

INTRODUCTION TO PROGRAMMING

What is a computer program?

The set of instructions in a proper sequence given to computer to perform certain task is called a computer program. It is written in any computer language.

Who is programmer?

The person who writes computer program is called programmer.

What is computer language?

The set of rules, symbols, characters and operators used to write a computer program is called programming language.

How many types of computer languages are there?

There are mainly two types of programming languages.

- i- High level programming languages
- ii- Low level programming languages

What are high level programming languages?

The computer languages that are close to human language or English language are categories as high level languages as, **GWBASIC, C, C++, PASCAL** etc.

What are low level programming languages?

The computer languages that are close to machine language are categories as high level languages as, Machine language and Assembly language.

What is source code?

The program written by a programmer in a high level language is called source code. Source code is not directly understandable by a computer. To make the source code understandable by the computer it is first converted into machine code by compiler or interpreter.

What is an object code?

When the source code is converted into machine code by a compiler then this machine code is called object code.

What is a Variable?

It is a named place in memory of computer who's value can be changed during the program execution. As

A=34

| |
|----|
| 34 |
|----|

A

Here A is a variable name and 34 is its value.

What are different types of variables used in BASIC?

There are mainly two types of variables used in BASIC

- i- Numeric Variables
- ii- String Variables

What are numeric variables give examples?

The variables that only stores numbers are numeric variables. As

RollNo=34 AcctNo=2345 legnth=45.34 eggs%=12 temp=-22

If the symbol % is used after a variable then it is an **integer** variable.

What is a string?

The sequence of characters is called string. As

"Arslan" "Ansa" "islamabad123" "786"

What are string variables give examples?

The variables that contain string value are string variables. There is always \$ sign at the end of the name of a string variable.

As

Capital\$="Islamabad" city\$="Gujranwala" address\$="A-141 Model town Gujranwala"

What are the rules for naming a variable in GW-BASIC?

- i- Variable name may contain alphabets (A-Z) and number (0-9) only.
- ii- First character must be a letter.
- iii- Variable name can be 40 characters long. No blank spaces are allowed.
- iv- There should be \$ sign at the end of the name of string variable.
- v- The integer variable should have % sign at the end off its name.

For example:

IDcardNo, RollNo, NoOfStudents%, FromLHR2GRW, Name\$

Are the valid variable names.

What is a constant?

Such a value that is not changed during the program execution.

What are the types of constants?

Mainly there are two types of constants in BASIC.

- i- Numeric constants
- ii- String constants.

What are numeric constants?

Numeric constants are of two types

i- Integer

ii- Real or Float

Integer constants are ordinary positive or negative integers as **35, 567, -75, -103**

Real or Float constants are positive or negative numbers that contains decimal point in it as **232.6, -2.0, 33.6, 56.0**

What are string constants?

String constants contain the string value that is never changed during program execution. As

"USA", "1234567890", "A.Q.Khan"

What is syntax error?

It is the error which occurred due to the use of any misspelled command or any grammatical rule violation of the language.

As **10 Prnt "Pakistan Zindabad"**

Or as **20 A+B=C**

How syntax errors can be detected and removed?

Syntax errors can only be detected by the compiler or interpreter at the time of compilation or interpretation. The list of errors with error codes and messages is given by the compiler after compilation. The expert programmer can identify the error by knowing the error code or by reading the error message. Programmer then does the correction.

What is logical error?

These errors occurred due to the use of wrong logic in a program. As if we want to perform subtraction **B-A** but mistakenly we typed **C=B+A** this will results in logical error. Logical errors cannot be detected by computer, compiler or interpreter.

How logical errors can be detected and removed?

Logical errors can only be detected by the programmer by observing the wrong results produced by the program. Then programmer examines the program carefully, trace out the fault and remove it.

What is an operator?

Operator is a symbol used for its operands to perform an operation on it.

How many types' operators we use in BASIC?

There are five types of operators we use in BASIC. These are

Brackets, Arithmetic operators, Relational operators, Logical operators. Assignment operator

What are arithmetic operators?

The arithmetic operators are used to perform different operations on their operands.

List the arithmetic operators.

