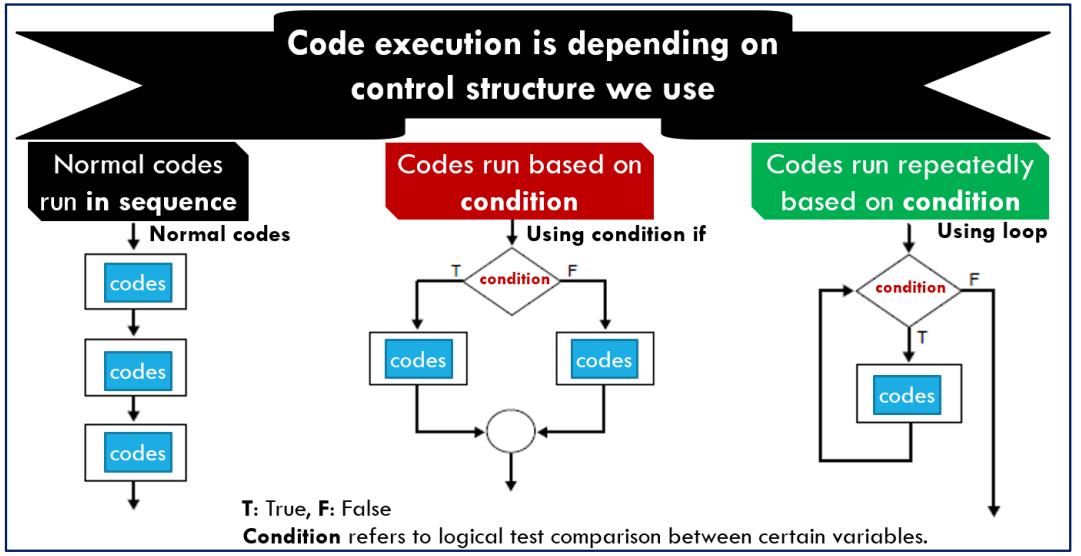
DATA STRUCTURE & PROGRAMMING I

Topic 3: Condition



Overview

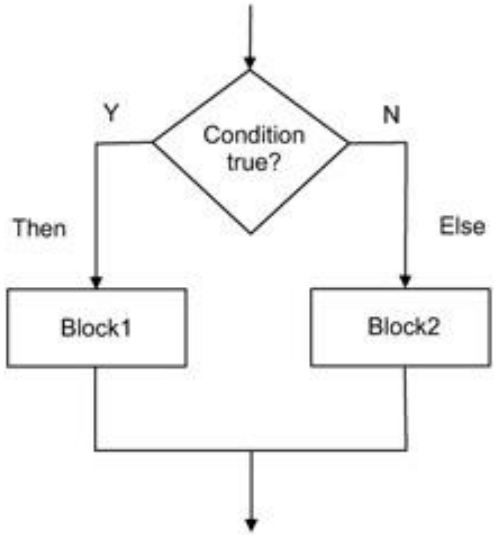
Outline

- Introduction to control structure
- Control structure for decision making
  - `if, else if, else`

