DATA STRUCTURE & PROGRAMMING I

Topic 4: Condition (part 2)

Overview

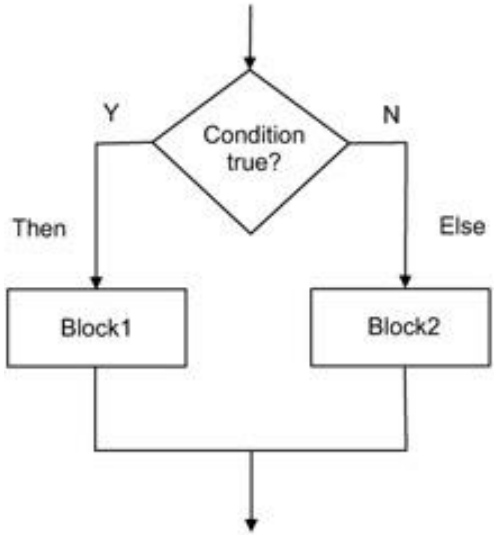
Outline

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

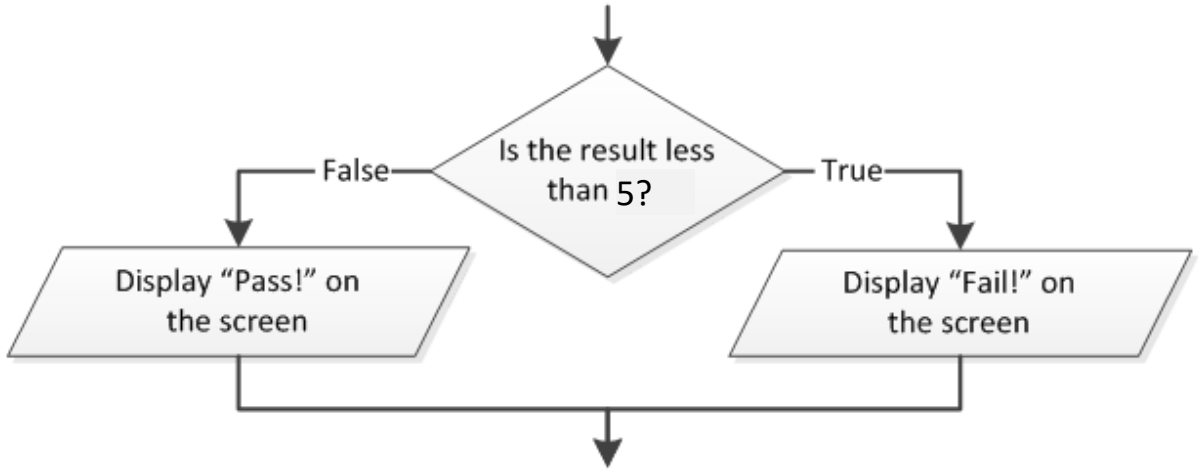
Introduction

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



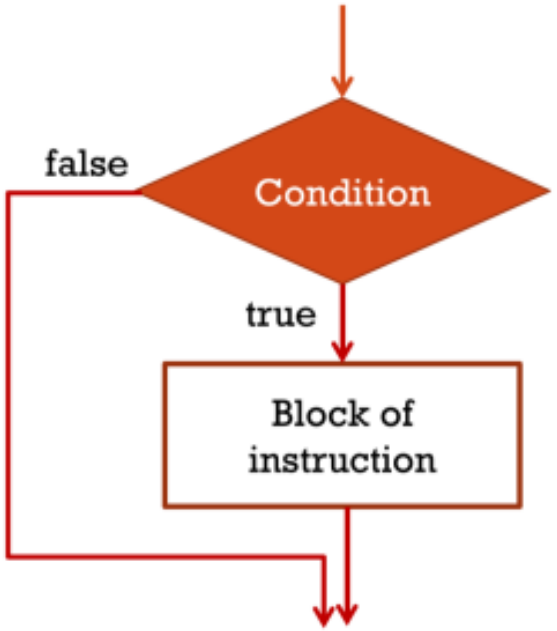
