Session 02

Control Statements

Session Objectives

- To learn about different types of Control Statements

Session Topics

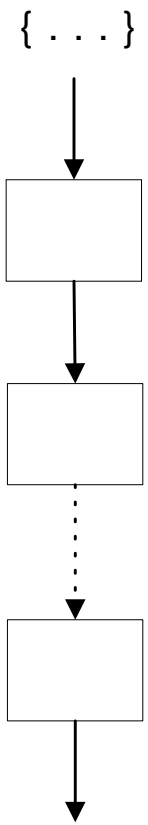
- Decision Structures – if statement, if-else statement, nested if statement
- The switch statement
- Repetition or Iteration structure - for statement, continue statement, nested loop, while loop

Decision making and Branching

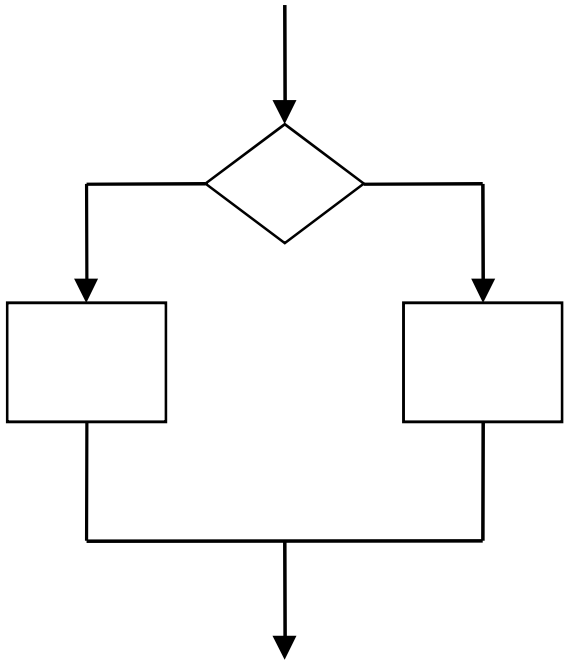
- To change the order of execution based on certain conditions or repeat a group a statements until certain specified conditions are met.
- Any expression can be used as a program statement by following the expression with a ';' (semicolon).
- ANSI C has the following categories of statements
  - Selection – if, switch
  - Iteration – for, do, while
  - Jump – continue, break, goto, return
  - Label – case, default, (goto) label statement
  - Expression – valid expression
  - Block – { … } (also called compound statements)

C Control Structure Decision

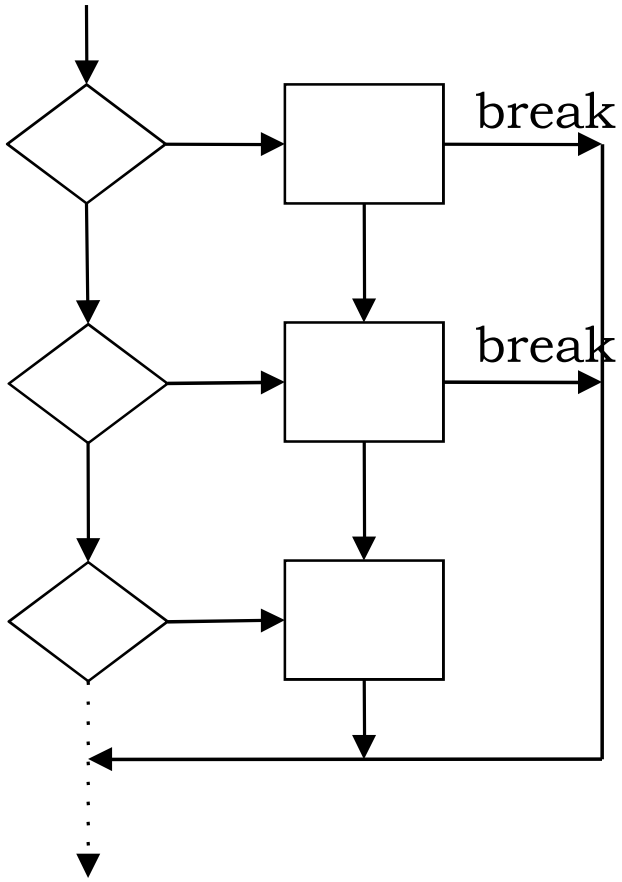
Compound Statements



if - else



switch - case



Arithmetic, Relational and Logical Operator

this expression	is true if
x == y	x is equal to y
x != y	x is not equal to y
x < y	x is less than y
x > y	x is greater than y
x <= y	x is less than or equal to y
x >= y	x is greater than or equal to y

Operators	Type
!	Logical NOT
* / %	Arithmetic and modulus
+ -	Arithmetic
< > <= >=	Relational
== !=	Relational
&&	Logical AND
||	Logical OR
=	Assignment

Example: if condition

```
if ( this condition is true )
        execute this statement ;
```

Simply:

```
if(condition)
statement;
```

Or

```
if(condition)
        {
        Statement 1;
        Statement 2;
        ….
        Statement n;
        }
```

The if – else Statement

- Structure *if (expression)*

  statement_1

  else

  statement_2

- The *else* part is optional
- The expression is evaluated: if *expression* is *TRUE* (I.e. non zero) then *statement_1*. If *expression* is *FALSE* (i.e. zero) then *statement_1* is executed if present. For multiple *if*'s, the else goes with the closest *if* without an *else* condition.