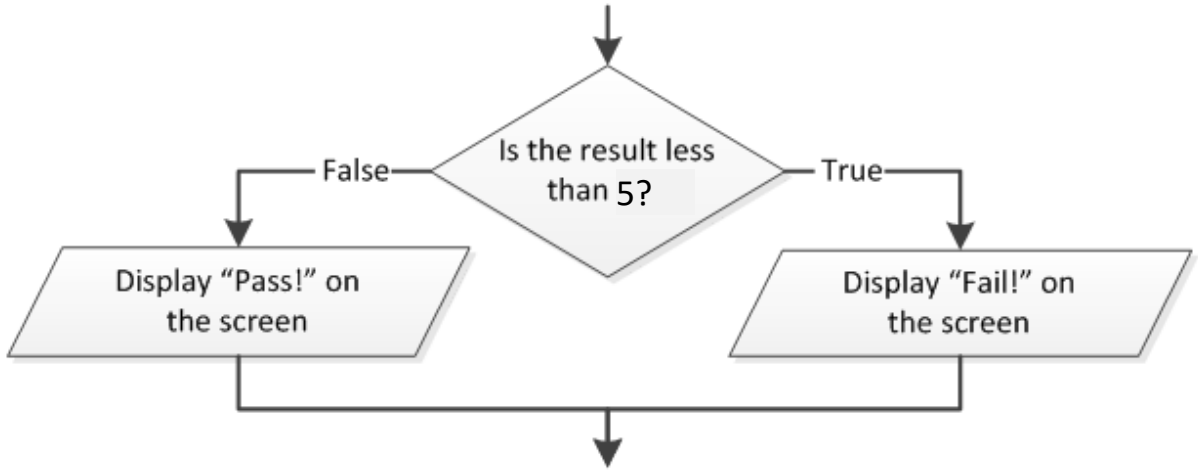
Introduction

What is control structure?

- It is the element of language that determines which block of statements should be executed
- Control structures:
  - Decision making
  - Loop



Decision making



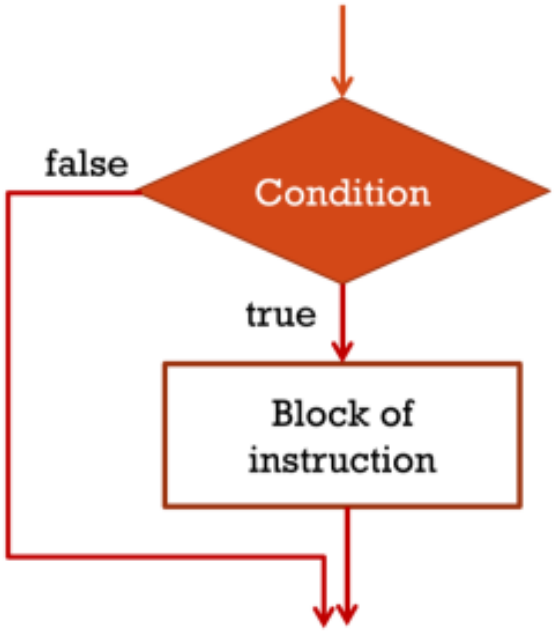
Example of decision making

Decision Making

Condition IF

- It execute instruction in some condition
- Syntax

```
if (condition) then
        block of instruction
end if
```



- *condition* is relational condition which returns *true* or *false*
  - Ex: a>b, a==b, a<=b (a and b should be defined and contain some values before)

- The block of instruction is executed only if *condition* return *true*
- If the *condition* return *false*, nothing happen

Decision Making

Examples

```
if (3<2) then
        write(“Hello\n”)
end if
write(“Hello 2”)
```

Example 1

Output:

```
Hello 2
```

```
a ← 2
b ← 3
if (a<b) then
        write(“Hi,”)
        write(“Welcome back!\n”)
end if
write(“Hello”)
```

