

# Computer Programming

## Index

S No.	Object of Experiments	Remarks	Date	Signature
1	Getting familiar with the Turbo C Integrated Development Environment. Installing and copying the compiler, changing directory settings.			
2	Making first program in C. Saving / copying files to USB or other storage devices.			
3	Understanding and Using format specifiers and escape sequences with printf.			
4	Studying different data types, variables, variable names, variable declaration, variable definition, variable initialization, escape sequences.			
5	Studying Math functions.			
6	Taking Input from the user at console screen using scanf and getch commands.			
7	Arithmetic operators, conditional operators, assignment operators, Increment/decrement operators.			
8	Studying loops. For loops, nested for loops, while loops, nested while loops, do while loops, nested do while loops.			
9	Studying loops with cross combination, for-while, while-for, do-while while, while do-while, for do-while, do-while for.			
10	Decision making and conditioning using If statements, If-else statements, switch-case.			
11	Graphics, basic applications of graphics by making buttons and animations.			
12	User defined functions, passing values to function, returning values from functions.			
13	Arrays, array index, single and multi dimensional arrays. Arrays and loops. Sorting data in arrays.			
14	Studying Structures, different ways to declare define and initialize structures.			
15	Parallel port programming, hardware (interrupts).			
16	Filing.			
17	Project Submission, Viva, Presentation.			

# Experiment 1

## Objective

Getting familiar with the Turbo C Integrated Development Environment. Installing and copying the compiler, changing directory settings.

## Theory

Click on

Start→Run

and type the path

`\\fileserver\Softwares\Programing Languages Section`

A new window will open. From there right click on the folder named as TC3 and select copy. Now Paste in it in your C or D partition or your USB drive. As a good approach C drive is normally not recommended for C compiler as C drive is a windows system partition.

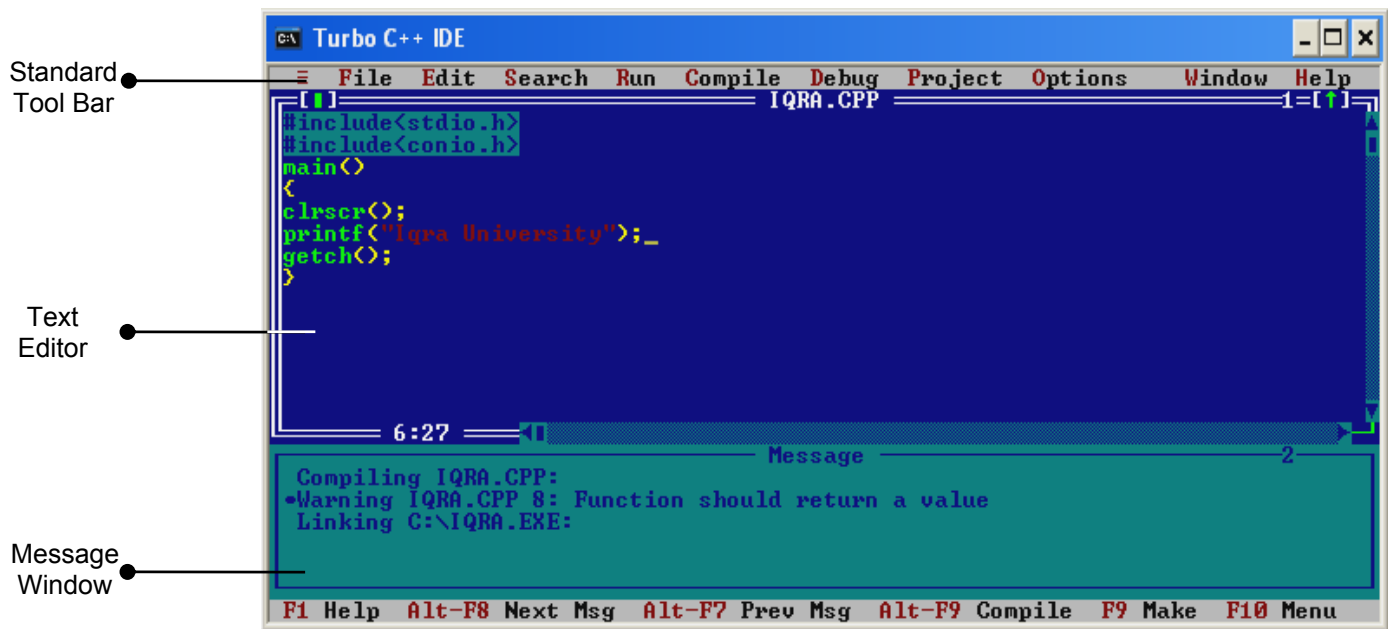
Assuming that the folder has been copied in the root of D drive, open

`D: partition → TC3 folder → BIN →`

Double click and open any one of the two TC.exe icons (as shown on right).



The window that opens is the known as the IDE of Turbo C (as shown below)




This IDE window further contains two more windows and a standard tool bar. The blue window is known as the text editor which is used to write the programs. And the Light bluish green window at the bottom is the message box which will display the error or other messages.

Before using the IDE there are few parameters and checks which need to be reviewed every time the IDE of windows is used. Make sure that the folder of TC3 (also known as compiler) has been copied in the root drive i.e. in the first window of any partition and not in sub folders. e.g.

`D:\TC3` is correct but `D:\TC3\CP\C language\Class work\TC3` is incorrect.

### Opening a new File

Close all windows in the Turbo C IDE (if there are any) by clicking in the small green box on the right top corner of each window .

On the standard tool bar click file, select new. A new Blue window appears.

### Saving a New File

Press F2 key to save this file. Make sure the path where you save this file is same as of compiler

e.g. *D:\TC3\BIN*

this path is visible at the bottom of save window. The name of the file will always be followed by **.cpp** extension (dot cpp).

### Opening an existing file

To open any previously saved file, click File, select open, in the path option type **D:\TC3\BIN\\*.\***

Asteric means all. The asteric before the dot means all file names and the asteric after the dot means all file types. **\*.cpp** means all files with dot cpp extension.

### Setting Directory Paths (to be checked each time the Turbo IDE is opened)

Once you have opened and saved a new file some directories need to be changed according to the location of your compiler in your computer otherwise the compiler make not work properly.

On the standard toolbar click on options then directories. Set the first letter of the first two paths (i.e. Include Directories and Library Directories) according to the location of the compiler or say the letter of the directory where you copied your compiler. The other two paths (i.e. Output Directories and Source Directories) will remain blank. e.g.



### Compilation and Output

After you have written the program press Ctrl+f9 to compile and check the output.

Alt+F5 key is used to display the output for last compilation.

### Technical Exits

To minimize the screen of Turbo C editor press Alt+Enter.

If some where the program hangs up compiler at output or gets busy without passing control to programmer press Ctrl+Pause\Break.

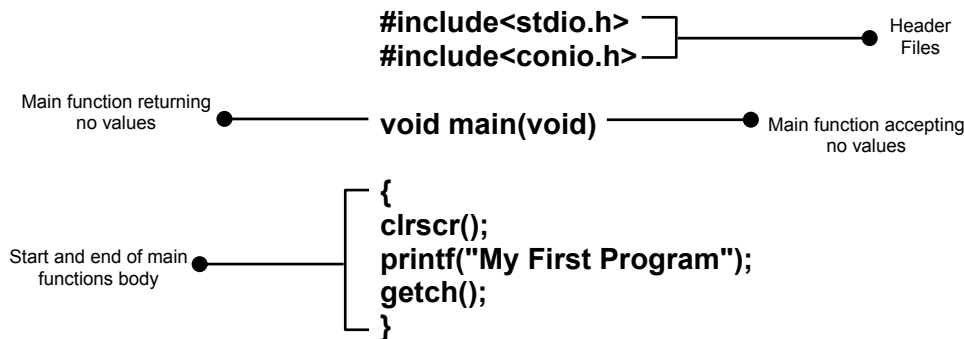
# Experiment 2

## Objective

Making first program in C. Saving / copying files to USB or other storage devices.

