



# Selection Structures: if and switch Statements

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# Control Structure

## □ Three kinds of control structures

- Sequence structure

- Programs executed sequentially by default
- Statements executed in order

- Selection structures

- If
- if...else
- switch

- Repetition structures

- while
- do...while
- for

# Control Structure

Before,

let us study: 1. Relational and equality operators  
2. Logical Operators

# Relational and equality operators

## Four different forms:

1. Variable **relational-operator** Variable
2. Variable **relational-operator** Constant
3. Variable **equality-operator** Variable
4. Variable **equality-operator** Constant

## Note:

You can use an expression instead of the variable or constant

# Relational and equality operators


Operator	Meaning	Type
<	less than	relational
>	greater than	relational
<=	less than or equal to	relational
>=	greater than or equal to	relational
==	equal to	equality
!=	not equal to	equality

# Logical Operators

- Three types of logical operators:

Operator	Meaning
&&	and
	or
!	not

# Operator Precedence

Operator	Precedence
function calls	highest
! + - & (unary operators)	
* / %	
+ -	
< <= >= >	
== !=	
&&	
=	lowest

# Example

double **x=3.0** , **y=4.0** , **z=2.0**;

int **flag=0**;

- What is the value after applying the following expression:

! flag

→ **!0 is 1 (true)**

x + y / z <= 3.5

→ **5.0 <= 3.5 is 0 (false)**

! flag || (y + z >= x - z )

→ **1 || 1 is 1 (true)**

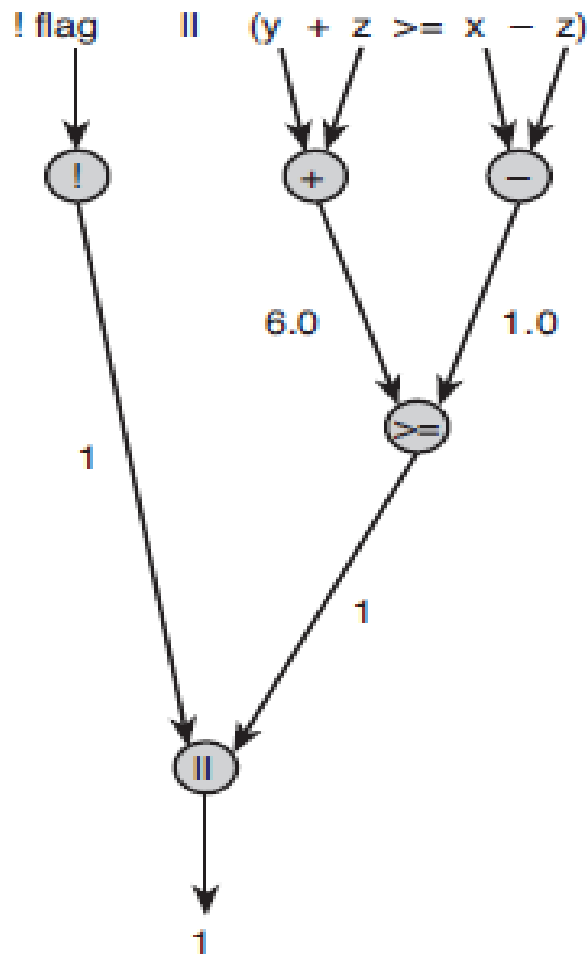
!(flag || (y + z >= x - z ))

→ **!(0 || 1) is 0 (false)**



# Example

Evaluation for **!flag || (y + z >= x - z)**



flag	y	z	x
0	4.0	2.0	3.0

! flag		(y + z	>=	x - z)	
0		4.0	2.0	3.0	2.0
1		6.0		1.0	
			1		

1
---

## Example: How to convert an English condition into a logical expression

**double** x = 3.0 , y = 4.0 , z = 2.0 .

English Condition	Logical Expression	Evaluation
x and y are greater than z	$x > z \ \&\& \ y > z$	1 && 1 is 1 (true)
x is equal to 1.0 or 3.0	$x == 1.0 \    \ x == 3.0$	0    1 is 1 (true)
x is in the range z to y, inclusive	$z \leq x \ \&\& \ x \leq y$	1 && 1 is 1 (true)
x is outside the range z to y	$!(z \leq x \ \&\& \ x \leq y)$ $z > x \    \ x > y$	!(1 && 1) is 0 (false) 0    0 is 0 (false)