Example 2

Output:

```
Hi, Welcome back!
Hello
```

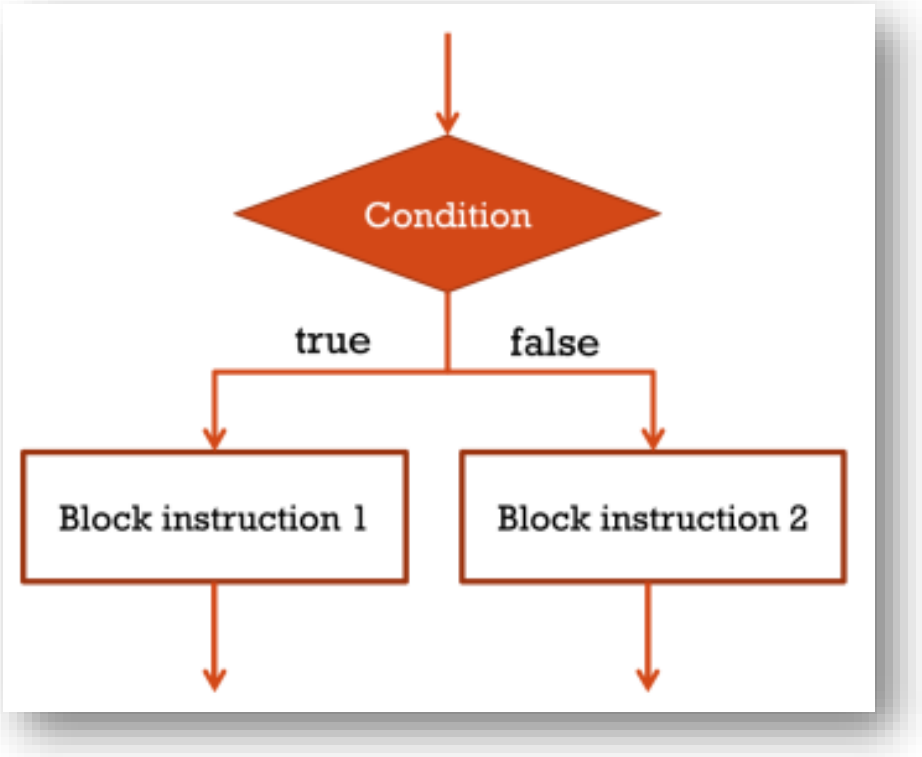
Decision Making

Condition IF and ELSE

- Syntax

```
if (condition) then
        block 1 instructions
else
        block 2 instructions
end if
```

  - When *condition* return *true*, block 1 is executed
  - When *condition* return *false*, block 2 is executed



Decision Making

Examples

```
a ← 9
if (a<9) then
        write(“Condition return true”)
else
        write(“Condition return false”)
end if
write(“Hello 2”)
```

Example 3

Output:

```
Condition return false
Hello 2
```

```
a ← 10
b ← 50
if ( a<b) then
        write(“Condition return true”)
else
        write(“Condition return false”)
end if
write(“Hello 2”)
```

Example 4

Output:

```
Condition return true
Hello 2
```

Decision Making

Example

```
Var a, b: Integer
Begin
    read(a, b)
    if (a>b+10) then
        write (“The greater value is:”, a)
    else
        write(“The smaller value is:”, b)
    end if
End
```

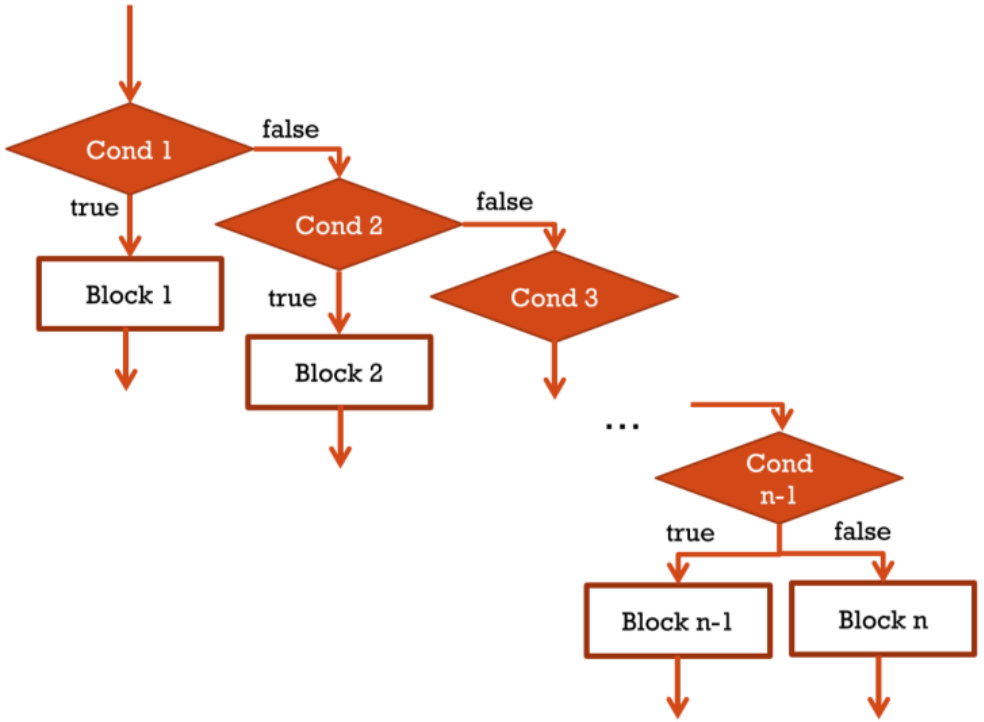
Example 5: Get two values from a user then check the bigger and the smaller value