Contd…

```
main()
{
int x=0;
if(x==0)
printf("X is zero");
}
```

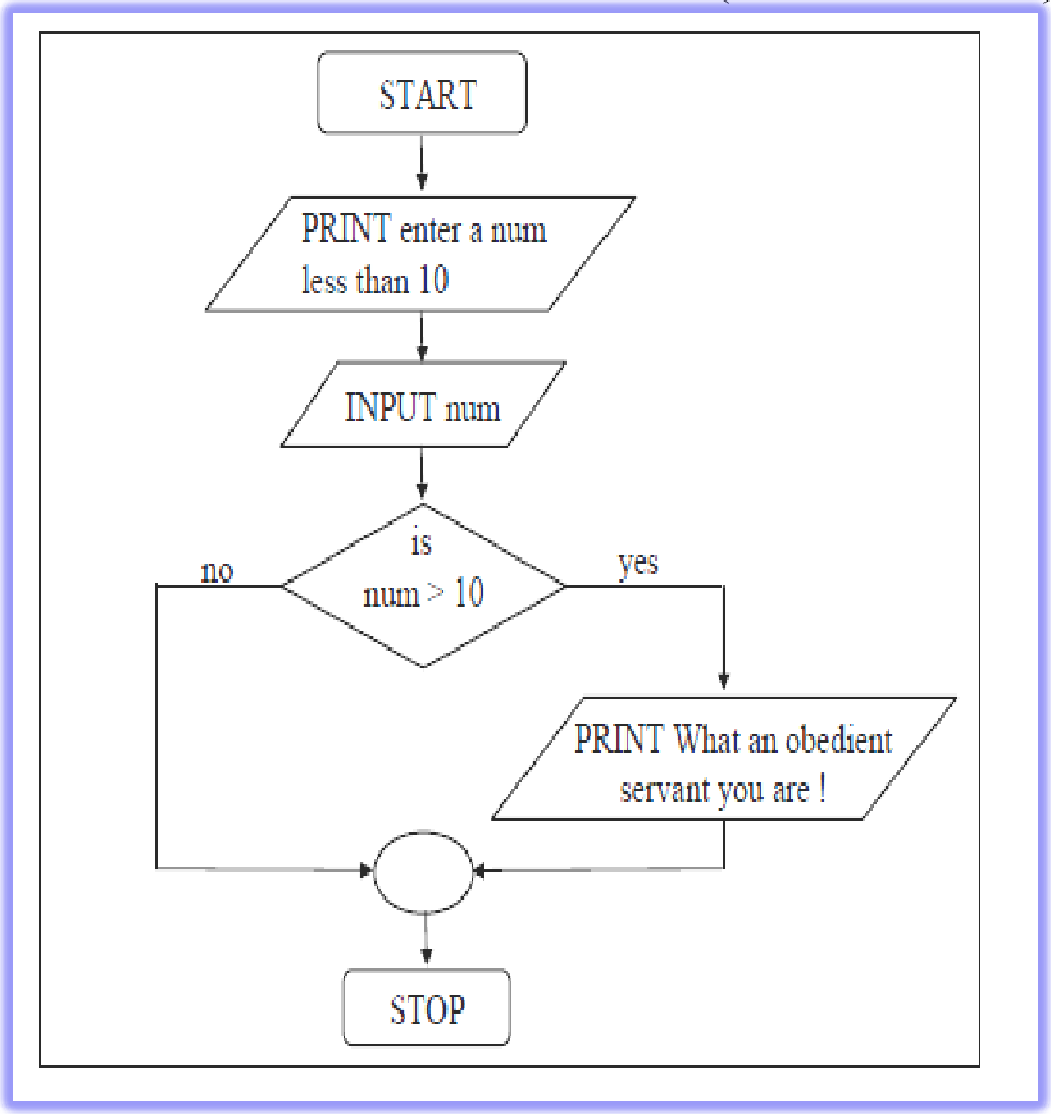
All control statements can be used in conjunction with relational and logical operator.

```
main()
{
int x=0,y;
if(x>0)
{
printf("X is positive");
y=x+3;
printf("%d",y);
}
}
```