^, -(negation), *, /, \, mod, +, -

| Operation Name | Symbol Used | Algebraic Expression | BASIC Expression |
|----------------------|-------------|----------------------|------------------|
| Exponentiation | ^ | 2^4 | 2^4 |
| Negation | - | -4 | -4 |
| Multiplication | * | 3×5 | $3 * 5$ |
| Division | / | $6 \div 3$ | $6 / 3$ |
| Integral division | \ | $7 \setminus 4$ | $7 \setminus 4$ |
| Modulus or Remainder | Mod | $7 \bmod 4$ | $7 \bmod 4$ |
| Addition | + | $4 + 8$ | $4 + 8$ |
| Subtraction | - | $5 - 3$ | $5 - 3$ |

What are relational operators?

Relational operators are used to compare two values. There are six relational operators in BASIC.

List the relational operators.

<, >, <=, >=, <>, =
If A=56 B=60 C=56 then

| Operation Name | Symbol Used | BASIC Expression | Evaluates to |
|--------------------------|-------------|------------------|-----------------|
| Equal to (comparison) | = | $A=C$ | True (Non zero) |
| Less than | < | $B < A$ | False (Zero) |
| Greater than | > | $A > C$ | False (Zero) |
| Less than or Equal to | <= | $A <= B$ | True (Non zero) |
| Greater than or Equal to | >= | $B >= A$ | True (Non zero) |
| Not Equal to | <> | $A <> B$ | True (Non zero) |

What are logical operators?

There are three logical operators **AND**, **OR** and **NOT**. These are used to combine simple relational expressions and to convert them into complex ones.

Construct a table that shows the operation of AND, OR and NOT logical operators.

| AND | | | OR | | | NOT | |
|-----|---|---------|----|---|--------|-----|-------|
| X | Y | X AND Y | X | Y | X OR Y | X | NOT X |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |

What is an assignment operator?

The symbol for this operator is =. It is used to assign some value to a variable. Variable must be written on left hand side of assignment operator and the value which is to be assigned is written on right hand side of the assignment operator. As

Pi=3.14 **Height=45.22** **Name\$="Javeria"** **Eggs%=12**

What is an Expression?

Expression is the combination of variables constants and operators. These are evaluated to some value. As

A= 2*B+C **d<(6s-45)** **(B<>D) OR (F=G) AND (F<56)** are different expressions

What is an arithmetic expression?

Such an expression in which arithmetic operators are used is called arithmetic expression. Arithmetic expression always evaluates to some numeric value. As **A=2*B+C** **Area=Length * Width** are some examples of arithmetic expressions.

What is a relational expression?

Such an expression in which relational operators are used is called relational expression. The result of relational expression is always True (non zero) or False (zero). As **B<>D, F=G, F<56** are some relational expressions.

What is a logical expression?

Such an expression in which logical operators are used is called logical expression. The result of logical expression is always evaluates to True (non zero) or False (zero). As **(B<>D) OR (F=G) AND (F<56)** is a logical expression.

What is a concatenation operator and what is its use?

When the symbol + is used between two string variables or strings in an expression it is used as a concatenation operator. It simply joins the two strings or the values of two string variables into a large string. As if $A\$ = \text{"Muhammad"}$ $B\$ = \text{"Ali"}$ then in the expression $Name\$ = A\$ + B\$$ the variable $Name\$$ will be assigned the string value **MuhammadAli**. Similarly the two strings **"Cindy"** and **"Crawford"** when concatenated as **"Cindy" + "Crawford"** will evaluate to new string **CindyCrawford**.

What do you meant by type conversion or type casting?

It is the process in which the real or float value is converted (round off) into integer value and then assigned to a integer value. As if $Eggs\% = 14.57$ then $Eggs$ is an integer variable and it will store the value **15**.

OR

Integer value is converted into real or float value and then assigned to integer variable. As if $Length = 45$ then $Length$ is a real or float variable and it will store the value **45.0**

What do know about operator precedence?

If there are many different types of operators in an expression then operator precedence determines the order in which the operators perform their operation on the operands. In the given table the precedence of operators in BASIC is given from highest to lowest.

| Operator | Precedence |
|-----------------------|------------------------|
| () | Highest ↓ Lowest |
| ^ | |
| - (Negation) | |
| *, / | |
| \ | |
| MOD | |
| +, - | |
| =, <, >, <=, >=, <> | |
| NOT | |
| AND | |
| OR | |
| = assignment operator | |

How the following expression is evaluated?

If $x=4$ $y=2$ then $z=2*x^y+3<x*y \text{ AND } 44/(2+x-15)-2>x+y \text{ OR } (\text{NOT}(x*y>y))$ will evaluates to

Step 1: The innermost bracket will be solved first, so $(x*y>y)$ will be solved.