Decision Making

Condition IF with ELSE IF

- Syntax

```
if (condition 1) then
        block of instructions 1
else if (condition 2) then
        block of instructions 2
else if (condition 3) then
        block of instructions 3
.
.
.
else if (condition n-1) then
        block instruction n-1
else
        block of instruction n
end if
```



Decision Making

Example

```
Var x: Integer
Begin
    read(x)
    if (x >= 0) then
        write("x is positive number")
    else if (x < 0) then
        write("x is negative number")
    end if
End
```

```
Var x: Integer
Begin
    read(x)
    if (x < 0) then
        write("x is negative number")
    else
        write("x is positive number")
    end if
End
```

Example 6: Get a number from a user then check whether it is positive or negative number

Decision Making

Example

```
Var x: Integer
Begin
    read(x)
    if (x == 100) then
        write("x is equal to 100")
    else if (x > 100) then
        write("x is greater than 100")
    else if (x < 100) then
        write("x is less than 10")
    end if
End
```

Example 7: Get a number from a user then check whether if is equal to 100, more than 100 or less than 100

Decision Making

Example

```
Var x: Integer
Begin
    read(x)
    if (x >= 100) then
        write("x is greater than or equal 100")
    else if (x > 50) then
        write("x is greater than 50 but less than 100")
    else
        write("x less than or equal 50")
    end if
End
```

Example 8: Get a number from a user then check if the number is greater than or equal 100, greater than 50 but less than 100, the rest condition.

Decision Making

Compare two algorithms below

```
Var x: Integer
Begin
    read(x)
    if (x>10) then
        write("x>10")
    end if
    if (5<x<=10) then
        write("5<x<=10")
    end if
    if (0<x<=5) then
        write("0<x<=5")
    end if
End
```

x>5 && x<=10

Algorithm 1

```
Var x: Integer
Begin
    read(x)
    if (x>10) then
        write("x>10")
    else if (x>5) then
        write("5<x<=10")
    else if (x>0) then
        write("0<x<=5")
    end if
End
```

Algorithm 2

Q & A

Practices and Discussion

Exercises

1. Write an algorithm to tell the grade of a score. The user input a score then program displays grade of the score using the grading method below:
   - Greater than or equal 90, grade "A"
   - Greater than or equal 80, grade "B"
   - Greater than or equal 70, grade "C"
   - Greater than or equal 60, grade "D"
   - Otherwise, grade "F"

Table 1: ASCII Code Table

Code	Char	Code	Char	Code	Char	Code	Char	Code	Char	Code	Char
32	[space]	48	0	64	@	80	P	96	`	112	p
33	!	49	1	65	A	81	Q	97	a	113	q
34	"	50	2	66	B	82	R	98	b	114	r
35	#	51	3	67	C	83	S	99	c	115	s
36	$	52	4	68	D	84	T	100	d	116	t
37	%	53	5	69	E	85	U	101	e	117	u
38	&	54	6	70	F	86	V	102	f	118	v
39	'	55	7	71	G	87	W	103	g	119	w
40	(	56	8	72	H	88	X	104	h	120	x
41	)	57	9	73	I	89	Y	105	i	121	y
42	*	58	:	74	J	90	Z	106	j	122	z
43	+	59	;	75	K	91	[	107	k	123	{
44	,	60	<	76	L	92	\	108	l	124	|
45	-	61	=	77	M	93	]	109	m	125	}
46	.	62	>	78	N	94	^	110	n	126	~
47	/	63	?	79	O	95	_	111	o	127	[backspace]