## Theory

How to work in a Turbo C environment. Basic Startup. Here is simple C language program.



```
#include<stdio.h>
#include<conio.h>
```

The first line of this program is `#include<stdio.h>`. Here `#include` tells the compiler to include something and `stdio` means Standard Input/Output where as `.h` means that it is a header file or in short we are including standard input/output header file. In the same way the next line is similar to the first one but it has `conio.h` in it where `conio` means the black colour console screen where we see our output and `.h` tells us that this is a header file. In other words we tell the compiler that we are including two files and the code we will write will be of c language as the compiler also supports C++ code.

```
void main(void)
```

This is third line. The first word in this is `void` which means any thing that has no value or is useless. The next word is `main` which is the brain function and is the only function readable in most programming languages. All the other functions are called within the main function. The third word within brackets is also `void`. The first `void` means that the main function won't return any value while the second `void` means that the main function is not going to accept any value. This complete line means that we have declared the main function here. For example a simple calculator takes two or more numbers from you and returns the result like addition, subtraction, multiplication etc. It may be confusing at this time to understand the `void` functionality but in experiment 11 we will discuss it in detail.

```
{
```

Following the main function line is a curly bracket which marks the starting of mains body. Always remember that if any bracket is opened in C language it needs to be closed hence the last line of the above program marks the ending of main function.

```
clrscr();
```

This is the first function called inside the main body. All functions will always have a round bracket closing `)` and a semicolon `;` at their end. In that way we easily recognize the number of functions in a program. According to this rule we can identify 3 functions in this program. However other properties in different functions may differ but this identity will be common in all functions. `clrscr` is short form of clear screen. It clears the screen of any previous output. If not used wont create any error but output will show all previous compilation result.

```
printf("My First Program");
```

This line has another function known as `printf` which is used for printing. Within the double quotes is the main body of this function where any character may be printed.

```
getch();
```

This is the last function of this program. Its name is short form of get character. Its purpose is to get a character. Its used in last to stop the program until a character is entered. If not used wont show any error but the output will not stop after compilation. In this case the output is checked manually by pressing `Alt+F5` key.

### Example

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); printf("My First Program"); getch(); }</pre>	My First Program

### Exercise

Carefully look at the following programs and write the output.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { printf("My First Program"); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); printf("My First Program"); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); clrscr(); printf("My First Program"); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); printf("My First Program"); clrscr(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); clrscr(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { getch(); printf("My First Program"); getch(); clrscr(); }</pre>	Write the output for the program on left

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); getch(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;conio.h&gt; #include&lt;stdio.h&gt; void main(void) { clrscr(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include"conio.h" #include"stdio.h" void main(void) { clrscr(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;conio.h&gt; #include&lt;stdio.h&gt; main() { clrscr(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;CONIO.H&gt; #include&lt;STDIO.H&gt; void main(void) { clrscr(); printf("My First Program"); getch(); }</pre>	Write the output for the program on left

## Assignment

Using the program below, make a resume showing your complete details.

Program
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); printf("\n*****RESUME*****"); printf("\n*****CV*****"); printf("\n*****"); printf("\n====="); printf("\nName      :  Abc"); printf("\nFathers Name  :  Xyz"); printf("\nDate of Birth :  dd-mm-yyyy"); printf("\nAddress      :  Engineering Department, Main Campus, Iqra University,"); printf("\n              Shaheed-e-Millat Road, Defence View Karachi"); printf("\nCNIC         :  XXXXX-XXXXXXX-X"); printf("\nGender       :  Male"); printf("\nHSC (College\Board) :  Science (Pre Engg), Iqra College, Karachi Board"); printf("\nHSC Year      :  August 2005 "); printf("\nSSC (School\Board) :  Science, Iqra School, Karachi Board"); printf("\nSSC Year      :  August 2003 "); getch(); }</pre>

# Experiment 3

## Objective

Understanding and Using format specifiers and escape sequences with printf.

## Theory

Format specifiers are used to substitute and print values inside a printf or scanf statement which are further applicable on variables. Below is a chart of format specifier examples using printf.

No.	Type	Syntax	Value	Example
1	Single Character	%c	One character within single quotes	printf("%c", 'a');
2	String	%s	A sentence of an unfixed length within double quotes	printf("%s", "Iqra Univ");
3	Decimal Integer	%d	Any whole number between -32,768 to 32,767	printf("%d", 12345);
4	Long Integer	%ld	Any number between -2,147,483,648 to 2,147,483,647	printf("%ld", 1234567);
5	Float	%f	Any decimal point number between $10^{-38}$ to $10^{38}$	printf("%f", 1234.567);
6	Double	%lf	Any decimal point number between $10^{-308}$ to $10^{308}$	printf("%lf", 12345678);

Escape Sequences are used to adjust spacing between lines or characters or the characters themselves.

No.	Syntax	Application	Example
1	\n	New Line	printf("\n");
2	\t	Tab eight spaces to right	printf("\t");
3	\b	Back space One space back	printf("\b");
4	\r	Carriage return Start of same line	printf("\r");
5	\'	Printing single quote	printf("\'");
6	\"	Printing double quotes	printf("\"");
7	\\	Printing back space	printf("\\");
8	\xdd	Printing characters by Hexa decimal ASCII value	printf("\x45");
9	\ddd	Printing characters by decimal ASCII value	printf("\d45");

## Example

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     printf("\n%c", 'a');     printf("\n%s", "Iqra University");     printf("\n%d", 20);     printf("\n%f", 35.5);     printf("\n%ld", 1234567);     getch(); }</pre>	A Iqra University 20 35.5 1234567
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     printf("\n%c %s %d %f %ld", 'a', "Iqra University", 20, 35.5, 1234567);     getch(); }</pre>	A Iqra University 2035.5 1234567

## Exercise

Write the output for following programs and give reasons.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     printf("\n%d",'a');     printf("\n%s","Iqra University");     printf("\n%c",20);     printf("\n%f",35.5);     printf("\n%d",1234567);     getch(); }</pre>	<i>Write the output for the program on left</i>

## Assignment

Use the program below to make your resume with format specifiers and escape sequences showing your complete details.

Program
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     printf("\t\t\t\t*****RESUME*****");     printf("\t\t\t\t*****CV*****");     printf("\t\t\t\t*****");     printf("\t\t\t\t=====");     printf("\nName       : %s","Abc");     printf("\nFathers Name   : %s","Xyz");     printf("\nDate of Birth   : %d-%d-%d",11,11,1989);     printf("\nAddress        : %s","Engineering Department, Main Campus, Iqra University,");     printf("\n                %s","Shaheed-e-Millat Road, Defence View Karachi");     printf("\nCell Phone      : 0%d-%d",300,1234567);     printf("\nCNIC            : %d-%d-%d",12345,1234567,1);     printf("\nGender          : %s","Male");     printf("\nHSC (College\\Board) : %s","Science (Pre Engg), Iqra College, Karachi Board");     printf("\nHSC Year         : %s %d","August",2005);     printf("\nSSC (School\\Board)  : %s","Science, Iqra School, Karachi Board");     printf("\nSSC Year         : %s %d","August",2003);     getch(); }</pre>

# Experiment 4

## Objective

Studying different data types, variables, variable names, variable declaration, variable definition, variable initialization, escape sequences.