## Example: Comparing Characters

Expression	Value
'9' >= '0'	1(true)
'a' < 'e'	1(true)
'B' <= 'A'	0(false)
'Z' == 'z'	0(false)
'a' <= 'A'	system dependent ( <b>false for ASCII</b> )
'a' <= ch && ch <= 'z'	1(true) if ch is a lowercase letter

# Logical Assignment

- Example:

```
#include <stdio.h>

int main()
{
    int age, senior_citizen;
    scanf("%d", &age);
    senior_citizen = (age >= 65);
    printf("senior_citizen = %d", senior_citizen );
    return 0;
}
```

# If Statement

- If statement with **one alternative**

```
if (x!=0)
```

```
    product = product * x
```

- If statement with **two alternatives**

```
if (rest_heart_rate >56)
```

```
    printf("Your heart is in excellent health!\n");
```

```
else
```

```
    printf("Keep up your exercise program!\n");
```

# if Statements with Compound Statements

**if (*condition*)**

**{**

**true task**

**}**

**Else**

**{**

**false task**

**}**

# Examples

- Write a complete c program to find weather a given integer is odd or even.

```
#include <stdio.h>
int main()
{
    int number;
    printf("Please enter a number");
    scanf("%d", &number);
    if (number%2==0)
        printf("Even Integer");
    else
        printf("Odd Integer");
    return 0;
}
```

# Examples

- Write a complete c program to find weather a given integer is divisible by three.

```
#include <stdio.h>
int main()
{
    int number;
    printf("Please enter a number");
    scanf("%d", &number);
    if (number%3==0)
        printf("Divisible by three");
    else
        printf("Does not divisible by three");
    return 0;
}
```



# Switch X and Y example

```
1. if (x > y) {
2.     temp = x;
3.     x = y;
4.     y = temp;
5. }
```

```
/* Switch x and y */
/* Store old x in temp */
/* Store old y in x */
/* Store old x in y */
```

# Multiple-Alternative Decisions

## Nested if statement

an if statement with another if statement as its true task or its false task

```
if (x > 0)
    num_pos = num_pos + 1;    //Number of positive numbers
else if (x < 0)
    num_neg = num_neg +1;    // Number of negative numbers
else
    num_zero = num_zero +1;  // Number of zeros
```

# Multiple-Alternative Decisions

```
#include <stdio.h>
int main()
{
    int number;
    printf("Please enter a number");
    scanf("%d", &number);
    if (number>0)
        printf("Positive");
    else if (number<0)
        printf("Negative");
    else
        printf("Zero");
    return 0;
}
```

# Example (if-else)

```
#include <stdio.h>
int main()
{
    int x=0;
    if (x==1)
    {
        printf ("hello");
        printf ("welcome");
    }
    else
    {
        printf ("hi");
        return 0;
    }
}
```

```
#include <stdio.h>
int main()
{
    int x=0;
    if (x==0)
    {
        printf ("hello");
        printf ("welcome");
    }
    else
    {
        printf ("hi");
        return 0;
    }
}
```

# Example ( if, if-else)

```
#include <stdio.h>
int main()
{
    int x=0;
    if (x==0)
    {
        printf ("hello");
        printf ("welcome");
    }
    else
    {
        printf ("hi");
        printf ("hi3");
    }
    return 0;
}
```

```
#include <stdio.h>
int main()
{
    int x=5;
    if (x<0)
        printf ("hello");
        printf ("welcome");
    return 0;
}
```

```
#include <stdio.h>
int main()
{
    int x=5;
    if (x>0)
        printf ("hello");
        printf ("welcome");
    return 0;
}
```