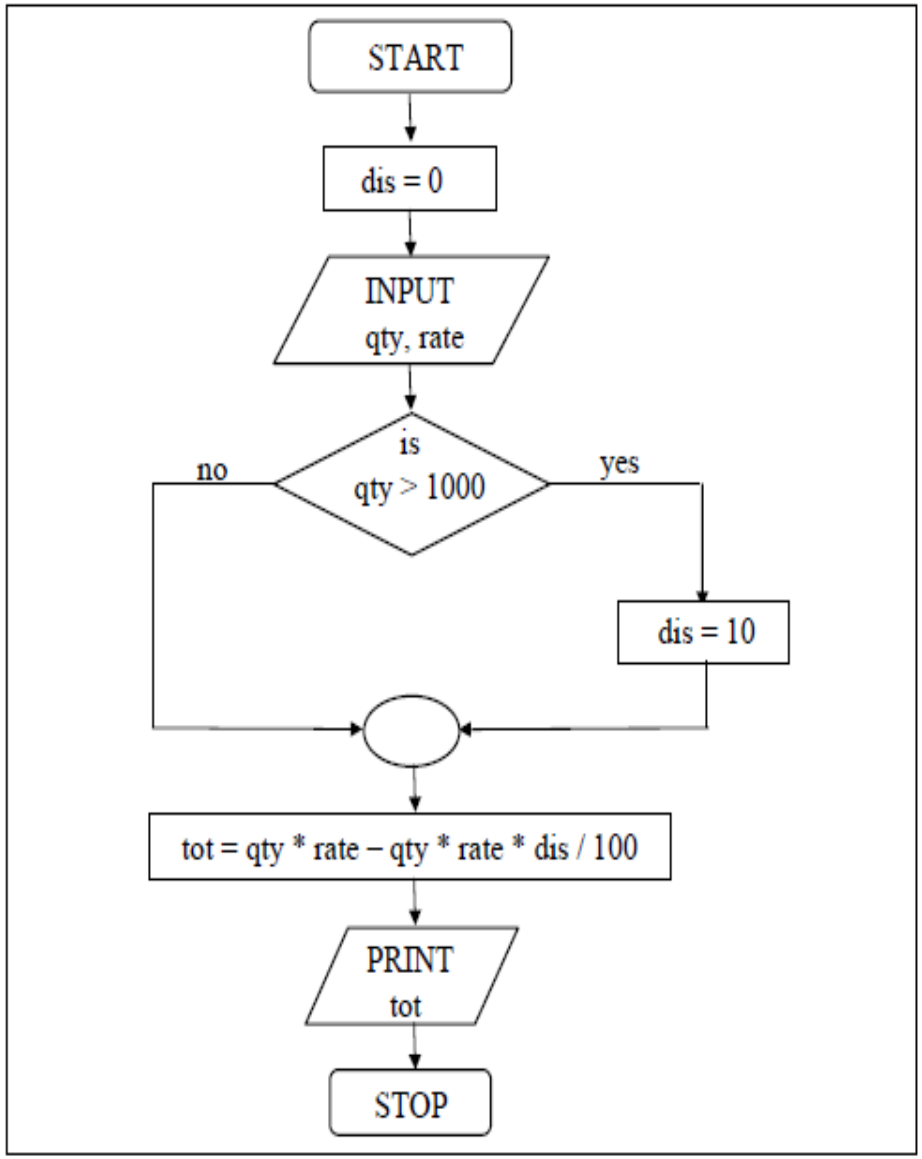
contd..

```
/* program to check greater between two numbers */
main()
{
int a,b;
printf("Enter two numbers");
scanf("%d %d",&a,&b);
if(a>b)
printf("%d is greater than %d",a,b);
}
```

if (contd…)

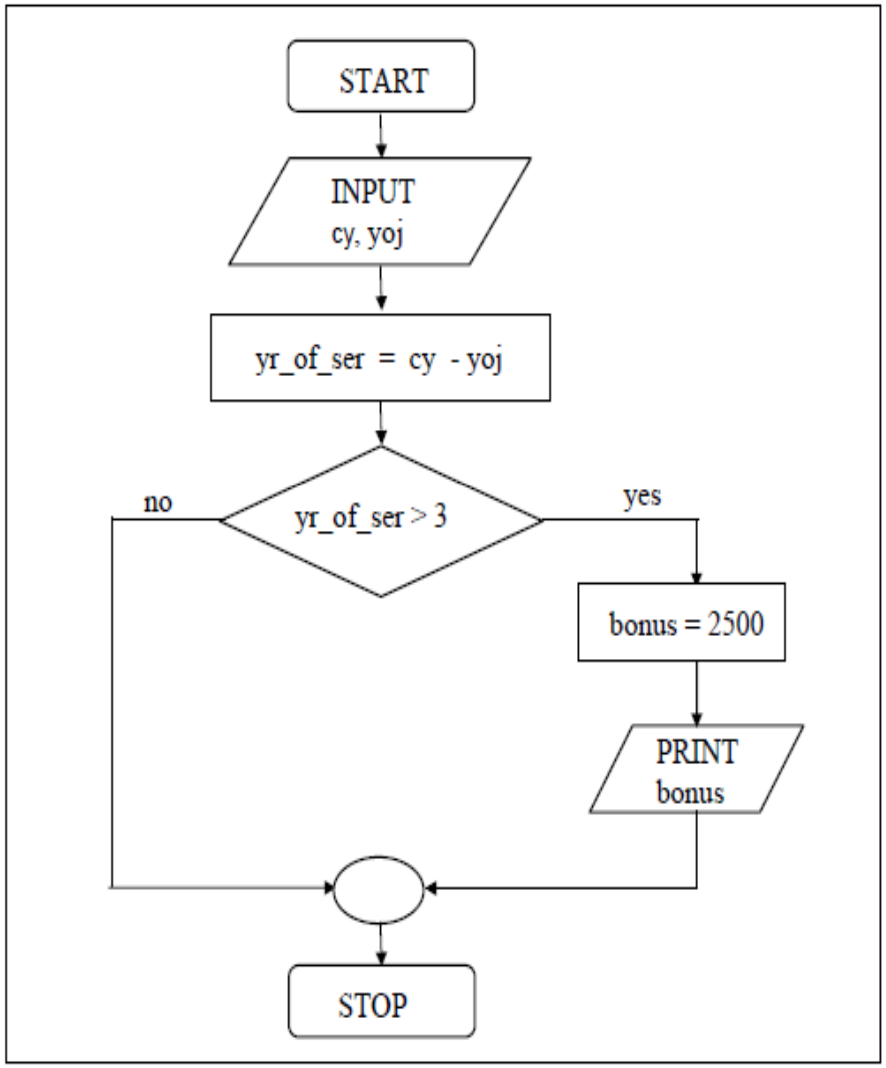



```
main()
{
int num;
printf("Enter a number")
scanf("%d",&num);
if(num>10)
printf("What an obedient
servant you are");
}
```




```
main( )
{
int qty, dis = 0 ;
float rate, tot ;
printf ( "Enter quantity and rate
" ) ;
scanf ( "%d %f", &qty, &rate) ;
if ( qty > 1000 )
dis = 10 ;
tot = ( qty * rate ) - ( qty * rate
* dis / 100 ) ;
printf ( "Total expenses = Rs.
%f", tot ) ;
}
```