2. Write an algorithm to find the biggest number between 5 numbers entered by a user.

3. Write an algorithm to ask for an input character from a user and tell if that character is a number, an uppercase letter, or an lowercase letter. If not, shower a message "That is not a number nor a letter". **Hint**: Convert a given character to a number then use ASCII code to check. E.g: ASCII code from 48 to 57, it is a number (0-9). (See Table 1 for ASCII Code)

4. Write an algorithm which requests a value of year, of month, day and tell if it is a valid date.

Practices and Discussion

Exercises

1. Write an algorithm to tell the grade of a score. The user input a score then program displays grade of the score using the grading method below:
   - When score is greater than or equal 90, then display **You got grade "A"**
   - When score is greater than or equal 80, then display **You got grade "B"**
   - When score is greater than or equal 70, then display **You got grade "C"**
   - When score is greater than or equal 60, then display **You got grade "D"**
   - Otherwise, display **You got grade "F"**

Practices and Discussion

Exercises

2. Write an algorithm to ask for an input character from a user and tell if that character is a number, an uppercase letter, or an lowercase letter. If not, show this message "It is not a number nor a letter".

Hint: Convert the given character to a number then use ASCII code to check.
E.g: ASCII code from 48 to 57, it is a number (0-9).

(See Table 1 for ASCII Code)

Table 1: ASCII Code Table

Code	Char	Code	Char	Code	Char	Code	Char	Code	Char	Code	Char
32	[space]	48	0	64	@	80	P	96	`	112	p
33	!	49	1	65	A	81	Q	97	a	113	q
34	"	50	2	66	B	82	R	98	b	114	r
35	#	51	3	67	C	83	S	99	c	115	s
36	$	52	4	68	D	84	T	100	d	116	t
37	%	53	5	69	E	85	U	101	e	117	u
38	&	54	6	70	F	86	V	102	f	118	v
39	'	55	7	71	G	87	W	103	g	119	w
40	(	56	8	72	H	88	X	104	h	120	x
41	)	57	9	73	I	89	Y	105	i	121	y
42	*	58	:	74	J	90	Z	106	j	122	z
43	+	59	;	75	K	91	[	107	k	123	{
44	,	60	<	76	L	92	\	108	l	124	|
45	-	61	=	77	M	93	]	109	m	125	}
46	.	62	>	78	N	94	^	110	n	126	~
47	/	63	?	79	O	95	_	111	o	127	[backspace]

Practices and Discussion

Exercises

3. Write an algorithm to find the minimum number between 7 numbers entered by a user.

4. Write an algorithm to ask a user for year, month, and day (3 integer variables). Then tell if it is a valid date.

Exercises

1. Write an algorithm to check whether a number entered by a user is an even or odd number.
2. Write an algorithm to check if a number entered by a user is positive or negative number.
3. Write an algorithm to find root of the quadratic equation $ax^2+bx+c=0$. Ask a user to inputs the coefficient a, b and c. Find delta, find x1 and x2 based on delta value. Then display the roots.
4. Write an algorithm to ask a user for 8 numbers. Find the max number among them. Display max number on screen.

Solution

Exercise 1:

```
Var score: Integer
Begin
    write(“Enter your score to identify your grade: ”)
    read(score)
    if (score>=90) then
        write(“You got grade A.”)
    else if (score>=80) then
        write(“You got grade B.”)
    else if (score>=70) then
        write(“You got grade C.”)
    else if (score>=60) then
        write(“You got grade D.”)
    else
        write(“You got grade F.”)
    end if
    write(“Quitting the program ...”)
End
```