$(4*2>2)$

$(8>2)$ operator * has higher precedence than > so it is solved first

(TRUE)

Step 2: The expression for second step will be

$z=2*4^2+3<4*2 \text{ AND } 44/(2+4-15)-2>4+2 \text{ OR } (\text{NOT}(\text{TRUE}))$

Now $(2+4-15)$ and $(\text{NOT}(\text{TRUE}))$ will be solved

$(6-15)$ as operators + and - have the same level of precedence but + coming first from left side so it is solved before -.

(-9)

$(\text{NOT}(\text{TRUE}))$

(FALSE) as NOT operator inverts the value.

Now the expression becomes

$z=2*4^2+3<4*2 \text{ AND } 44/(-9)-2>4+2 \text{ OR } (\text{FALSE})$

Step 3: Now ^ will be solved so the expression will become

$z=2*16+3<4*2 \text{ AND } 44/(-9)-2>4+2 \text{ OR } (\text{FALSE})$

Step 4: Now the operators * and / have higher precedence level than the other operators so they will be solved first. As * occurs before / from the left so it is solved before /. So the expression will become

$z=32+3<8 \text{ AND } (-4.888)-2>4+2 \text{ OR } (\text{FALSE})$

Step 5: Now the operators + and – have higher precedence level than the others operators so they will be solved first from left to right sequence. Hence the expression will become

z=35<8 AND (-6.888)>6 OR FALSE

Step 6: The operators < and > now have higher precedence than the other operators, now it's their turn to be solved first. Hence the expression will become

z=FALSE AND FALSE OR FALSE

Step 7: In last AND operator has higher precedence level than OR so it will be evaluated first.

z=FALSE OR FALSE

Step 8: Finally **z=FALSE**

Write few characteristics of BASIC language.

1. **BASIC** stands for Beginner's All Purpose Symbolic Instruction Code.
2. It is simple to understand.
3. It is suitable for both mathematical and business problems.
4. It is easy to learn for the beginners.
5. It can run almost every computer from microcomputer to mainframe.
6. In it debugging and modification of programs is very easy.

What is the purpose of CLS command? Write its syntax and also explain it with example.

CLS

Purpose:

This command is used to clear the screen.

Syntax:

CLS

Example:

CLS

Explanation:

After typing CLS when we press enter the screen will be cleared.

What is the purpose of NEW command? Write its syntax and also explain it with example.

NEW

Purpose:

This command is used to close all open files and to clear the RAM.

Syntax:

NEW

Example:

NEW

Explanation:

After typing NEW we will press enter button. As soon as we press enter button the files which are loaded in the memory (RAM) will be closed.

What is the purpose of LOAD command? Write its syntax and also explain it with example.

LOAD

Purpose:

By using this command we can load a file from disk to memory (RAM).

Syntax:

LOAD filename[,r]

Example1:

LOAD qpc123.bas

Example2:

LOAD qpc123.bas,r

Example3:

LOAD d:\college\GC\qpc123.bas,r

Explanation:

In example1 the file qpc123.bas will be loaded from disk from current directory into RAM.

In example2 the file qpc123.bas will be loaded from disk from current directory into RAM and then run.

In example3 the file qpc123.bas will be loaded from the folder GC which is in the folder college which is on drive D and then run.

What is the purpose of SAVE command? Write its syntax and also explain it with example.

SAVE

Purpose:

By using this command we can save a file on disk for future use.

Syntax:

```
SAVE filename[,a]  
SAVE filename[,p]
```

Example1:

```
SAVE qpc123.bas
```

Example2:

```
SAVE qpc123.bas,a
```

Example3:

```
SAVE qpc123.bas,p
```

Explanation:

In example1 the file qpc123.bas will be saved to the current directory. If no option of a or p is given then the file will be saved in compressed binary format.

In example2 the file qpc123.bas will be saved to the current directory in ASCII format.

In example3 the file qpc123.bas will be saved to the current directory in an encoded binary (protected) format. In this format we can not see or change the file but we can only execute it.

What is the purpose of RUN command? Write its syntax and also explain it with example.

RUN

Purpose:

This command is used to run the program which is in the memory, if the program is not in memory then this command can also load it and then run it.

Syntax:

```
RUN filename[,r]  
RUN [line number][,r]
```

Example1:

```
RUN
```

Example2:

```
RUN qpc123.bas
```

Example3:

```
RUN qpc123.bas,r
```

Example4:

```
RUN 30
```

Example5:

```
RUN 30,r
```

Explanation:

In example1 the file which is already loaded in the memory will be executed from beginning to the end of program.