Example : Compound Statement within if




```
/* Calculation of bonus */
main( )
{
int bonus, cy, yoj, yr_of_ser ;
printf ( "Enter current year and
year of joining " ) ;
scanf ( "%d %d", &cy, &yoj ) ;
yr_of_ser = cy - yoj ;
if ( yr_of_ser > 3 )
{
bonus = 2500 ;
printf ( "Bonus = Rs. %d", bonus ) ;
}
}
```

if-else

if-else is used to make decision based upon certain condition

```
if (expression)
statement 1;
else
statement 2;
```

```
if (a>0)
{
printf("a is positive");
}
else
printf("a is negative");
```

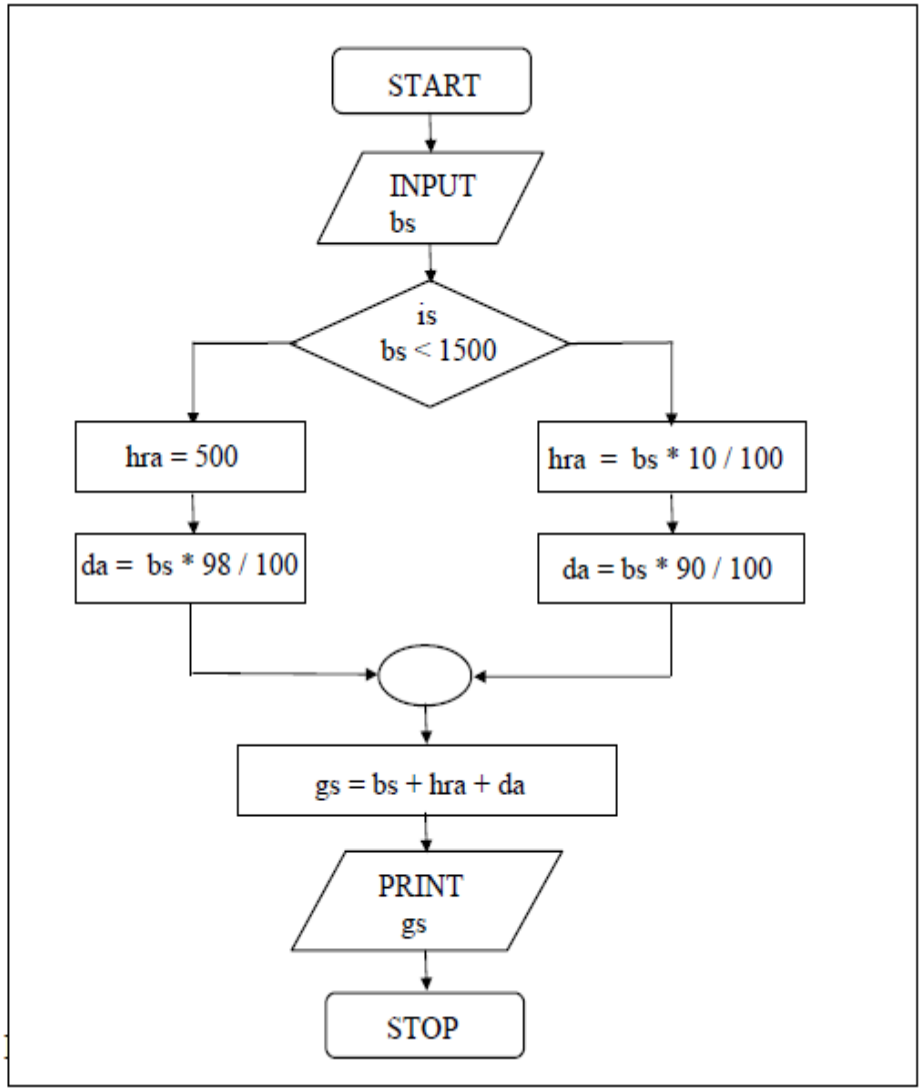
```
if (expression)
{
statement 1;
statement 2;
…
statement n;
}
else
{
Statement k;
Statement z;
…
Statement L;
}
```

```
if (a>0)
{
printf("a is positive");
z=a+b;
}
else
{
printf("a is negative");
z = a;
}
```

z =a+b, a>0

z =a , otherwise

```
/* Calculation of gross salary */
main( )
{
float bs, gs, da, hra ;
printf ( "Enter basic salary " ) ;
scanf ( "%f", &bs ) ;
if ( bs < 1500 )
{
hra = bs * 10 / 100 ;
da = bs * 90 / 100 ;
}
else
{
hra = 500 ;
da = bs * 98 / 100 ;
}
gs = bs + hra + da ;
printf ( "gross salary = Rs. %f", gs ) ;
}
```



•The group of statements after the **if upto and not including the else is called an 'if block'. Similarly, the statements after the else form the 'else block'.**

•Notice that the **else is written exactly below the if. The statements in the if block and those in the else block have been indented to the right. This formatting convention is** followed throughout the book to enable you to understand the working of the program better.

•Had there been only one statement to be executed in the if block and only one statement in the else block we could have dropped the pair of braces.