Solution

Exercise 2:

```
Var n1,n2,n3: Integer
Begin
    write(“Enter three integer numbers: ”)
    read(n1,n2,n3)
    if (n1>=n2 AND n1>=n3) then
        write(n1,“ is the biggest number.”)
    else if (n2>=n1 AND n2>=n3) then
         write(n2,“ is the biggest number.”)
    else if (n3>=n1 AND n3>=n1) then
         write(n3,“ is the biggest number.”)
    end if
    write(“Quitting the program ...”)
End
```

```
Var n1,n2,n3, max: Integer
Begin
     write(“Enter three integer numbers: ”)
     read(n1,n2,n3)
     max ← n1

     if (max<n2) then
          max ← n2
     end if
     if (max<n3) then
          max ← n3
     end if

     write(max,“ is the biggest number.”)
     write(“Quitting the program ...”)
End
```

Solution

Exercise 3:

```
Var ch: Integer
Var n: Integer
Begin
    write(“Enter a character: ”)
    read(ch)
    n ← ord(ch)
    if (n>=48 AND n<=57) then
        write(“It is a number.”)
    else if (n>=65 AND n<=90) then
        write(“It is an uppercase letter.”)
    else if (n>=97 AND n<=122) then
        write(“It is a lowercase letter.”)
    else
        write(“That is not a number or a letter.”)
    end if
    write(“Quitting the program ...”)
End
```

ASCII Code Table

Code	Char	Code	Char	Code	Char	Code	Char	Code	Char	Code	Char
32	[space]	48	0	64	@	80	P	96	`	112	p
33	!	49	1	65	A	81	Q	97	a	113	q
34	"	50	2	66	B	82	R	98	b	114	r
35	#	51	3	67	C	83	S	99	c	115	s
36	$	52	4	68	D	84	T	100	d	116	t
37	%	53	5	69	E	85	U	101	e	117	u
38	&	54	6	70	F	86	V	102	f	118	v
39	'	55	7	71	G	87	W	103	g	119	w
40	(	56	8	72	H	88	X	104	h	120	x
41	)	57	9	73	I	89	Y	105	i	121	y
42	*	58	:	74	J	90	Z	106	j	122	z
43	+	59	;	75	K	91	[	107	k	123	{
44	,	60	<	76	L	92	\	108	l	124	|
45	-	61	=	77	M	93	]	109	m	125	}
46	.	62	>	78	N	94	^	110	n	126	~
47	/	63	?	79	O	95	_	111	o	127	[backspace]

Solution

Exercise 3:

Code	Char	Code	Char	Code	Char	Code	Char	Code	Char	Code	Char
32	[space]	48	0	64	@	80	P	96	`	112	p
33	!	49	1	65	A	81	Q	97	a	113	q
34	"	50	2	66	B	82	R	98	b	114	r
35	#	51	3	67	C	83	S	99	c	115	s
36	$	52	4	68	D	84	T	100	d	116	t
37	%	53	5	69	E	85	U	101	e	117	u
38	&	54	6	70	F	86	V	102	f	118	v
39	'	55	7	71	G	87	W	103	g	119	w
40	(	56	8	72	H	88	X	104	h	120	x
41	)	57	9	73	I	89	Y	105	i	121	y
42	*	58	:	74	J	90	Z	106	j	122	z
43	+	59	;	75	K	91	[	107	k	123	{
44	,	60	<	76	L	92	\	108	l	124	|
45	-	61	=	77	M	93	]	109	m	125	}
46	.	62	>	78	N	94	^	110	n	126	~
47	/	63	?	79	O	95	_	111	o	127	[backspace]

Case study:

Switch case statement

1. What is Switch statement?
2. Give an example using switch in C language

Syntax in C Programming

C program

Decision making: `if, else if, else`

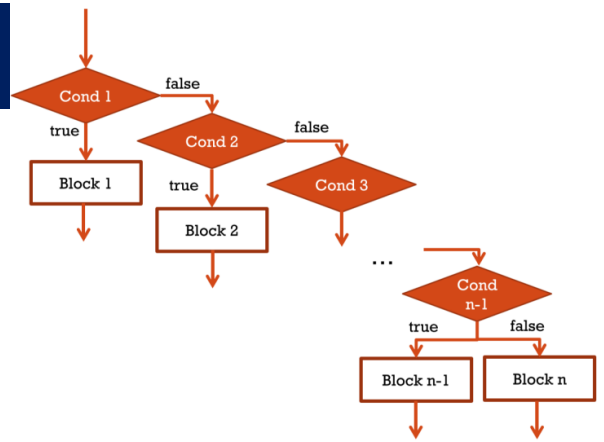
- Syntax

```
if (condition 1) {
     block of instructions 1
}else if (condition 2) {
     block of instructions 2
}else if (condition 3
     block of instructions 3
}
.
.
.
else if (condition n-1){
     block instruction n-1
}else{
     block of instruction n
}
```

Syntax in C

```
#include <stdio.h>
int main(){
     int n=10
     if (n==10) {
          print("n is equal to 10");
     }else if (n>0) {
          print("n is greater than 0");
     }else if (n<0) {
          print("n is less than 0");
     }else{
          print("n is 0");
     }
}
```

Example in C




```
if (condition 1) then
      block of instructions 1
else if (condition 2) then
      block of instructions 2
else if (condition 3) then
      block of instructions 3
.
.
.
else if (condition n-1) then
      block instruction n-1
else
      block of instruction n
end if
```

Algo syntax for decision making

C program

Decision making with choices: `switch`

- Syntax

```
switch (n){
    case constant1:
        // code to be executed if n is equal to constant1;
        break;

    case constant2:
        // code to be executed if n is equal to constant2;
        break;
        .
        .
        .
    default:
        // code to be executed if n doesn't match any constant
}
```

Syntax in C

```
#include <stdio.h>
int main(){
     char sex;
     printf("Enter your sex: ");
     scanf("%c", &sex);

     switch(sex){
      case 'M':
         printf("You are a male\n");
         break;
      case 'F':
         printf("You are a female\n");
         break;
      default:
         printf("wrong input\n");
     }
}
```

Example in C

Example: Test if a variable is a positive number.

```
62      int n=100;
63
64      if(n>0){
65          printf("%d is positive number", n);
66      }
```

Example: Test if a variable is a positive/negative number.

```
int n=0;

if(n>0){
    printf("%d is positive number", n);
}
else{
    printf("n is negative number")
}
```

Example: Compare between two numbers

```
71      int n=100;
72      int m=-155;
73      if(n == m){
74          printf(" n and m are the same");
75      }
76      else if(n>m){
77          printf(" n is greater than m");
78      }
79      else if(n<m){
80          printf(" n is less than m");
81      }else{
82          printf(" Hello everyone!")
83      }
```

Example: Using C program to test a number event/odd and negative/positive/neutral number.

Testcondion.c

```
3
4   #include<stdio.h>
5
6   main(){
7       int n;
8       int r;
9
10
11      // while(10>0){
12      printf("\n\n Enter a number: ");
13      scanf("%d" ,&n);
14
15      r = n%2;
16
17      //if 1
18      if(r==0){  //when remain is 0
19         printf("\t%d is an even number", n);
20      }else if(r!=0){
21         printf("\t%d is an odd number", n);
22      }
23
24      //another if 2
25      if(n==0){
26          printf("\n\t%d is a neutral number", n);
27          printf("\n\t\tGood bye!");
28      }else if(n>0){
29          printf("\n\t%d is a positive number", n);
30          printf("\n\t\tThank you!\n\n");
31      }else if (n<0){
32          printf("\n\t%d is a negative number", n);
33          printf("\n\tSee you next week!");
34      }
35
36      // }
37
38  }
39
```

C:\Users\bouch\Desktop\DemoI2\Testcondion.exe

```
 Enter a number: 9
        9 is an odd number
        9 is a positive number
                Thank you!


Process returned 0 (0x0)   execu
Press any key to continue.
```

Assignment

Deadline: **1 week**

CELSIUS TO FAHRENHEIT

$$T_F = \left(\frac{9}{5}T_C\right) + 32$$

FAHRENHEIT TO CELSIUS

$$T_C = \frac{5}{9}\left(T_F - 32\right)$$

Temperature conversion program

Ex1- Write a C program to display a menu for temperature conversion.