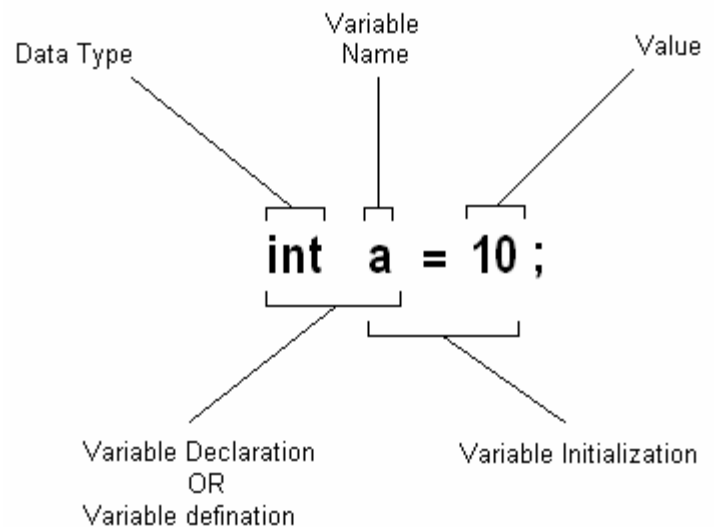
## Theory

Variables are declared by first writing data types followed by a variable name, e.g.

```
int a=10;
```

Here

*int* is data type,  
*a* is variable name  
 and after the equals to sign (=) is the value in it 10  
 the value is always followed by a terminator



No.	Data Type	Syntax	Supported format Specifier	Value	Example
1	Single Character	char	%c	One character within single quotes	char a='a';
2	Decimal Integer	int	%d	Any whole number between -32,768 to 32,767	int a=10;
3	Long Integer	long int	%ld	Any number between -2,147,483,648 to 2,147,483,647	long int a=12345;
4	Float	float	%f	Any decimal point number between $10^{-38}$ to $10^{38}$	float a=1234.567;
5	Double	double	%lf	Any decimal point number between $10^{-308}$ to $10^{308}$	double a=123456;

## Variable Names

Variable names will always start with an alphabet.

Variable names can contain numbers (1,2,45,66) and underscores (\_) but no other special characters (!@#\$\$%^&\*).

Variable names cannot resemble to any predefined word e.g. include, printf, getch, scanf etc..

A variable name cannot be used for multiple declarations.

## Example

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {   clrscr();   char a='a';   int b=12;   float c=12.5;   double d=1234567;   printf("%c %d %f %lf",a,b,c,d);   getch(); }</pre>	a 12 12.5 1234567
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {   clrscr();   char a='a',a1='b';   int b=12,b1=13;   float c=12.5,c1=13.5;   double d=1234567,d1=1234568;   printf("\n%c %d %f %lf",a,b,c,d);   printf("\n%c %d %f %lf",a1,b1,c1,d1);   getch(); }</pre>	b 13 13.5 1234568

## Exercise

Write the output for following programs.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); char a=97; int b='A'; float c=12.5; double d=1234567; printf("%c %d %f %lf",a,b,c,d); getch(); }</pre>	<i>Write the output for the program on left</i>

## Assignment

Using the program below, make a resume with format variables showing your complete details.

Program
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int dd,mm,yyyy,cell1,cnic3; long int cnic1,cnic2,cell2; dd=11; mm=11; yyyy=1989; cell1=300; cell2=1234567; cnic1=12345; cnic2=1234567; cnic3=1; printf("\n*****RESUME*****"); printf("\n*****CV*****"); printf("\n*****"); printf("\n====="); printf("\nName      : %s","Abc"); printf("\nFathers Name : %s","Xyz"); printf("\nDate of Birth : %d-%d-%d",dd,mm,yyyy); printf("\nAddress      : %s","Engineering Department, Main Campus, Iqra University,"); printf("\n              %s","Shaheed-e-Millat Road, Defence View Karachi"); printf("\nCell Phone   : 0%d-%d",cell1,cell2); printf("\nCNIC        : %d-%d-%d",cnic1,cnic2,cnic3); printf("\nGender      : %s","Male"); printf("\nHSC (College\Board) : %s","Science (Pre Engg), Iqra College, Karachi Board"); printf("\nHSC Year      : %s %d","August",2005); printf("\nSSC (School\Board) : %s","Science, Iqra School, Karachi Board"); printf("\nSSC Year      : %s %d","August",2003); getch(); }</pre>

# Experiment 5

## Objective

Studying Math functions.

## Theory

Math.h header file is included for the definitions of math functions listed below. It is written as `#include<math.h>`.

Trigonometric / Maths Functions
sin(n)
cos(n)
tan(n)
sinh(n)
cosh(n)
tanh(n)
pow(nmb,pwr)
sqrt(n)

## Example

The program below shows the result for math and trigonometric functions. The functions pass the values to variables which are further used for printing in printf.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; #include&lt;math.h&gt; void main(void) {     clrscr();     float a=45,b=1,sn,cs,tn,snh,csh,tnh;     sn=sin(a);     cs=cos(a);     tn=tan(a);      snh=sinh(b);     csh=cosh(b);     tnh=tanh(b);      printf("\n\n Trigonometric Functions");     printf("\nsin  45 = %.2f",sn);     printf("\ncos  45 = %.2f",cs);     printf("\ntan  45 = %.2f",tn);      printf("\n\n Hyperbolic Functions");     printf("\nsinh 1 = %.2f",snh);     printf("\ncosh 1 = %.2f",csh);     printf("\ntanh 1 = %.2f",tnh);      getch(); }</pre>	<pre>Trigonometric Functions sin  45 = 0.85 cos  45 = 0.53 tan  45 = 1.62  Hyperbolic Functions sinh 1 = 1.18 cosh 1 = 1.54 tanh 1 = 0.76</pre>

The program below shows the result for math and trigonometric functions. It also demonstrates that some functions may be called within the body of another function. For example here all the trigonometric functions are called inside printf function.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; #include&lt;math.h&gt; void main(void) { clrscr();  printf("\n\n\n Trignometric Functions"); printf("\nsin 45 = %.2f",sin(45)); printf("\ncos 45 = %.2f",cos(45)); printf("\ntan 45 = %.2f",tan(45));  printf("\n\n\n Hyperbolic Functions"); printf("\nsinh 1 = %.2f",sinh(1)); printf("\ncosh 1 = %.2f",cosh(1)); printf("\ntanh 1 = %.2f",tanh(1));  printf("\n\n\n Math Functions"); printf("\npow 2,3 = %.2f",pow(2,3)); printf("\nsqrt 49 = %.2f",sqrt(49));  getch(); }</pre>	<pre>Trignometric Functions sin 45 = 0.85 cos 45 = 0.53 tan 45 = 1.62  Hyperbolic Functions sinh 1 = 1.18 cosh 1 = 1.54 tanh 1 = 0.76  Math Functions pow 2,3 = 8.00 sqrt 49 = 7.00</pre>

### Assignment

### Assingment

Program the following.

- Implement the following equation

$$3x^4 \sin(180x) + 4x^3 \cos(90x) + x^2\sin(\tan(45)) + 7x + 9\cos(90x^2 )$$

where x may be user defined value.

# Experiment 6

## Objective

Taking Input from the user at console screen using scanf and getche commands.

## Theory

Scanf command can take input of different data types at a time.

Gerche command can take only one character input.