•As with the **if statement, the default scope of else is also the statement immediately after the else. To override this default scope a pair of braces as shown in the above example must be used.**

if-else with logical operator

```
 main()
{
int x=3,y=9,z;
if(x>=3 && y == 9)
z = x+y;
else
z=x+9;
}
```

```
 main()
{
int x=3,y=9,z;
if(x>=3 || y == 9)
z = x+y;
else
z=x+9;
}
```

```
 main()
{
int x=3,y=9,z=5,k;
if(x>=3 || y == 9 && z < 5)
z = x+y;
else
z=x+9;
}
```

Class Work

WAP to check greatest number among 3 numbers.

Nested *if-elses*

```
/* A quick demo of nested if-else
*/
main( )
{
int i ;
printf ( "Enter either 1 or 2 " ) ;
scanf ( "%d", &i ) ;

if ( i == 1 )
printf ( "You are male !" ) ;
else
{
if ( i == 2 )
printf ( “You are female" ) ;
else
printf ( “Gender not verified !" ) ;
} }
```

Forms of *if*

(a)
```
if ( condition )
    do this ;
```

(b)
```
if ( condition )
    {
    do this ;
    and this ;
    }
```

(c)
```
if ( condition )
    do this ;
    else
    do this ;
```

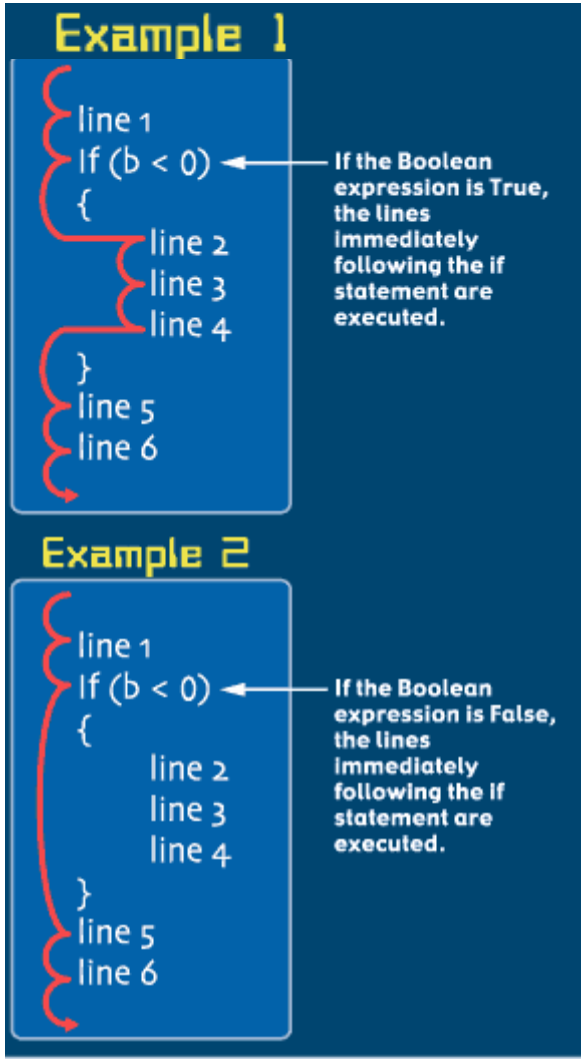
(d)
```
if ( condition )
    {
    do this ;
    else
    {
    do this ;
    and this ;
    }
```

(e)
```
if ( condition )
    do this ;
    else
    {
    if ( condition )
    do this ;
    else
    {
    do this ;
    and this ;
    }
    }
```

(f)
```
if ( condition )
    {
    if (condition )
    do this ;
    else
    {
    do this ;
    and this ;
    }
    }
    else
    do this ;
```

The if – else Statement- Examples

```
#include <stdio.h>
int main()
{
int b;
printf("Enter a value:");
scanf("%d", &b);
if (b < 0)
printf("The value is
negative\n");
else if (b == 0)
printf("The value is zero\n");
else
printf("The value is
positive\n");
return 0;
}
```



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 80 - Distinction

Percentage between 60 and < 80 - Second division

Percentage between 50 and < 60 – Second Division

Percentage less than 40 and < 50 – Third Division

Percentage less than 40 and fail in either one of the subject - Fail

```
#include<stdio.h>
main()
{
int english,math,history,nepali,science;
float percentage;
printf("Enter marks in 5 subjects");
scanf("%d %d %d %d
%d",&english,&math,&history,&nepali,&science
);
if(english>=40 && math>=40 && history>=40
&& nepali>=40 && science>=40)
{
if(english<=100 && math <=100 &&
history<=100 && nepali<=100 && science<=100)
{
percentage=(english+math+science+history+nepal
i)/5.0;
printf("\"Congratulation you have passed all
subjects\"\n");
printf("Your have secured
%5.2f%%\n",percentage);
if(percentage>=80 && percentage<=100 )
printf("Distinction\n");
else if(percentage>=60 && percentage<80)
printf("First Division\n");
else if(percentage>=50 && percentage<60)
printf("Second Division\n");
else
printf("Third Division\n");
}
else
printf("Your marks is greater than 100
which is not possible\n");
}
else
printf("Sorry!!! you are fail\n");
}
```

Problem

A company insures its drivers in the following cases:

- If the driver is married.
- If the driver is unmarried, male & above 30 years of age.
- If the driver is unmarried, female & above 25 years of age.