Example of decision making

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
```

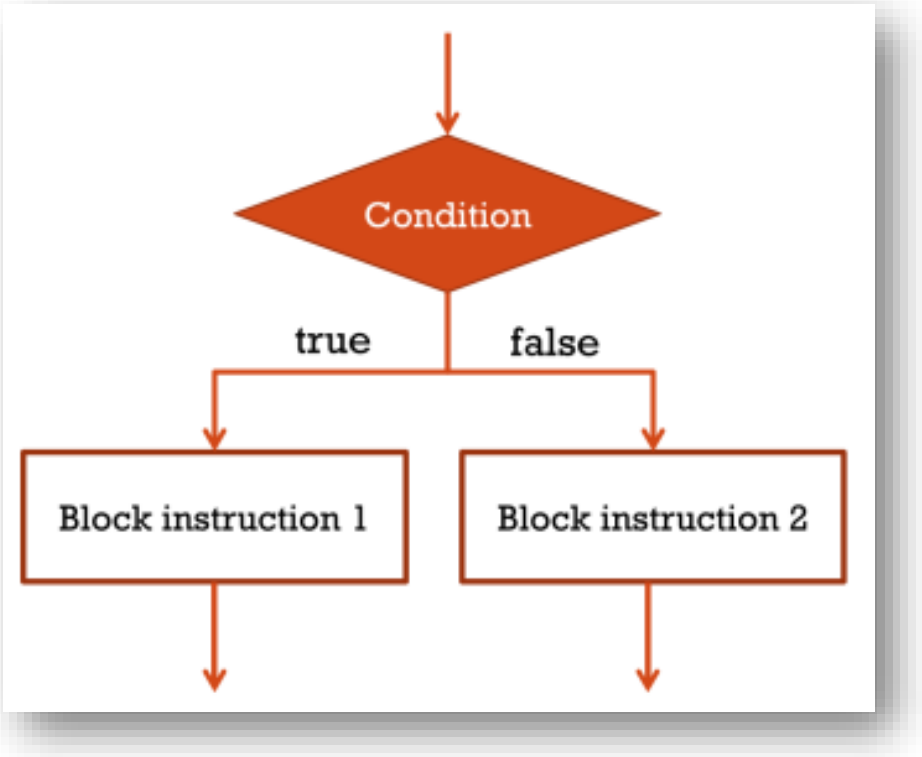
Decision Making

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
```

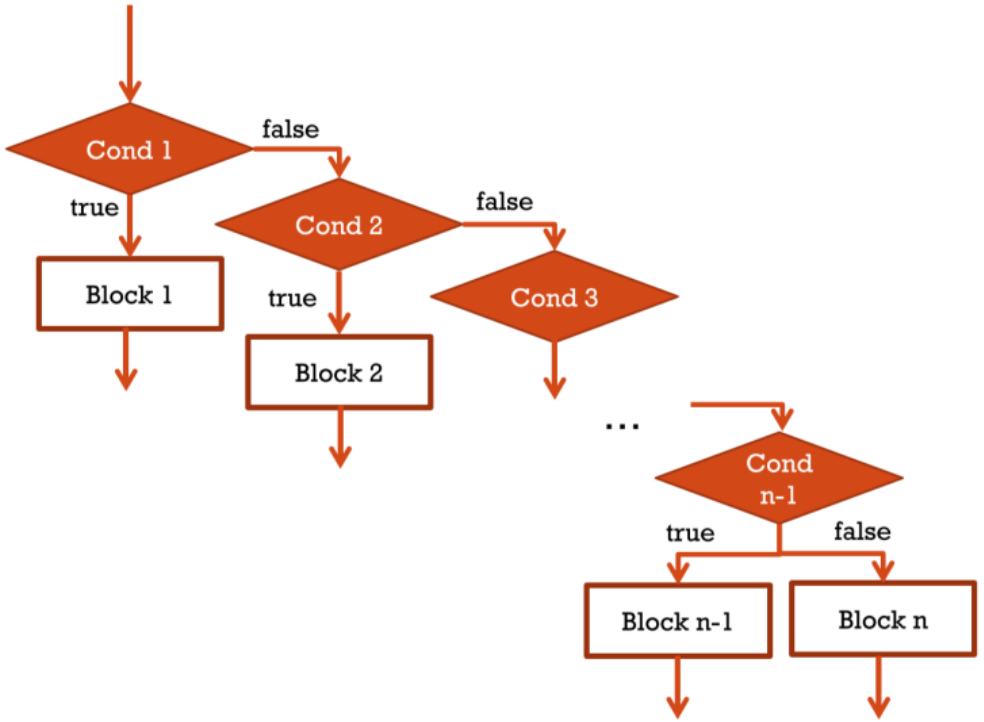
Example 5: Get two values from a user then check the bigger and the smaller value