## Example

Write the output after supplying appropriate input on console screen.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); char a; int b; float c; double d; printf("\nEnter character "); scanf("%c",&amp;a); printf("\nEnter integer "); scanf("%d",&amp;b); printf("\nEnter float "); scanf("%f",&amp;c); printf("\nEnter double "); scanf("%lf",&amp;d); printf("\n%c %d %f %lf",a,b,c,d); getch(); }</pre>	<i>Write the output for the program on left</i>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); char a; int b; float c; double d; printf("Enter char integer float double\n"); scanf("%c %d %f %lf",&amp;a,&amp;b,&amp;c,&amp;d); printf("\n%c %d %f %ld",a,b,c,d); getch(); }</pre>	<i>Write the output for the program on left</i>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); printf("\nWhat is your section : "); getche(); getch(); }</pre>	<i>Write the output for the program on left</i>

## Assignment

Use the program below to make a resume that takes input from the user and shows complete details.

### Program

```
#include<stdio.h>
#include<conio.h>
void main(void)
{
clrscr();
int dd,mm,yyyy,cell1,cnic3;
long int cnic1,cnic2,cell2;
printf("\n*****RESUME*****");
printf("\n*****CV*****");
printf("\n*****");
printf("\n=====");
printf("\nName      : %s","Abc");
printf("\nFathers Name : %s","Xyz");
printf("\nDate of Birth : (dd-mm-yyyy)");
scanf("%d %d %d",&dd,&mm,&yyyy);
printf("%d-%d-%d",dd,mm,yyyy);
printf("\nAddress      : %s","Engineering Department, Main Campus, Iqra University,");
printf("\n              %s","Shaheed-e-Millat Road, Defence View Karachi");
printf("\nCell Phone    : (3XX-1234567)");
scanf("%d %ld",&cell1,&cell2);
printf("0%d-%ld",cell1,cell2);
printf("\nCNIC        : (12345-1234567-1)");
scanf("%ld %ld %ld",&cnic1,&cnic2,&cnic3);
printf("%ld-%ld-%ld",cnic1,cnic2,cnic3);
printf("\nGender      : %s","Male");
printf("\nHSC (College\Board) : %s","Science (Pre Engg), Iqra College, Karachi Board");
printf("\nHSC Year        : %s %d","August",2005);
printf("\nSSC (School\Board) : %s","Science, Iqra School, Karachi Board");
printf("\nSSC Year        : %s %d","August",2003);
getch();
}
```

# Experiment 7

## Objective

Arithmetic operators, conditional operators, assignment operators, Increment/decrement operators.

## Theory

Arithmetic operators		Relational operators		Assignment operators		Increment/decrement operators	
Add	+	Greater Than	>	Addition assignment	+=	Increment	++
Subtract	-	Less Than	<	Subtraction assignment	-=	Decrement	--
Multiplication	*	Greater or Equal	>=	Multiplication assignment	*=		
Division	/	Less or Equal	<=	Division assignment	/=		
Remainder	%	Equal Equal	==				
		Not Equal	!=				

## Example

Explain the following program after careful study.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=2,b=4,c1,c2,c3,c4,d1,d2,d3,d4; c1=c2=c3=c4=5; d1=d2=d3=d4=8; printf("\n%d %d %d %d",a+b,a-b,a*b,a/b); printf("\n%d %d %d %d %d %d",a&gt;b,a&lt;b,a&gt;=b,a&lt;=b,a==b,a!=b); printf("\n%d %d %d %d",c1+=3,c2-=3,c3*=3,c4/3); printf("\n%d %d %d %d",d1++,++d2,d3--,--d4); getch(); }</pre>	<pre>6 -2 8 0 0 1 0 1 0 1 8 2 15 1 8 9 8 7</pre>

## Exercise

Write output for following programs and give reasons.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d",a++,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d",++a,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d",a--,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d",- a,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d %d %d",a++,++a,a,a - -); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d %dd",a+5,++a,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d %dd",a+=5,++a,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d %dd",a-=5,- a,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; main() { clrscr(); int a=5; printf("\n%d %d %dd",a+=5,a++,a); printf("\n%d ",a); getch(); }</pre>	Write the output for the program on left

## Assingment

Program the following.

- Prompt user to input distance in Kilometers and display it in meters.
- For the following equation  $3x^4 + 4x^3 + x^2 + 7x + 9$  , substitute the value of x and generate the result.
- Input any number from user and generate its square e.g. square of 8 is 64
- Input any number from user and generate its cube e.g. cube of 8 is 512
- Input a 4 digit number in any integer type variable and sum all the four digits, e.g. int a =3487, result = 22

# Experiment 8

## Objective

Studying loops. For loops, nested for loops, while loops, nested while loops, do while loops, nested do while loops.

## Theory

for	while	do while
<pre>for(initialization ; check range ; iteration) {     body }</pre>	<pre>initialization; while(check range) {     body     iteration; }</pre>	<pre>initialization; do {     body     iteration; } while(check range)</pre>

## Example

The table below shows simple loops.  
All the three programs have same output.

Loop	Program	Output
For	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     for(int a=0;a&lt;=12;a++)         printf("%d x 2 = %d\n",a,a*2);     getch(); }</pre>	<pre>0 x 2 = 0 1 x 2 = 2 2 x 2 = 4 3 x 2 = 6 4 x 2 = 8 5 x 2 = 10 6 x 2 = 12 7 x 2 = 14 8 x 2 = 16 9 x 2 = 18 10 x 2 = 20 11 x 2 = 22 12 x 2 = 24</pre>
While	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a=0;     while(a&lt;=12)     {         printf("%d x 2 = %d\n",a,a*2);         a++;     }     getch(); }</pre>	
Do while	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a=0;     do     {         printf("%d x 2 = %d\n",a,a*2);         a++;     } while(a&lt;=12);     getch(); }</pre>	

This table below shows nested loops  
All the three programs have same output.

Nested Loop	Program	Output
For	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     for(int a=0;a&lt;=3;a++)     {         for(int b=0;b&lt;=3;b++)             printf("%d%d\t",a,b);         printf("\n");     }     getch(); }</pre>	<pre>00 01 02 03 10 11 12 13 20 21 22 23 30 31 32 33</pre>
While	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a=0,b;     while(a&lt;=3)     {         b=0;         while(b&lt;=3)         {             printf("%d%d\t",a,b);             b++;         }         printf("\n");         a++;     }     getch(); }</pre>	
Do while	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a=0,b;     do     {         b=0;         do         {             printf("%d%d\t",a,b);             b++;         }while(b&lt;=3);         printf("\n");         a++;     }while(a&lt;=3);     getch(); }</pre>	

This program of while loops takes continuous input until enter key is pressed.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a=0; printf("Type any sentence\n"); while(getche()!='\r') a++; printf("\nTotal Characters typed = %d",a); getch(); }</pre>	<p>Type any sentence Iqra University Total Characters typed = 15</p>

### Exercise

Carefully observe the following program and write output with reasons.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); for(int a=0;a&lt;=12;a++); printf("%d x 2 = %d\n",a,a*2); getch(); }</pre>	<p>Write the output for the program on left</p>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); for(int a=0;1;a++); printf("%d x 2 = %d\n",a,a*2); getch(); }</pre>	<p>Write the output for the program on left</p>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a=0; while(0) { printf("%d x 2 = %d\n",a,a*2); a++; } getch(); }</pre>	<p>Write the output for the program on left</p>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a=0,b; while(a&lt;=3); { b=0; while(b&lt;=3); { printf("%d%d\t",a,b); b++; } printf("\n"); a++; } getch(); }</pre>	<p>Write the output for the program on left</p>

## Assingment

- Input any number from user and generate its factorial e.g. factorial of 7 is 5040

For the following output write programs with a logical method.