Operands		Results			
x	y	!x	!y	x && y	x || y
0	0	1	1	0	0
0	non-zero	1	0	0	0
non-zero	0	0	1	0	1
non-zero	non-zero	0	0	1	1

```
/* Insurance of driver - without using logical
operators */
main( )
{
char sex, ms ;
int age ;
printf ( "Enter age, sex, marital status " ) ;
scanf ( "%d %c %c", &age, &sex, &ms ) ;
if ( ms == 'M' )
printf ( "Driver is insured" ) ;
else
{
if ( sex == 'M' )
{
if ( age > 30 )
printf ( "Driver is insured" ) ;
else
printf ( "Driver is not insured" ) ;
}
else
{
if ( age > 25 )
printf ( "Driver is insured" ) ;
else
printf ( "Driver is not insured" ) ;
}
}
}
```

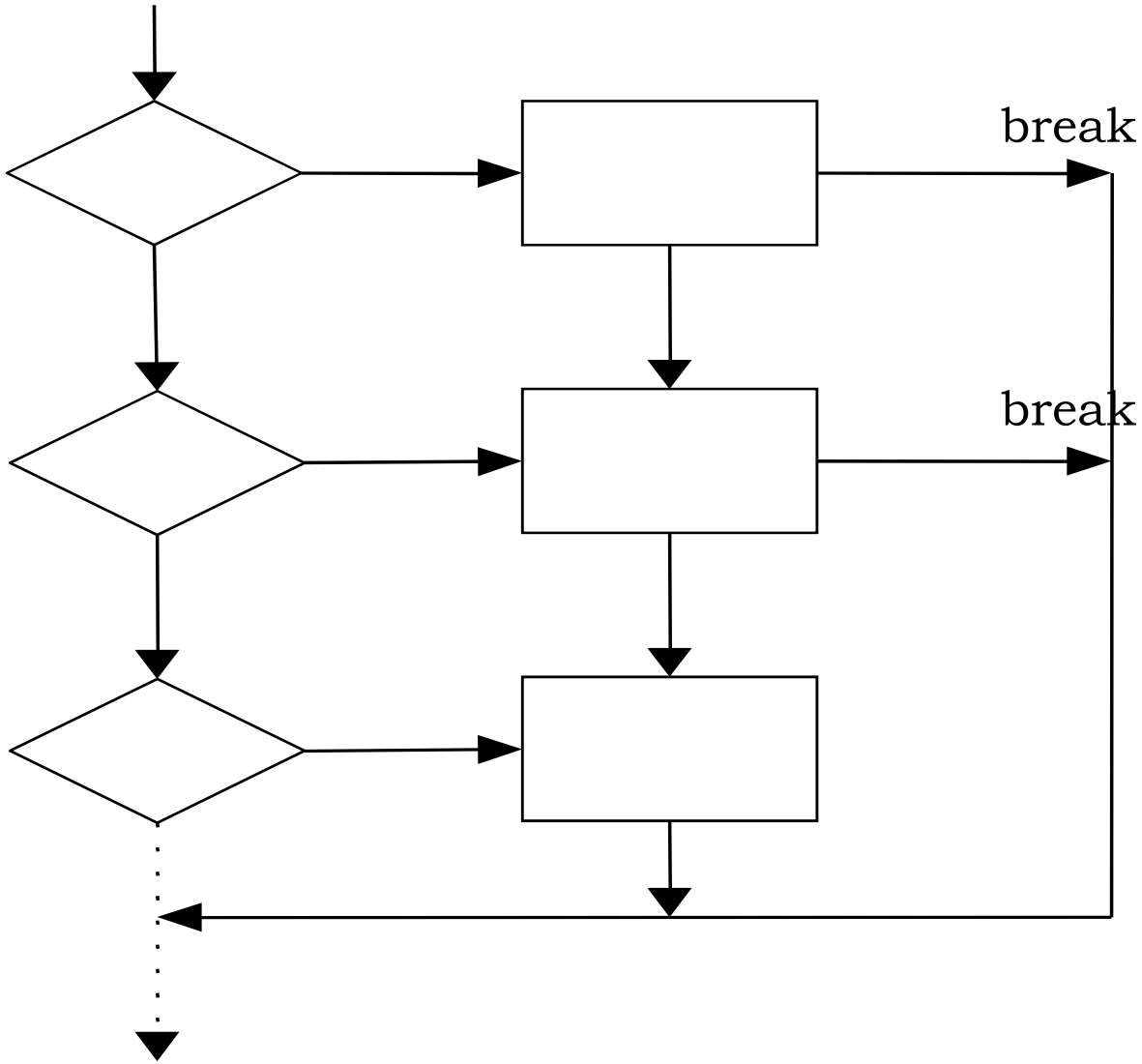
```
/* Insurance of driver - using logical
operators */
main( )
{
char sex, ms ;
int age ;
printf ( "Enter age, sex, marital status " ) ;
scanf ( "%d %c %c" &age, &sex, &ms ) ;

if ( ( ms == 'M') || ( ms == 'U' && sex ==
'M' && age > 30 ) ||
( ms == 'U' && sex == 'F' && age > 25 ) )
printf ( "Driver is insured" ) ;
else
printf ( "Driver is not insured" ) ;
}
```

