )
{
    int  a, b, c, d ;
    a = 2 % 5 ;
    b = -2 % 5 ;
    c = 2 % -5 ;
    d = -2 % -5 ;
    printf ( "a = %d b = %d c = %d d = %d\n", a, b, c, d ) ;
    return 0 ;
}
```

(b)
```
# include <stdio.h>
int main( )
{
    int  a, b, c, d ;
    a = 2 % 5 ;
    b = -2 % 5 ;
    c = 2 % -5 ;
    d = -2 % -5 ;
    printf ( "a = %d b = %d c = %d d = %d\n", a, b, c, d ) ;
    return 0 ;
}
```

*Output:*

a = 2  b = -2  c = 2  d = -2

(c)
```
# include <stdio.h>
int main( )
{
    float a = 5,  b = 2 ;
    int c, d ;
    c = a % b ;
    d = a / 2 ;
    printf ( "%d\n", d ) ;
    return 0 ;
}
```

(c)
```
# include <stdio.h>
int main( )
{
    float a = 5,  b = 2 ;
    int c, d ;
    c = a % b ;
    d = a / 2 ;
    printf ( "%d\n", d ) ;
    return 0 ;
}
```

*Output:*

Error. Mod ( % ) operator cannot be used on **floats**

(d)

```
#include<stdio.h>
int main( )
{
printf ( "nn \n\n nn\n" ) ;
printf ( "nn /n/n nn/n" ) ;
return 0;
}
```

(d)

```
#include<stdio.h>
int main( )
{
printf ( "nn \n\n nn\n" ) ;
printf ( "nn /n/n nn/n" ) ;
return 0;
}
```

**Output**

```
nn

nn
nn  /n/n  nn/n
```

# Program #1

- Temperature of a city in Farhenheit degree is input through the keyboard. Write a program to convert it into centigrade degree.

# Algorithm 1

Step 1: Start

Step 2: Input temperature in Farhenheit degree as F_degree

Step 3: Compute C_degree = (F_degree -32)*5/9

Step 4: Print C_degree

Step 5: End

## Algorithm

Step 1: Start
Step 2: Input temperature in Farhenheit degree as F_degree
Step 3: Compute C_degree = (F_degree -32)*5/9
Step 4: Print C_degree
Step 5: End

## Program

```
#include<stdio.h>
int main()
{
float f_degree, c_degree;
printf(“Enter the temperature in Farhenheit”) ;
scanf(“% f”, &f_degree);
c_degree = (f_degree -32)*5/9;
printf(“Temperature in celcius =%f”, c_degree);
return 0;
}
```

- Write a program to calculate area and circumference of a circle