Program	Output
Write the program for the output on right	<pre> 10 x 2 = 20 12 x 2 = 24 14 x 2 = 28 16 x 2 = 32 18 x 2 = 36 20 x 2 = 40 </pre>
Write the program for the output on right	<pre> 33 32 31 30 23 22 21 20 13 12 11 10 03 02 01 00 </pre>
Write the program for the output on right	<pre> 00 00 00 00 00 11 00 00 00 00 22 00 00 00 00 33 </pre>
Write the program for the output on right	<pre> 12 x 2 = 24 11 x 2 = 22 10 x 2 = 20 9 x 2 = 18 8 x 2 = 16 7 x 2 = 14 6 x 2 = 12 5 x 2 = 10 4 x 2 = 8 3 x 2 = 6 2 x 2 = 4 1 x 2 = 2 0 x 2 = 0 </pre>
<pre> #include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a,b,c; for(a=1;a&lt;=9;a+=2) { for(b=9;b&gt;a;b--) printf(" ");  for(c=1;c&lt;=a;c++) printf("%d ",a);  printf("\n"); } getch(); } </pre>	<p>Explain the program on left and its output which is given below</p> <pre>       1      3 3 3     5 5 5 5    7 7 7 7 7 7   9 9 9 9 9 9 9 </pre>
<pre> #include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a,b; long float c=1; for(a=0;a&lt;=8;a++) { for(b=8;b&gt;a;b--) printf(" ");  printf("%.lf ",c*c); printf("\n"); c=c*10+1; } getch(); } </pre>	<p>Explain the program on left and its output which is given below</p> <pre>       1      1 2 1     1 2 3 2 1    1 2 3 4 3 2 1   1 2 3 4 5 4 3 2 1  1 2 3 4 5 6 5 4 3 2 1 1 2 3 4 5 6 7 6 5 4 3 2 1 </pre>
Write the program for the output on right	<pre>       +      + + +     + + + + +    + + + + + + +   + + + + + + + + + </pre>

Use the program below to make a resume that takes input from the user using while loop and shows complete details.

## Program

```
#include<stdio.h>
#include<conio.h>
void main(void)
{
clrscr();
int dd,mm,yyyy,cell1,cnic3;
long int cnic1,cnic2,cell2;
printf("\n*****RESUME*****");
printf("\n*****CV*****");
printf("\n*****");
printf("\n=====");
printf("\nName      : ");
while(getche()!='\r');
printf("\nFathers Name  : ");
while(getche()!='\r');
printf("\nDate of Birth   : (dd-mm-yyyy)");
scanf("%d %d %d",&dd,&mm,&yyyy);
printf("%d-%d-%d",dd,mm,yyyy);
printf("\nAddress      : ");
while(getche()!='\r');
printf("\nCell Phone     : (3XX-1234567)");
scanf("%d %ld",&cell1,&cell2);
printf("0%d-%ld",cell1,cell2);
printf("\nCNIC          : (12345-1234567-1)");
scanf("%ld %ld %d",&cnic1,&cnic2,&cnic3);
printf("%ld-%ld-%d",cnic1,cnic2,cnic3);
printf("\nGender        : ");
while(getche()!='\r');
printf("\nHSC (College\Board) : ");
while(getche()!='\r');
printf("\nHSC Year       : %s %d","August",2005);
printf("\nSSC (School\Board) : ");
while(getche()!='\r');
printf("\nSSC Year       : %s %d","August",2003);
getch();
}
```

# Experiment 9

## Objective

Studying loops with cross combination, for-while, while-for, do-while while, while do-while, for do-while, do-while for.

## Theory

for while	while for	for do-while	do-while for	while do-while	do-while while
for( ) { while( ) }	while( ) { for( ) }	for( ) { do while( ) }	do { for( ) }while( )	while( ) { do while( ) }	do { while( ) }while( )

## Example

The table below shows loops with cross combinations.

Loop	Program	Output
For While	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a,b=0;     for(a=0;a&lt;=3;a++)     {         b=0;         while(b&lt;=3)         {             printf("%d%d\t",a,b);             b++;         }         printf("\n");     }     getch(); }</pre>	<pre>00  01  02  03 10  11  12  13 20  21  22  23 30  31  32  33</pre>
While For	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int a=0,b;     while(a&lt;=3)     {         for(b=0;b&lt;=3;b++)         {             printf("%d%d\t",a,b);         }         printf("\n");         a++;     }     getch(); }</pre>	

## Assignment

With the help of above program make the following crossed combination programs for the same output.

- For Do-while
- Do-while For
- While Do-while
- Do-while while

# Experiment 10

## Objective

Decision making and conditioning using If statements, If-else statements, switch-case.

## Theory

If	Nested If	If-else	Else-if	Switch-case
<pre>if(cond) {     Body }</pre>	<pre>if(cond) {     If(cond)     {         body     } }</pre>	<pre>if(cond) {     body } else {     Body }</pre>	<pre>if(cond) {     body } else if(cond) {     Body }</pre>	<pre>switch(cond) {     case'1':         body     case'2':         body }</pre>

## Example

This program illustrates simple if and nested if statements with else conditions.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     char ch;     int chr=0, wrd=1;     printf("Type any sentence\n");     while((ch=getche())!='\r')     {         chr++;         if(ch==' ')         {             wrd++;             chr--;         }     }     printf("\nTotal Characters = %d",chr);     printf("\nTotal Words = %d", wrd);     getch(); }</pre>	<pre>Type any sentence Iqra Univ Khi Sindh Pak Total Characters = 19 Total Words = 5</pre>
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int cp=0;     printf("Enter CP marks between 1 &amp; 100\n");     scanf("%d",&amp;cp);     if(cp&gt;=0 &amp;&amp; cp&lt;=100)     {         if(cp&gt;=75)             printf("\nGrade A");          else             if(cp&gt;=50)                 printf("\nGrade C");     }     else         printf("\nIncorrect Input");     getch(); }</pre>	<p>Write the output for the program on left</p>

This program lets the user choose a number between 1 and 99 and guesses it in less than 10 hints.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); float gss,incr; char ch; printf("Think of a number Between 1 &amp; 99\n"); printf("Press `g` for grater\n"); printf("Press `l` for less\n"); printf("Enter for exit\n");  incr=gss=50; while(incr&gt;1.0) { printf("\nls your number greater, less or equal to %.0f\n",gss); incr/=2; if((ch=getch())=='e') break; else if(ch=='g') gss+=incr; else gss-=incr; } printf("You guessed %.0f",gss); getch(); }</pre>	<p>Think of a number between 1 and 99 Press `g` for greater Press `l` for less Enter for exit</p> <p>Is your number greater, less or equal to 50</p> <p>Is your number greater, less or equal to 75</p> <p>Is your number greater, less or equal to 88 You guessed 88</p>

This program prompts the user to type his/her name. If any thing other than Upper/lower case alphabets or a space is entered for example 1,2,@#\$% then it is detected and nothing is printed until a correct character is input.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); char ch; printf("Name : "); while((ch=getche())!='\r') { if( (ch&gt;=65 &amp;&amp; ch&lt;=90)    (ch&gt;=97 &amp;&amp; ch&lt;=122)    ch==' '); else printf("\b\b"); } getch(); }</pre>	<p>Write the output for the program on left</p>

This is a simple calculator program that adds or subtracts two numbers entered by the user.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); float nm1=1.0,nm2=1.0; char op;  while(!(nm1==0.0 &amp;&amp; nm2==0.0)) { printf("\nType Number Operatot Number\n"); scanf("%f %c %f",&amp;nm1,&amp;op,&amp;nm2); switch(op) { case'+': printf(" = %f ",nm1+nm2); break; case'-': printf(" = %f ",nm1-nm2); break; default: printf("\nUnknown Operator\n"); } printf("\n\n"); } getch(); }</pre>	<p>Write the output for the program on left</p>

This is same as the previous one except it take numbers instead of operators to show that switch can also accept numbers.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); float nm1=1.0,nm2=1.0; int op;  while(!(nm1==0.0 &amp;&amp; nm2==0.0)) { printf("\nType Number Operator Number\n"); printf("\nType 1 for addition and 2 for subtraction in operator\n"); scanf("%f %d %f",&amp;nm1,&amp;op,&amp;nm2); switch(op) { case 1: printf(" = %f ",nm1+nm2); break; case 2: printf(" = %f ",nm1-nm2); break; default: printf("\nUnknown Operator\n"); } printf("\n\n"); } getch(); }</pre>	<p>Write the output for the program on left</p>

### Assingment

Program the following.