The switch-case Statement

- AKA switch-case-default
- Multiple branch selection statement
- Tests the value of an expression against a list of integer or char constants
- When a match is found, then statement associated with that constant is executed.
- Structure

```
switch (expression)
        {
                case I1: statements;
                case I2: statements;
                case I3: statements;
                case In: statements;
                default: statements; // optional
        }
```

switch - case

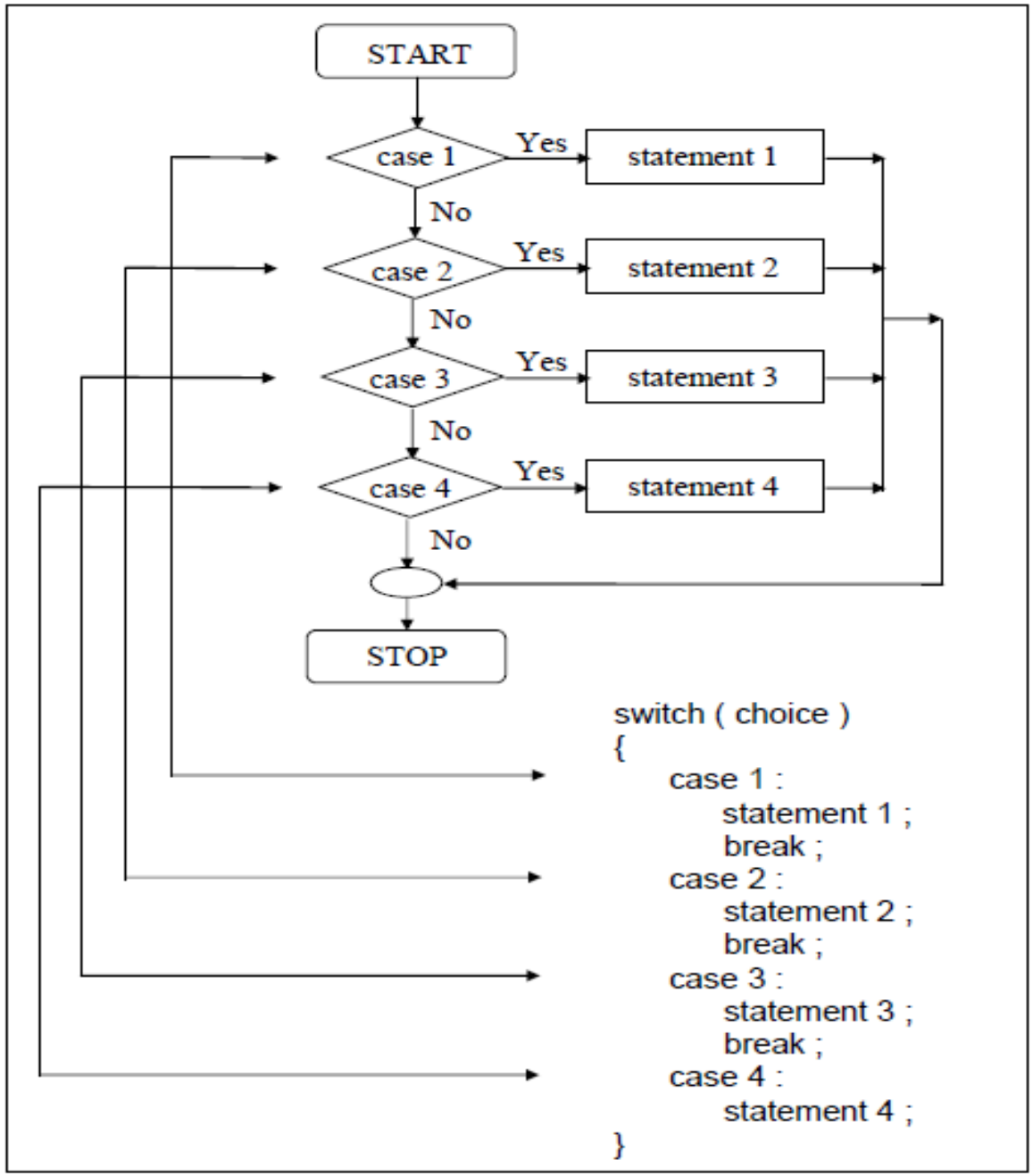


The switch-case Statement contd…

- Operation: the expression is evaluated; then execution continues at the statements following the case statement that matches the result or after the label *default* if there are no matches. If the *default* case does not exist, then execution continues after the last case statement.
- Execution continues through remaining cases in the switch structure unless the *break* instruction is encountered. If a *break* is encountered, then execution continues after the present *switch-case* instance.

```
switch ( integer expression )
{
case constant 1 :
do this ;
case constant 2 :
do this ;
case constant 3 :
do this ;
default :
do this ;
}
```

```
main( )
{
int i = 2 ;
switch ( i )
{
case 1 :
printf ( "I am in case 1 \n" ) ;
break;
case 2 :
printf ( "I am in case 2 \n" ) ;
break;
case 3 :
printf ( "I am in case 3 \n" ) ;
break;
default :
printf ( "I am in default \n" ) ;
}
}
```


START
case 1
Yes
statement 1
No
case 2
Yes
statement 2
No
case 3
Yes
statement 3
No
case 4
Yes
statement 4
No
STOP
switch (choice)
{
case 1 :
statement 1 ;
break ;
case 2 :
statement 2 ;
break ;
case 3 :
statement 3 ;
break ;
case 4 :
statement 4 ;
}

```
main( )
{
int i = 22 ;
switch ( i )
{
case 121 :
printf ( "I am in case 121 \n" ) ;
break ;
case 7 :
printf ( "I am in case 7 \n" ) ;
break ;
case 22 :
printf ( "I am in case 22 \n" ) ;
break ;
default :
printf ( "I am in default \n" ) ;
}
}
```

```
main( )
{
char c = 'x' ;
switch ( c )
{
case 'v' :
printf ( "I am in case v \n" ) ;
break ;
case 'a' :
printf ( "I am in case a \n" ) ;
break ;
case 'x' :
printf ( "I am in case x \n" ) ;
break ;
default :
printf ( "I am in default \n" ) ;
}
}
```

```
switch ( ch )
{
case 'a' :
case 'A' :
printf ( "a for apple" ) ;
break ;
case 'b' :
case 'B' :
printf ( "b for ball" ) ;
break ;
case 'c' :
case 'C' :
printf ( "c for cat" ) ;
break ;
default :
printf ( “Capital A,B or C and small a, b, c is
not stored in ch" ) ;
}
}
```