# Example

```
#include <stdio.h>
int main()
{
    int x=5;
    if (x=0)
        printf ("hello");
    printf ("welcome");
    return 0;
}
```

```
#include <stdio.h>
int main()
{
    int y=0;
    if (y)
        printf ("hello");
    printf ("welcome");
    return 0;
}
```

```
#include <stdio.h>
int main()
{
    int y=8;
    if (y)
        printf ("hello");
    printf ("welcome");
    return 0;
}
```

```
#include <stdio.h>
int main()
{
    int y=8, x=0;
    if (y || x)
        printf ("hello");
    printf ("welcome");
    return 0;
}
```

# **Let us review the concepts:**

1. If grade has the value of 60 , what will the following code display?

```
If (grade >= 60 )  
    printf ("Passed");
```

- a. nothing.
- b. 60
- c. Passed
- d. printf("Passed");

# Extra Exercises

2. What will be the value of i after the C statements at the right have been executed?

a.	5	i = 3;
b.	6	j = 10;
c.	8	if ((3 * i) < j)
d.	10	i = i + 2;
e.	15	i = i + 3;

3. What is displayed by the C statements at the right if the value input is 3?

a.	Equal	scanf("%d", &n);
b.	Less	if (n = 5)
c.	Greater	printf("Equal\n");
d.	no output	else if (n < 5)
		printf("Less\n");
		else
		printf("Greater\n");



# The switch Statement

- The switch statement selection is based on the **value of a single variable** or of a **simple expression**.
- Expression may be of type **int** or **char**, but not of type **double** or **string**.
- The multiple selection mechanism in C is the **switch statement**.



# The switch Statement

Before,

- let us Recall:
1. Multiple Selection with if
  2. Multiple Selection with if-else

# Multiple Selection with if

```
if (day == 0 ) {  
    printf ("Sunday") ;  
}  
if (day == 1 ) {  
    printf ("Monday") ;  
}  
if (day == 2) {  
    printf ("Tuesday") ;  
}  
if (day == 3) {  
    printf ("Wednesday") ;  
}
```

```
if (day == 4) {  
    printf ("Thursday") ;  
}  
if (day == 5) {  
    printf ("Friday") ;  
}  
if (day == 6) {  
    printf ("Saturday") ;  
}  
if ((day < 0) || (day > 6)) {  
    printf("Error - invalid day.\n")  
;  
}
```

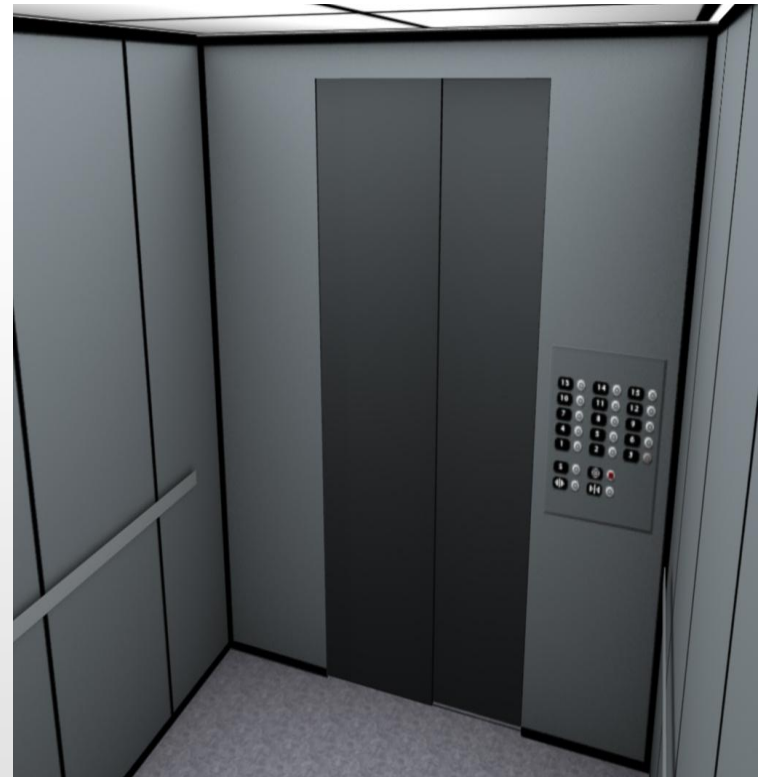
# Multiple Selection with if-else

```
if (day == 0 ) {  
    printf ("Sunday") ;  
} else if (day == 1 ) {  
    printf ("Monday") ;  
} else if (day == 2) {  
    printf ("Tuesday") ;  
} else if (day == 3) {  
    printf ("Wednesday") ;  
} else if (day == 4) {  
    printf ("Thursday") ;  
} else if (day == 5) {  
    printf ("Friday") ;  
} else if (day = 6) {  
    printf ("Saturday") ;  
} else {  
    printf ("Error - invalid day.\n") ;  
}
```