- Make the number guessing program with switch case.
- Make an alphabet guessing program using if-else.
- Complete the simple calculator program for multiplication and division. Also make it using if-else.
- Make your resume such that in the name field it dose not accept any thing else than alphabets and space bar.
- Look at the scenario below.

Design a marks sheet for a student with 5 subjects

Math, Physics, Electronics, Islamiat, Computer Programming.

Take marks as input from user calculate grade for each subject,

CGPA and percentage. Detect error for out ranged numbers e.g. below 0 or above 100.

Marks	Grade	GPA
0-49	F	2
50-59	C	2.25
60-69	C+	2.5
70-79	B	2.75
80-89	B+	3
90-95	A	3.5
96-100	A+	4

# Experiment 11

## Objective

Graphics, basic applications of graphics by making buttons and animations.

## Theory

Graphics.h header file is used for graphics function, dos.h is used for delay function and math.h is used for trigonometric functions. Below are some of the graphics functions that may be used in this course.

For the table below xc, yc, x1, y1, n atc all represent constant values.

ellipse(xc,yc,start,end,xrad,yrad);	setlinestyle(n);
rectangle(x1,y1,x2,y2);	setfillstyle(n);
line(x1,y1,x2,y2);	floodfill(n);
circle(xc,yc,rad);	setfillpattern(n);
arc(xc,yc,start,end,rad);	setfillstyle(n);
bar(x1,y1,x2,y2);	settextstyle(n);
bar3d(x1,y1,x2,y2,z1,z2);	settextjustify(n);
putpixel(x,y,color);	textheight(n);
outtextxy(x,y,"Text");	textwidth(n);
setcolor(n);	setusercharsize(n);
setbkcolor(n);	

## Example

This program has a graphical button which is animated to be pressed when ever any keyboard button is pressed.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; #include&lt;graphics.h&gt; #include&lt;dos.h&gt; void btn1(void); void main(void) {     clrscr();     int driver,mode;     driver=EGA;     mode=EGAH;     initgraph(&amp;driver,&amp;mode,"c:\\tc3\\bgi");     btn1();     getch(); }  void btn1(void) {     int x1=250,y1=125,x2=275,y2=150,dly=75;     rectangle(x1,y1,x2,y2);     line(x2+2,y1,x2+2,y2+2); ///Vertical     line(x1,y2+2,x2+2,y2+2); ///Horizontal     while(getche()!='r')     {         setcolor(0);          ///Black         line(x2+2,y1,x2+2,y2+2); ///Vertical         line(x1,y2+2,x2+2,y2+2); ///Horizontal         delay(dly);         setcolor(15);         ///White         line(x1+2,y1+2,x1+2,y2); ///Vertical         line(x1+2,y1+2,x2-1,y1+2); ///Horizontal         delay(dly);         setcolor(0);          ///Black         line(x1+2,y1+2,x1+2,y2-1); ///Vertical         line(x1+2,y1+2,x2-1,y1+2); ///Horizontal         setcolor(15);         ///White         line(x2+2,y1,x2+2,y2+2); ///Vertical         line(x1,y2+2,x2+2,y2+2); ///Horizontal     } }</pre>	<p>Write the output for the program on left</p>

This program shows an animated circle which rotates in a circular path.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; #include&lt;graphics.h&gt; #include&lt;dos.h&gt; #include&lt;math.h&gt; void main(void) {     clrscr();     int driver,mode;     driver=EGA;     mode=EGAHI;     initgraph(&amp;driver,&amp;mode,"c:\\tc3\\bgi");     setcolor(15);     int r=50;     float pi=22/7,d;     while(!kbhit())     {         setcolor(15);         cleardevice();         d=(pi/(90*3))*r;         circle(250+130*sin(d),150-100*cos(d),10);         delay(4);         r++;     }     getch();     closegraph(); }</pre>	<p><i>Write the output for the program on left</i></p>

### Assignment

Graphically program the following.

- Design simple calculator with buttons such that it resembles an actual calculator.
- Make any presentation with animation to any selected topic (e.g. solar system, trigonometric waveform).

# Experiment 12

## Objective

User defined functions, passing values to function, returning values from functions.

## Theory

Functions give user a facility to make functions according to their own needs.

## Example

This program has a simple function with no return type or arguments passing and prints a sentence.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt;  void iqra(void);  void main(void) {     clrscr();     iqra();     getch(); }  void iqra(void) {     printf("\nIqra University"); }</pre>	Iqra University

This program has a function with no return type but two arguments passed as integers and printed with their sum.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt;  void add1(int,int);  void main(void) {     clrscr();     add1(2,4);     getch(); }  void add1(int a,int b) {     printf("\n%d + %d = %d",a,b,a+b); }</pre>	2 + 4 = 6

This program has a function with integer return type and two arguments passed as integers.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt;  int add1(int,int);  void main(void) {     int a,b,c1;     a=2;     b=4;     clrscr();     c1=add1(2,4);     printf("\n%d + %d = %d",a,b,c1);     getch(); }  int add1(int a,int b) {     int c2;     c2=a+b;     return c2; }</pre>	2 + 4 = 6

## Assignment

With the help of program below make the resume of experiment number 9 with functions.

### Program

```
#include<stdio.h>
#include<conio.h>
void resume(void);

void main(void)
{
    clrscr();
    resume();
    getch();
}

void resume(void)
{
    clrscr();
    char ch;
    int dd,mm,yyyy,cell1,cnic3;
    long int cnic1,cnic2,cell2;
    printf("\n*****RESUME*****");
    printf("\n*****CV*****");
    printf("\n*****");
    printf("\n=====");
    printf("\nName      : ");
    while((ch=getche())!='\r')
    if( (ch>=65 && ch<=90) || (ch>=98 && ch<=122) || ch==' ');
    else printf("\b\b");
    printf("\nFathers Name : ");
    while((ch=getche())!='\r')
    if( (ch>=65 && ch<=90) || (ch>=98 && ch<=122) || ch==' ');
    else printf("\b\b");
    printf("\nDate of Birth : (dd-mm-yyyy)");
    scanf("%d %d %d",&dd,&mm,&yyyy);
    printf("%d-%d-%d",dd,mm,yyyy);
    printf("\nAddress : ");
    while((ch=getche())!='\r')
    if( (ch>=65 && ch<=90) || (ch>=98 && ch<=122) || ch==' ');
    else printf("\b\b");
    printf("\nCell Phone : (3XX-1234567)");
    scanf("%d %ld",&cell1,&cell2);
    printf("0%d-%ld",cell1,cell2);
    printf("\nCNIC : (12345-1234567-1)");
    scanf("%ld %ld %ld",&cnic1,&cnic2,&cnic3);
    printf("%ld-%ld-%ld",cnic1,cnic2,cnic3);
    printf("\nGender : ");
    while(getche()!='\r');
    printf("\nHSC (College\Board) : ");
    while(getche()!='\r');
    printf("\nHSC Year : %s %d","August",2005);
    printf("\nSSC (School\Board) : ");
    while(getche()!='\r');
    printf("\nSSC Year : %s %d","August",2003);
    getch();
}
```

# Experiment 13

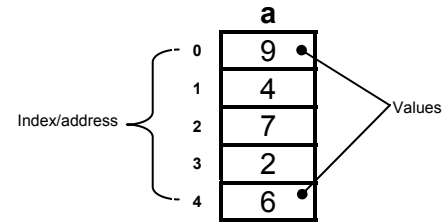
## Objective

Arrays, array index, single and multi dimensional arrays. Arrays and loops. Sorting data in arrays.