Valid Switch Expression

switch (i + j * k)

switch (23 + 45 % 4 * k)

switch (a < 4 && b > 7)

Avoid

- A float expression cannot be tested using a **switch**
- Cases can never have variable expressions (for example it is wrong to say **case a +3 :)**
- Multiple cases cannot use same expressions. Thus the following **switch is illegal:**

```
{
case 3 :
...
case 1 + 2 :
...
}
```

Using switch- case

a) WAP that will output following

x= a+b if y=2

x= a-b if y=4

x= a*b if y=0

x= a/b if y= 1

x= a%b, otherwise

```
#include<stdio.h>
void main()
{
int y,a=5,x,b=2;
scanf("%d",&y);
switch(y)
{
case 2: x=a+b;break;
case 4: x=a-b;break;
case 0: x= a*b;break;
case 1: x=a/b;break;
default: x=a%b;
}
printf("x=%d",x);
}
```

Using switch- case

a) WAP that will output following

x= a+b if y='+'

x= a-b if y='-'

x= a*b if y='*'

x= a/b if y= '/'

x= a%b, otherwise

```
#include<stdio.h>
void main()
{
int a=5,x,b=2;
char y;
scanf("%c",&y);
switch(y)
{
case '+': x=a+b;break;
case '-': x=a-b;break;
case '*': x= a*b;break;
case '/': x=a/b;break;
default: x=a%b;
}
printf("x=%d",x);
}
```

Problem

WAP that will calculate area of the following entities.

- If user enter value 1,your program will display area of circle
- If user enter value 2,your program will display area of triangle
- If user enter value 3,your program will display area of rectangle
- Other wise your program will display “Please enter either 1 or 2 or 3”

Problem

WAP that will display days of a week based upon the value entered by user

For example : if value is 1,it will display SUNDAY

if value is 2,it will display Monday and so on,

Solve same problem using if-else-if ladder.

```
#include<stdio.h>
#include<conio.h>
#define PI 3.1416
main()
{
int choice,length,breadth,base,height;
float radius,area;
printf("Enter value 1 or 2 or 3
to\ncalulate either area of circle\n or
area of triangle or \narea of
rectangle");
scanf("%d",&choice);
switch(choice)
{
case 1: printf("Enter radius");
        scanf("%f",&radius);
        area=PI*radius*radius;
        printf("area of circle
is=%f",area);
        break;
case 2:  printf("Enter base and height");
        scanf("%d %d",&base,&height);
        area=1.0/2*base*height;
        printf("area of triangle
is=%f",area);
        break;
case 3:  printf("Enter length and
breadth\n");
        scanf("%d
%d",&length,&breadth);
        area=length*breadth;
        printf("area of rectangle
is=%f",area);
        break;
default: printf("donot press any key except 1
or 2 or 3");
}
return 0;
}
```

```
#include<stdio.h>
#include<conio.h>
#define PI 3.1416
main()
{
int choice,length,breadth,base,height;
float radius,area;
printf("Enter value 1 or 2 or 3
to\ncalulate either area of circle\n or
area of triangle or \narea of rectangle");
scanf("%d",&choice);
        if(choice==1)
        {
        printf("Enter radius");
        scanf("%f",&radius);
        area=PI*radius*radius;
        printf("area of circle
is=%f",area);
        }
else if(choice==2)
        {
        printf("Enter base and height");
        scanf("%d %d",&base,&height);
        area=1.0/2*base*height;
        printf("area of triangle is=%f",area);
        }
else if(choice==3)
        {
        printf("Enter length and breadth\n");
        scanf("%d %d",&length,&breadth);
        area=length*breadth;
        printf("area of rectangle
        is=%f",area);
        }
else
printf("donot press any key except 1 or 2 or 3");
return 0;
}
```

Common Programming error

```
main( )
printf(“Hello World”);
}
```

```
main( )
{
printf(“Hello World”)
}
```

```
main( )
{
int a;
printf(“Enter a value”);
scanf(“%d”,a);
Printf(“Value is %d”);
}
```

```
main( )
{
int a;
printf(“Enter a value”);
scanf(“%d”,&a);
printf(“Value is %f”,a);
}
```

Contd...

```
scanf("%d %d %d",a,b,c);
printf("%d %d %d %d",a,b,c,d)
```

```
main( )
{
int a,b
scanf("%d %d",&a,&b);
if(a>b)
printf("%d",a);
printf("I am a");
else
printf("%d",b);
printf("I am b");
}
```

```
main( )
{
int a;
float b;
scanf("%d %d",&a,&b);
if(a>b);
printf("%d",a);
else
printf("%d",b);
}
```

```
main( )
{
int a;
float b;
scanf("%d %d",&a,&b);
printf("%d %d",a,b);
}
```

Contd...

What are outputs of the following code?

```
main()
{
int a=10,b=20;
if(a>b);
{
a=a+15;
b=b+25;
}
printf("%d %d",a,b);
}
```

What are outputs of the following code?

```
main()
{
int a=10,b=20;
if(0)
{
a=a+15;
b=b+25;
}
printf("%d %d",a,b);
}
```

What are outputs of the following code?

```
main()
{
int a=10,b=20;
If(255)
{
a=a+15;
b=b+25;
}
printf("%d %d",a,b);
}
```

Thank You