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

Nested condition

Remark

- Nested condition are used for sub conditions.

```
Var x: Integer
Begin
    read(x)
    if (x<0) then          //Condition 1
        write("It is a negative number.")
    else                   //Condition 2
        if (x==0) then     //Sub-condition 2.1
            write("It is zero.")
        else               //Sub-condition 2.2
            write("It is a positive number.")
        end if
    end if
    write("Quitting the program ...")
End
```

```
Var x: Integer
Begin
    read(x)
    if (x<0) then          //Condition 1
        write("It is a negative number.")
    else if (x==0) then    //Condition 2
            write("It is zero.")
    else                   //Condition 3
            write("It is a positive number.")
        end if
    end if
    write("Quitting the program ...")
End
```

Q & A

Assignment

- Deadline duration: 1 week
- What to submit: Source codes + Screenshot of program code with output

Ex 1

CELSIUS TO FAHRENHEIT

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

FAHRENHEIT TO CELSIUS

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

Write a program to display a menu for temperature co

Menu:

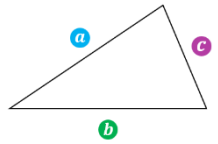
1- Converting temperature in Celsius to Farenheit or Farenheit to Celsius

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

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

4- Calculate the surface of a rectangle with a given width and height. Says it is a square if width and height are the same.

Heron's Formula



$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

WHERE $s = \frac{a+b+c}{2}$

s = semi-perimeter

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- When a user input number 1, ask for type of conversion (a) Celsius to Farenheit or b) Farenheit to Celsius). Then ask for a source respective temperature. Finally, display the converted destination of targeted temperature type
- When a user inputs number 2, 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 3, ask a user to input the radius. Find the area of the circle and display.
- When a user inputs number 4, ask a user to input width and height. Calculate and display the surface of this rectangle. Test the inputs of width and height. If they are the same, display that it is square shape.

Ex 2

A program to test if a given input date is valid

Input a date (yyyy-mm-dd): 2023-10-30

Output:
The input date is invalid.

Input a date (yyyy-mm-dd): 2023-02-30

Output:
The input date is invalid.

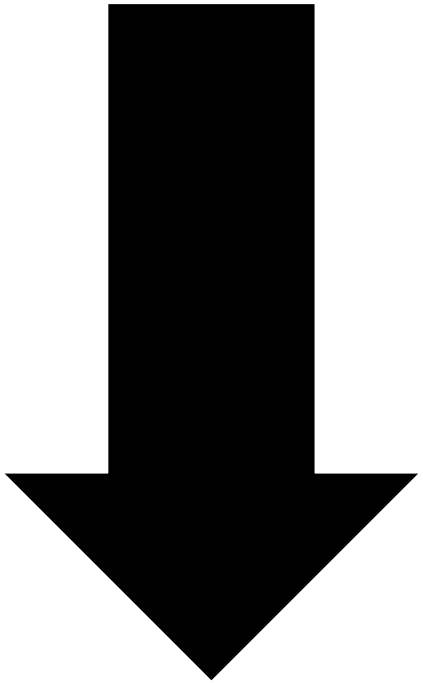
Input a date (yyyy-mm-dd): 2023-12-28

Output:
The input date is valid.