## Theory

Arrays are variables that can hold multiple values at one time. They have a specified length and have addresses known as indexes for data retrieval starting from zero.

```
int a[5]={9,4,7,2,6};
```



Stdlib.h is used for rand function which generates random numbers within a given range.

## Example

Below are three tables showing one dimensional character, integer and float arrays. Each table shows three different methods of declaring and initializing an array.

ONE DIMENSIONAL CHARACTER ARRAY			
	Method 1 (Declaration and initialization)	Method 2 (Declaration and initialization)	Method 3 (Separate declaration and initialization)
char	<code>char a[5]={'a','b','c','d','e'};</code>	<code>char a [5]="abcde";</code>	<code>char a [5];</code> <code>a[0]='a';</code> <code>a[1]='b';</code> <code>a[2]='c';</code> <code>a[3]='d';</code> <code>a[4]='e';</code>

ONE DIMENSIONAL INTEGER ARRAY			
	Method 1 (Declaration and Initialization)	Method 2 (Separate declaration and initialization)	Method 3 (Separate declaration and initialization)
int	<code>int a[5]={1,2,3,4,5};</code>	<code>int a[5];</code> <code>a[0]=1;</code> <code>a[1]=2;</code> <code>a[2]=3;</code> <code>a[3]=4;</code> <code>a[4]=5;</code>	<code>int a[5];</code>  <code>for(int a1=0;a1&lt;=4;a1++)</code>  <code>printf("\na[%d]=%-3d",a1,a[a1]=a1+1);</code>

ONE DIMENSIONAL FLOAT ARRAY			
	Method 1 (Declaration and initialization)	Method 2 (Separate declaration and initialization)	Method 3 (Separate declaration and initialization)
float	<code>float a[5]={1.1,1.2,1.3,1.4,1.5};</code>	<code>float a[5];</code> <code>a[0]=1.1;</code> <code>a[1]=1.2;</code> <code>a[2]=1.3;</code> <code>a[3]=1.4;</code> <code>a[4]=1.5;</code>	<code>float a[5];</code>  <code>for(int a1=1;a1&lt;=5;a1++)</code>  <code>printf("\na[%d]=%2.2f",a1,a[a1]=1+(a1/10.0));</code>

The picture below shows how a two dimensional array may look like.

aa				
	0	1	2	3
0	0	5	10	15
1	1	6	11	16
2	2	7	12	17
3	3	8	13	18
4	4	9	14	19

Table below shows three different methods of declaring and initializing a two dimensional integer array.

TWO DIMENSIONAL INTEGER ARRAY			
	Method 1 (Declaration and initialization)	Method 2 (Separate declaration and initialization)	Method 3 (Separate declaration and initialization)
Int	<pre>int aa[4][5]={     {0,1,2,3,4},     {5,6,7,8,9},     {10,11,12,13,14},     {15,16,17,18,19} };</pre>	<pre>int aa[4][5];  aa[0][0]=1; aa[0][1]=2; aa[0][2]=3; aa[0][3]=4; aa[0][4]=5;  aa[1][0]=6; aa[1][1]=7; aa[1][2]=8; aa[1][3]=9; aa[1][4]=10;  aa[2][0]=11; aa[2][1]=12; aa[2][2]=13; aa[2][3]=14; aa[2][4]=15;  aa[3][0]=16; aa[3][1]=17; aa[3][2]=18; aa[3][3]=19; aa[3][4]=20;</pre>	<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int aa[4][5];      for(int a=0;a&lt;4;a++)     {         for(int b=0;b&lt;5;b++)         {             printf("%d\t",aa[a][b]==((a*10)+b));         }         printf("\n");     }     printf("");      getch(); }</pre>

This program shows a two dimensional character array namely aa, of fixed length (5 rows and 15 columns) or say 5 single dimensional arrays, each of length 15, initialized in one of the several ways shown above for integer arrays.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     int b;     char aa[5][15]={         {"Engineering"},         {"Department"},         {"Iqra"},         {"University"},         {"Karachi"}     };      for(int a=0;a&lt;=4;a++)     {         b=0;         while(aa[a][b]!=0)         {             printf("%c",aa[a][b]);             b++;         }         printf("\n");     }      getch(); }</pre>	<p>Write the output for the program on left</p>

This program shows a three dimensional integer array namely aaa, of such length that has 4 two dimensional arrays and each two dimensional array has 3 rows and 2 columns initialized in one of the several ways shown above for integer arrays this function prints the element on address 2,1,0.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int aaa[4][3][2]={     {{1,2},{3,4},{5,6}},     {{7,8},{9,10},{11,12}},     {{13,14},{15,16},{17,18}},     {{19,20},{21,22},{23,24}}, }; printf("%d",aaa[2][1][0]); getch(); }</pre>	<p>Write the output for the program on left</p>

## ALGORITHMS

Arrays have many properties applicable on them. Three such properties are.

- Searching an array,
- Entering data in an array,
- Sorting an array.

Hence we apply these on array using algorithms which may be categorized as follows.

- Searching
  - By address or location
  - By Value
- Input
  - FIFO (First in First out)
  - FILO or LIFO
- Sorting
  - Ascending / Descending

## Exercise

This program prompts the user for a number from the given data searches and returns its location.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int a[5]={8,6,3,7,2},vl,a1,a2=0; for(a1=0;a1&lt;=4;a1++) printf("%d ",a[a1]); printf("\nFrom the above enter one value to search : "); scanf("%d",&amp;vl); while(a[a2]!=vl) { a2++; } printf("Location of %d is %d",vl,a2+1); getch(); }</pre>	<p>Write the output for the program on left</p>

This program accepts data from the user in a stack or First In Last Out (FILO) method such that every time the user enters a number it is stored at zero location and all the other numbers are shifted to next positions.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int aa,arr[5]={0,0,0,0,0}; for(int a1=0;a1&lt;5;a1++) { for(int a2=5;a2&gt;=0;a2--) { arr[a2]=arr[a2-1]; } printf("Enter Value for FILO\n"); scanf("%d",&amp;arr[0]); for(int a3=0;a3&lt;5;a3++) printf("\n%d",arr[a3]); getch(); clrscr(); } for(int d=0;d&lt;5;d++) printf("\n%d",arr[d]); getch(); }</pre>	<p>Write the output for the program on left</p>

This program sorts the numbers in side the array in ascending order.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); int tmp,arr[5]={23,16,97,33,42}; for(int a=0;a&lt;5;a++) { for(int b=0;b&lt;4;b++) { if(arr[b]&gt;arr[b+1]) { tmp=arr[b]; arr[b]=arr[b+1]; arr[b+1]=tmp; } } } for(int c=0;c&lt;5;c++) printf("\n%d",arr[c]); getch(); }</pre>	<p>Write the output for the program on left</p>

This program randomly generates 10 values between 1 and 100 to be placed in integer array.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; #include&lt;stdlib.h&gt; void main(void) { clrscr(); int a[10],b; for(b=0;b&lt;10;b++) { printf("\n%d",a[b]=(rand()%100+1)); } getch(); }</pre>	<p>Write the output for the program on left</p>

## Assignment

Program the following.