Menu:

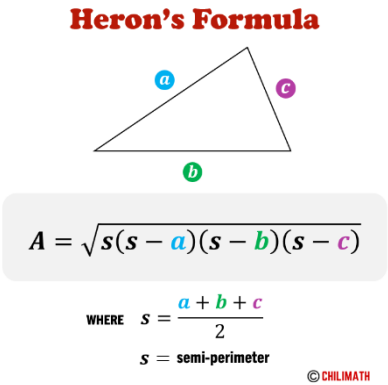
1- Converting temperature in Celsius to Farenheit

2- Converting temperature in Farenheit to Celsius

- When a user input number 1, ask for a temperature in Celsius then write a formula in order to convert it into Farenheit. Display the result on screen.
- When a user input number 2, ask for a temperature in Celsius then write a formula in order to convert it into Farenheit. Display the result on screen.

Assignment

Deadline: **1 week**



Program to compute area of shape

Ex2- Write a C program to display a menu for computing area as follows:

Menu:

1- Computer area of a triangle when knowing the side a, b and c.

2- Find area of a circle when knowing the radius.

3- Calculate the surface of a rectangle with a given width and height.

- When a user inputs number 1, ask users for a, b and c. Then compute the survey of a training using Heron formula. Display the result on screen.
- When a user inputs number 2, ask a user to input the radius. Find the area of the circle and display.
- When a user inputs number 3, ask a user to input width and height. Calculate and display the surface of this rectangle.

Assignment

Deadline: **1 week**

A C program to find maximum numbers between 8 input numbers

Ex3: Ask a user for 8 input numbers. Display the maximum number among them.

```
Input: 8 10 6 99 34 65 11 29

Output:
  The max number is: 99
```

Assignme

Deadline: **1 week**

Exercises

4. Write a C program to find the minimum number between 7 numbers entered by a user.

5. Write a C program to solve the quadratic equation $ax^2+bx+c=0$. Ask a user to inputs the coefficient a, b and c then display the roots.

6. Write a C program to ask a user for year, month, and day (3 integer variables). Then tell if it is a valid date.

Assignment

Deadline: **1 week**

Tip: To generate a random number

```
1   #include<stdio.h>
2   #include<time.h>
3   int main() {
4       srand(time(0));
5       int n;
6       int min=1, max=10000;
7
8       //Random number  [min, max]
9       n=rand()%max + min;
10      printf("%d ", n);
11  }
```

Ex7: Number prediction program!

Write a C program to guess a number. The computer generate a random number. Then program asks a user to input a number for guessing. The user has 3 chances of guessing.

The program keeps asking the user to input a number until the user input the correct one compared to the randomized number.

- If the user inputs a number **greater than the randomized number**, tell a user to input another smaller number.
- If the user inputs a number **less than the randomized number**, tell a user to input another bigger number.
- If the user inputs **the correct number (the number is same to the randomized number)**, display "Congratulations! You guess only **n** times to be correct.", where n is the number of attempts the user made to get it right.

```
**********************
**** Number prediction program ***
**********************
Generating a random number ...!
A randomized number has been generated successfully!

        Enter your guess number: 7
Your predicted number is too big
You can try predicting a smaller number

        Enter your guess number: 5
Your predicted number is  too small.
You can try predicting a bigger number.

        Enter your guess number: 6
Congrats!!! You have predict it right in 3 times

Process returned 0 (0x0)   execution time : 12.257 s
```

Tips to generate a random number

```c
#include<stdio.h>
#include<time.h>
int main() {
        srand(time(0));
        int n;
        int min=1, max=10000;

        //Random number  [min, max]
        n=rand()%max + min;
        printf("%d ", n);
}
```