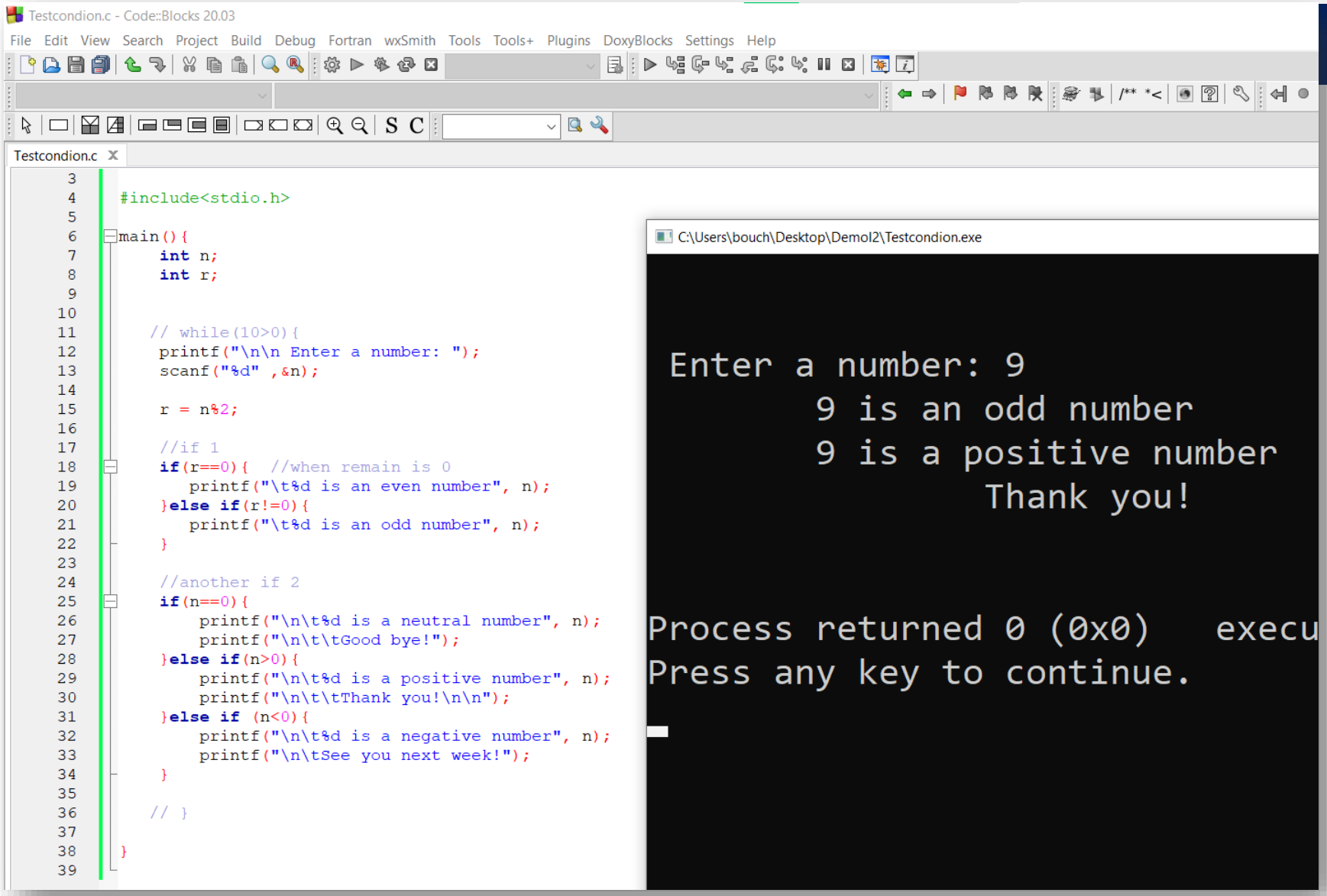
Input a date (yyyy-mm-dd): 2004-02-29

Output:
The input date is valid.

A review about simple condition ……



Test odd/event and positive/negative number



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 a program 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.

Exercises

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

2. 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.

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

```
Var y,m,d: Integer
Begin
     read(y, m, d)
     if(y>=0) then
          if(m==1 OR m==3 OR m==5 OR m==7 OR m==8 OR m==10 or m==12) then
              if(d>=0 AND d<=31) then
                     write(“VALID DATE)
              else
                     write(“INVALID)”)
              end if
          else if (m==4 OR m==6 …..)  //month with day being <=30
              if(d>=0 AND d<=30) then
                     write(“VALID DATE”)
              else
                     write(“INVALID”)
              end if
          else if (m==2) then
              if(m%4==0) //leap year
                     if(d>=0 AND d<=29) then
                         write(“VALID DATE”)
                     else
                         write(“INVALID”
                     end if
             else
                     …..// d>=0 AND d<=28
             end if
          end if
     End if
End
```

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

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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	|
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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