**This if-else structure is more efficient than the corresponding if structure. Why?**

# The **switch** Multiple-Selection Structure

```
switch ( integer expression )  
{  
    case constant1 :  
        statement(s)  
        break ;  
    case constant2 :  
        statement(s)  
        break ;  
    . . .  
    default: :  
        statement(s)  
        break ;  
}
```



# switch Statement Details

- The **last statement** of each case in the switch should almost always be a **break**.
- The **break** causes program control to **jump to the closing brace of the switch structure**.
- **Without the break**, the code flows into the next **case**. This is almost never what you want.
- A switch statement will **compile without a default case, but always consider using one**.

# The **switch** Multiple-Selection Structure

```
switch ( day )
{
    case 0: printf ("Sunday\n") ;
            break ;
    case 1: printf ("Monday\n") ;
            break ;
    case 2: printf ("Tuesday\n") ;
            break ;
    case 3: printf ("Wednesday\n") ;
            break ;
    case 4: printf ("Thursday\n") ;
            break ;
    case 5: printf ("Friday\n") ;
            break ;
    case 6: printf ("Saturday\n") ;
            break ;
    default: printf ("Error -- invalid day.\n") ;
            break ;
}
```

# Why Use a switch Statement?

- A nested if-else structure is just as efficient as a switch statement.
- However, a switch statement may be easier to read.
- Also, it is easier to add new cases to a switch statement than to a nested if-else structure.



# Common Programming Errors

```
if( 0 <= x <= 4)  
    printf("Condition is true\n" );
```



Instead, use

```
if( 0 <= x && x <= 4)
```

The following always prints the same thing:

```
if ( x = 10 )  
    printf( " x is 10\n" );
```

# Common Programming Errors

```
If (x = 10)
    printf(" x is 10');
```

" instead of '

```
If (x = 10)
    printf(" x is 10")
```

semicolon

```
If (x = 10)
    printf(" x is 10'
```

printf(" x is 10 "');

# Example (Creating Menus)

```
switch( choice )
{
    case 1: printf( "Do edit\n" );
            break;
    case 2: printf( "Do delete\n" );
            break;
    case 3: printf( "Done\n" );
            break;
    default: printf( "Invalid choice!\n" );
            break;
}
```

# Example (More Practice)

Write a C program which takes the 3 sides of a triangle, and print whether the triangle is an equilateral, isosceles or scalene triangle. Your program should include at least one function called **triangle\_type**, this function takes the sides of the triangle and return 1 if the triangle is equilateral, 2 if the triangle is scalene and 3 for isosceles triangle.