- Prompt the values from user for a single dimensional integer array of length 5 and accept them in First In First Out from.
- Consider a one dimensional character array of length 5 and holding data a, e, i, o and u. Sort them in ascending order.
- Randomly place values in a 2 dimensional integer array.
- Prompt values from user for a one dimensional integer array of length 10 in FILO order. Arrange this array in ascending and descending order in other 2 arrays.
- In the resume of experiment number 11 use arrays where necessary, e.g. 1 dimensional character array for name, fathers name, address, University etc fields.

# Experiment 14

## Objective

Studying Structures, different ways to declare define and initialize structures.

## Theory

Structures are variables which can accept values of different data types (e.g. char, int, float, etc.) or as defined by the user.

## Example

The structure iqra of this program has been defined and declared at a time. While its initialized in another statement.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     struct iqra     {         char chr;         int nmb;     }iq1,iq2;      iq1.chr='a';     iq1.nmb=1;      iq2.chr='b';     iq2.nmb=2;      printf("\niq1.chr = %c \t iq1.nmb = %d",iq1.chr,iq1.nmb);     printf("\niq2.chr = %c \t iq2.nmb = %d",iq2.chr,iq2.nmb);     getch(); }</pre>	<pre>iq1.chr = a      iq1.nmb = 1 iq1.chr = b      iq1.nmb = 2</pre>

The structure of this program has been defined, declared and initialized in three different steps.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) {     clrscr();     struct iqra     {         char chr;         int nmb;     };      struct iqra iq1;     struct iqra iq2;      iq1.chr='a';     iq1.nmb=1;      iq2.chr='b';     iq2.nmb=2;      printf("\niq1.chr = %c \t iq1.nmb = %d",iq1.chr,iq1.nmb);     printf("\niq2.chr = %c \t iq2.nmb = %d",iq2.chr,iq2.nmb);     getch(); }</pre>	<pre>iq1.chr = a      iq1.nmb = 1 iq1.chr = b      iq1.nmb = 2</pre>

The structure in this program has first been defined. But declared and initialized in another statement together.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); struct iqra { char chr; int nmb; };  struct iqra iq1={'a',1}; struct iqra iq2={'b',2};  printf("\n iq1.chr = %c \t iq1.nmb = %d",iq1.chr,iq1.nmb); printf("\n iq2.chr = %c \t iq2.nmb = %d",iq2.chr,iq2.nmb); getch(); }</pre>	<pre>iq1.chr = a      iq1.nmb = 1 iq1.chr = b      iq1.nmb = 2</pre>

This program has structure with arrays.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;conio.h&gt; void main(void) { clrscr(); struct iqra { char name[25]; int nmb; };  struct iqra iq1={"Engineering",1}; struct iqra iq2={"Media Science",2}; struct iqra iq3={"Management",3}; struct iqra iq4={"Computer Science",4}; struct iqra iq5={"Fashion Design",5};  printf("\nDepartment = %s \t\t Department Code = %d",iq1.name,iq1.nmb); printf("\nDepartment = %s \t\t Department Code = %d",iq2.name,iq2.nmb); printf("\nDepartment = %s \t\t Department Code = %d",iq3.name,iq3.nmb); printf("\nDepartment = %s \t\t Department Code = %d",iq4.name,iq4.nmb); printf("\nDepartment = %s \t\t Department Code = %d",iq5.name,iq5.nmb);  getch(); }</pre>	<pre>Department = Engineering      Department Code = 1 Department = Media Science    Department Code = 2 Department = Management       Department Code = 3 Department = Computer Science Department Code = 4 Department = Fashion Design    Department Code = 5</pre>

## Assignment

Program the following.

- Make the resume of experiment number 12 with structures.

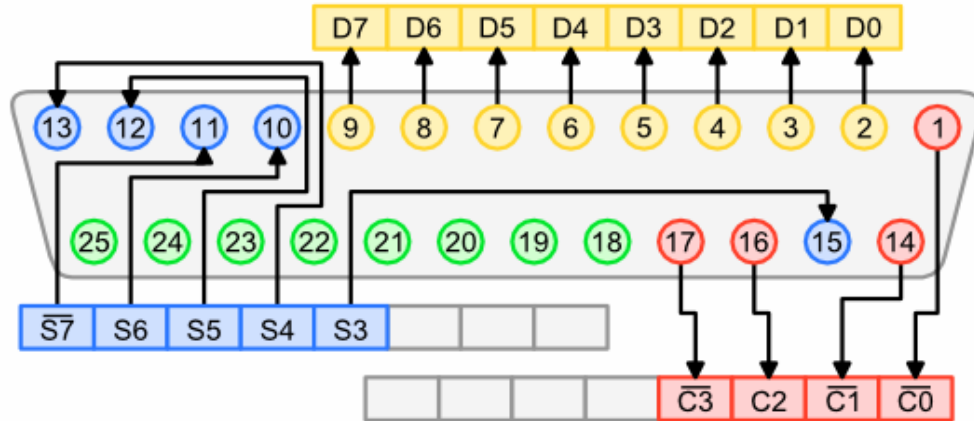
# Experiment 15

## Objective

Parallel port programming, hardware (interrupts).

## Theory

The function of outportb is used to communicate with parallel port in C language.



Capitals	Total Pins	Port address	Parallel port pin number
D = Data Register	8 pins. (D0,D1,D2,D3,D4,D5,D6 and D7)	0x378	2,3,4,5,6,7,8 and 9
S = Status Register	5 pins. (S3,S4,S5 and S6)	0x379	10,11,12,13 and 15
C = Control Register	4 pins. (C0,C1,C2 and C3)	0x37a	1,14,16 and 17

Pin No (D-Type 25)	SPP Signal	Direction In/out	Register.bit
1*	nStrobe	In/Out	Control.0
2	Data 0	In/Out	Data.0
3	Data 1	In/Out	Data.1
4	Data 2	In/Out	Data.2
5	Data 3	In/Out	Data.3
6	Data 4	In/Out	Data.4
7	Data 5	In/Out	Data.5
8	Data 6	In/Out	Data.6
9	Data 7	In/Out	Data.7
10	nAck	In	Status.6
11*	Busy	In	Status.7
12	Paper-Out / Paper-End	In	Status.5
13	Select	In	Status.4
14*	nAuto-Linefeed	In/Out	Control.1
15	nError / nFault	In	Status.3
16	nInitialize	In/Out	Control.2
17*	nSelect-Printer/ nSelect-In	In/Out	Control.3
18 - 25	Ground	Gnd	

The syntax of output function is given below,

`outportb(address of port on parallel port,data);`

or

`outportb(0x378,0x01);`

where 0x378 is the address of data port on a parallel port and 0x01 is the data/value passed to that port.

0x01      means      0000 0001

0x04      means      0000 0100

0x55      means      0101 0101

0x0A      means      0000 1010

### Example

The structure of this program has been defined and declared at a time. While its initialized in another statement.

Program	Output
<pre>#include&lt;stdio.h&gt; #include&lt;dos.h&gt; void main(void) {     outportb(0x378,0x01); }</pre>	

### Assignment

Program the following.

- Using graphical buttons change the status (On/Off) of any user selected LED on Project Board.

### Note

- Parallel ports are not accessible on Windows XP systems. Normally Windows 98 is used for parallel programming with minimum 486 KHz.