In example2 all opened files will be closed and the memory will be cleared before the file qpc123.bas will be loaded and executed.

In example3 all data files will be kept opened but other files will be closed before the file qpc123.bas will be loaded and executed.

In example4 the file which is currently in memory will be executed from line number 30 to the end.

In example5 all data files will be kept opened and the program will be executed from line number 30 to the end.

What is the purpose of SYSTEM command? Write its syntax and also explain it with example.

SYSTEM

Purpose:

This command is used to exit from the GW-BASIC and return to WINDOWS environment.

Syntax:

```
SYSTEM
```

Example:

```
SYSTEM
```

Explanation:

After typing SYSTEM we press the enter button then we go back to operating system (WINDOWS) environment.

What is the purpose of END command? Write its syntax and also explain it with example.

END

Purpose:

This is used to terminate the program execution.

Syntax:

END

Example:

END

Explanation:

This statement is used in the program where the termination of the program is required.

What is the purpose of LET statement? Write its syntax and also explain it with example.

LET

Purpose:

It is used to assign a value to a variable.

Syntax:

[LET] variable = expression/constant

Example1:

LET A=100

Example2:

LET A=D+B/C

Explanation:

In example1 the value 100 is assigned to variable A

In example2 the expression on right hand side of equality sign will be evaluated and then assigned to the variable A.

What is the purpose of LIST command? Write its syntax and also explain it with example.

LIST

Purpose:

This command is used to display the loaded program on the screen partially or completely.

Syntax:

LIST [starting line number][-ending line number][,filename]

LIST [starting line number-][,filename]

Example1:

LIST

Example2:

LIST 10

Example3:

LIST 30-

Example4:

LIST 30-70

Example5:

LIST -80

Example6:

LIST 30-50,qpc123.bas

Example7:

LIST 60-,qpc123.bas

Explanation:

In example1 the whole program which is currently loaded into the memory from beginning to the end will be displayed.

In example2 only the line number 20 will be displayed of the program which is currently loaded in the memory.

In example3 the line number from 30 to the end will be displayed of the program which is currently loaded in the memory.

In example4 the line number from 30 to 70 will be displayed of the program which is currently loaded in the memory.

In example5 the line number from beginning to 80 will be displayed of the program which is currently loaded in the memory.

In example6 the line number from 30 to 50 will be displayed of the file qpc123.bas from the current directory.

In example7 the line number from 60 to end will be displayed of the file qpc123.bas from the current directory.

What is the purpose of PRINT command? Write its syntax and also explain it with example.

PRINT

Purpose:

It is used to display text and numbers on the screen.

Syntax:

```
PRINT [list of expressions][;]
? [list of expressions][;]
```

Example1:

```
PRINT
```

Example2:

```
PRINT A,B,C
```

Example3:

```
PRINT A;Name$
```

Example4:

```
PRINT "Pakistan Zindabad"
```

Example5:

```
? "How R U"
```

Explanation:

In example1 only the blank line will be printed.

In example2 the values of variables A,B and C will be printed on the same line at the beginning of each zone of 14 spaces.

In example3 first the value of variable A will be printed and just after it the value of string variable Name\$ will be printed on the same line.

In example4 the text Pakistan Zindabad will be printed on a line.

In example5 ? is used instead of PRINT. ? will work same as PRINT. The text How R U will be printed on a line.

What is the purpose of LPRINT statement? Write its syntax and also explain it with example.

LPRINT**Purpose:**

This command is used to print data from the printer.

Syntax:

```
LPRINT [list of expressions][;]
```

Example1:

```
LPRINT
```

Example2:

```
LPRINT A,B,C
```

Example3:

```
LPRINT A;Name$
```

Example4:

```
LPRINT "Pakistan Zindabad"
```

Explanation:

In example1 only the blank line will be printed.

In example2 the values of variables A,B and C will be printed on the same line at the beginning of each zone of 14 spaces.

In example3 first the value of variable A will be printed and just after it the value of string variable Name\$ will be printed on the same line.

In example4 the text Pakistan Zindabad will be printed on a line.

Explain the usage of two separators , and ; in the PRINT statement.

Comma (,):

If comma is used to separate the expressions in the PRINT statement then it causes the second expression to be displayed at start of next zone. Each zone is of 14 spaces.