## NOTE:

Your triangle should be satisfied these conditions

- side 1 + side 2 > side 3
- side 1 + side 3 > side 2
- side 2 + side 3 > side 1

Try these sides:

3 4 5  
1 1 1  
3 3 1

Code

# Example (More Practice)

**Write a C program which display color name based on first character of color (small or capital letters).**

**Note: Your program should work with the following colors:  
white , red and green**

Code

# Example (More Practice)

Write a C program which takes a character as input from the user. Check whether the character is an alphabet or not.

```
#include<stdio.h>
int main()
{
    char ch;
    printf("Enter the character to be checked: ");
    scanf("%c",&ch);
    //checking if it is a Alphabet
    if( (ch>='A'&&ch<='Z') || (ch>='a'&&ch<='z') )
    {
        printf("The input character is an alphabet\n");
    }
    else
    {
        printf("The input character is NOT an alphabet\n");
    }
}
```

# Example (More Practice)

What will be printed by this carelessly constructed `switch` statement if the value of `color` is 'R'?

```
switch (color) { /* break statements missing */
case 'R':
    printf("red\n");
case 'B':
    printf("blue\n");
case 'Y':
    printf("yellow\n");
}
```

## *Extra Exercises*

**Write a program that takes three numbers as input from the user and finds out whether one of the three numbers is the arithmetic mean of the other two.**

**For example: Input: 7,15,11**

**Output: 11 is the mean of 7 and 15**

Code



## *Extra Exercises*

Write a program that takes a positive integer in the range 1 to 365 (which corresponds to the day of the year) as input and outputs the day of the week. Assume that day 1 is Sunday. Make use of the switch statement.

For example: Input: 16

Output: Monday

Code

# **Extra Exercises**

***The marks obtained by a student in 5 different subjects are input through the keyboard***

***The student gets a division as per the following rules:***

***Percentage above or equal to 60 - First division***

***Percentage between 50 and 59 - Second division***

***Percentage between 40 and 49 - Third division***

***Percentage less than 40 – Fail.***

***Write a program to calculate the division obtained by the student.***

## ***Example (output screen)***

Enter marks in five subjects

34 26 35 35 70

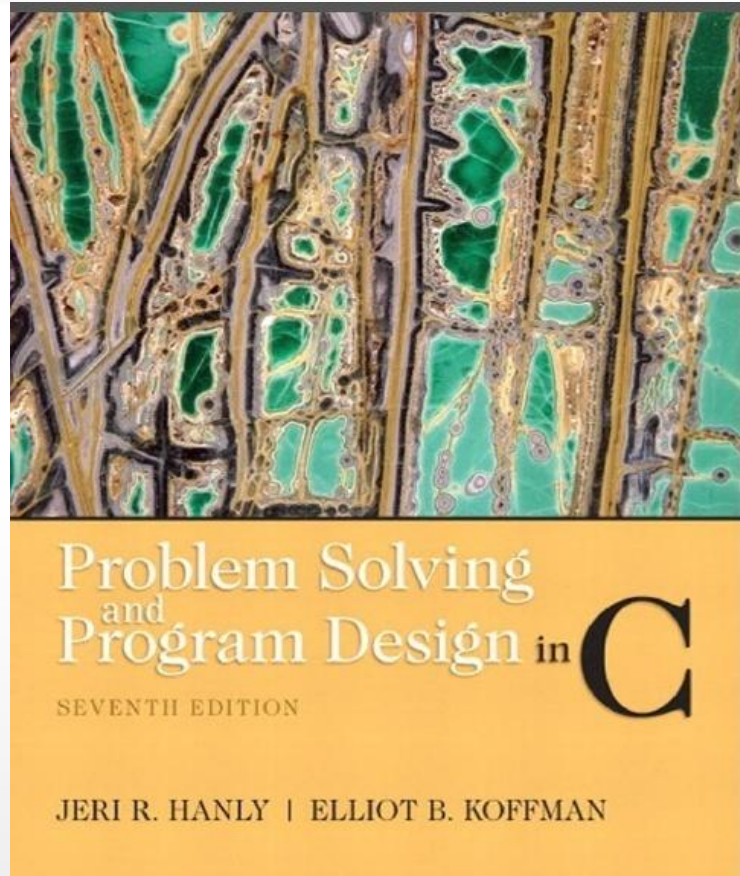
Third division

Code

# Question?



**“Success is the sum of small efforts, repeated day in and day out.”**  
Robert Collier



## ***References:***

***Problem Solving & Program Design in C (main reference)***