Semicolon (;):

If semicolon is used to separate the expressions in the PRINT statement then it causes the second expression to be printed just after the first expression.

Spaces:

Any spaces or tabs used in PRINT statement are not effective.

What is the purpose of INPUT statement? Write its syntax and also explain it with example.

INPUT**Purpose:**

This statement is used to input data from the user during the program execution.

Syntax:

INPUT [any string;] comma separated list of variables

INPUT [any string;] comma separated list of variables

Example1:

INPUT A,B

Example2:

INPUT "Enter two numbers ",A,B

Example3:

INPUT "Enter two numbers ";A,B

Explanation:

In example1 two values separated by comma will be provided like 20,30

In example2 we will be shown a message "Enter two numbers " then we have to provide two number separated by comma.

In example3 a question mark ? will be shown after the message and then we have to provide two numbers separated by comma.

What is the purpose of READ statement? Write its syntax and also explain it with example.

READ**Purpose:**

This statement reads value from the DATA statement somewhere in the same program and assigns them to corresponding variables.

Syntax:

READ comma separated list of variables

Example:

READ A,B,C\$

Explanation:

In the above example the values of variables A,B and C\$ will be taken from DATA statement in the program. Remember that READ statement is always used in conjunction with DATA statement.

What is the purpose of DATA statement? Write its syntax and also explain it with example.

DATA**Purpose:**

This statement is used to store the numeric and string constants that are accessed by a READ statement placed somewhere in the program.

Syntax:

DATA comma separated list of constants

Example:

```
10 READ length, width
20 PRINT "area =",length*width
30 DATA 3,5
40 END
```

Explanation:

In the above example when the READ statement will be executed it will search a DATA statement in the program from top to bottom. As soon as the first DATA statement will be encountered the variable "length" will take its value from the first element of the list of constants provided in the DATA statement and the variable "width" will take its value from the second element in the list. Remember if all the constants are used in a DATA statement by some READ statements then that DATA statement is no more used by other READ statements without the use of RESTORE statement.

What is the purpose of RESTORE statement? Write its syntax and also explain it with example.

RESTORE**Purpose:**

This statement causes the DATA statement to be reused if it has already been used by the READ statement.

Syntax:

RESTORE [line number]

Example:

```
10 READ A,B,C,D
20 PRINT "the sum is =",A+B+C+D
30 DATA 10,20
40 DATA 30,40
50 RESTORE
60 READ w,x,y,z
```

```
70 PRINT "the  
80 END
```

Explanation:

In the above example the first READ statement on line 10 will take the values 10 and 20 for variables A and B from first DATA statement but still more variables are there to be filled so the second DATA statement will be used for the same READ statement and the values 30, 40 will be taken for variables C and D. The DATA statements on line 30 and 40 have made bond with READ statement on line 10. The DATA statements on line 30 and 40 can be used by READ statement on line 60 if their bond with READ statement on line 10 will be broken with RESTORE statement on line 50. Now the READ statement on line 60 will read the values of variables w,x,y and z as 10,20,30 and 40 from the DATA statements on line 30 and 40.

What is the purpose of IF-THEN statement? Write its syntax and also explain it with example.

IF-THEN**Purpose:**

It is decision making statement. We can execute some statements on the basis of the result of some condition.

Syntax:

IF condition/expression THEN statement/line number

Example1:

```
IF a<200 THEN PRINT "Hello"
```

Example2:

```
IF a<200 THEN GOTO 30
```

Example3:

```
IF a<200 THEN 30
```

Explanation:

In example1 if the value of variable a will be less than 200 then Hello will be printed.

In example 2 if the value of variable a will be less than 200 then control of program will jump to line number 30.

In example 3 if the value of variable a will be less than 200 then control of program will jump to line number 30.

What is the purpose of IF-THEN-ELSE statement? Write its syntax and also explain it with example.

IF-THEN-ELSE**Purpose:**

If we have two different courses of action which are to be followed on either result of the condition then we make use of this statement.

Syntax:

IF condition/expression THEN statement/line number ELSE statement/line number

Example1:

```
IF a<200 THEN PRINT "Lahore" ELSE PRINT "Karachi"
```

Example2:

```
IF a<200 THEN 30 ELSE 90
```

Explanation:

In example1 if the value of variable a is less than 200 then Lahore will be printed otherwise Karachi will be printed.

In example2 if the value of variable a is less than 200 then control of the program will jump to line number 30 otherwise jump to line number 90.