INTRODUCTION TO COMPUTER PROGRAMMING (BASIC)

Chapter · October 2016

4 authors:

Usman Opeyemi Lateef
Tai Solarin University of Education
36 PUBLICATIONS   **67** CITATIONS

SEE PROFILE

Akeem Owoade
Tai Solarin University of Education
7 PUBLICATIONS   **4** CITATIONS

SEE PROFILE

Abimbola B.L.
Tai Solarin University of Education
1 PUBLICATION   **3** CITATIONS

SEE PROFILE

Gbenga Ogunsanwo
Tai Solarin University of Education
11 PUBLICATIONS   **15** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project   Fault-tolerance to Cascaded Link Failures of Video Traffic on Attacked Wireless Networks   View project

Project   Global socio-economic consequences of the Covid-19 pandemic   View project

CHAPTER 6
USMAN O.L., OWOADE A.A., ABIMBOLA B.L., & OGUNSANWO G.O.
usmanol@tasued.edu.ng, owoadeaa@tasued.edu.ng, abimbolabl@tasued.edu.ng,
ogunsanwogo@tasued.edu.ng
Computer and Information Sciences Department, TASUED

INTRODUCTION TO COMPUTER PROGRAMMING (BASIC)
DEFINITION OF CONCEPTS
PROGRAM, PROGRAMMER, AND PROGRAMMING LANGUAGE

A program is a set of instructions written in a language (such as BASIC) understandable by the computer to perform a particular function on the computer. A well written program could be parceled well to form an application package customized for solving specific type of problem on the computer system.

A computer programmer is computer scientist (a professional) skilled in using constructs of programming languages to develop executable and acceptable computer programs. A software developer is a programmer. Programmers often work hand in hand with system analysts on large projects.

Programming languages are artificial notational languages created or developed to be used in preparing coded instructions on the computer for later execution by the computer. They are usually composed of series of usage rules (syntax) that determine the meaning (semantics) of expressions written in the language. Each programming language comes handy with its own translator i.e interpreter or compiler as the case may be.

Programming

Programming is the art of developing computer programs with the aid of selected programming language by a computer programmer. It is a special skill whose quality is tested by the quality of the resulting program or software. In programming, programming stages must be properly followed, i.e from problem definition to maintenance and review

BASIC PROGRAMMING: NATURE AND CHARACTERISTICS

BASIC is an acronym for beginners' all-purpose symbolic instruction code.BASIC is the name of a high level programming language developed at Dartmouth College, New Hampshire USA under the auspices of professors John G Kemeny and Thomas E. Kutz during their academic years- 1963-64. The language was developed. To teach beginners the basic construct s of programming theory and as much, one of the easiest programming languages to learn.

As a high level programming language program code written in written in BASIC must be translated to its equivalence in machine code before it can be executed on the computer. A BASIC interpreter (i.e. translator software) is needed for this purpose. We call the program source code before it translated by the interpreter while the translated version, ready for execution, is called the object code. However, interpreter is not the only translator used in programming. Compilers are used by several other high-level programming languages such as C++, Pascal, etc while assemblers are used by assembly languages. Java has both interpreter and complier

Translates the sources code line by line and statement by statement

Does not generates an intermediates object code from the source code and

Translates and executes the sources code simultaneously

Merits of BASIC Programming Language

BASIC is the simplest programming language

BASIC is friendly, easy to teach and to learn compared to other HLL languages

It is flexible and easy to code or modify existing code

It has simplified grammar (syntax) and relatively fewer number of statements

It has a multipurpose language suitable for interactive environments

Its interpreter is small and portable

It can be programmed on a terminal

It is very common and readily available on many micro and mini computers

It is the most widely used time sharing language in U.S.A and Canada

It comes automatically with every new microcomputer

Demerits of BASIC Programming Language

It has slow execution pace, as translation is combined with execution.

Many versions of BASIC are unstructured because of statements such as GOTO.

Limited portability as different versions requires different interpreter for source code translation.

Different Versions of BASIC Programming Language

More than 50 versions ("*dialect*") of BASIC exist today as a result of variations in hardware systems. All these variations are expected to conform to the universally accepted standard set out by American National Standard Institute (ANSI). Some of these versions are: ANSI BASIC, VISUAL BASIC, GW BASIC, QUICK BASIC, TURBO BASIC, BASICA, MFBASIC, CASSETTE BASIC, APPLE BASIC etc.

BASIC Character Set

Alphabets Letters: A-Z; a-z

Digits Numbers: 0-9

Special characters: ?, (,), +, =, *, &, ", %, $, n, !, >, <, *f,* \, ;, :, @, ', etc

Structure of Basic Program

Each instruction in a BASIC program is written as a separate statement. A complete program is thus made up of sequence of basic statements. BASIC statements are executed in the order of appearance unless a deliberate jump to instruction (i.e. an instruction to transfer control) is given.

Below are some general rules applicable to several versions of BAIC with the exception of more recent versions like Visual BASIC

Every statement must appear on a separate line

A statement must not exceed one line in length

 Each statement must be preceded by a line number (*or statement number or label*) which must be an integer.

Two statements cannot have the same line number.

Blank spaces can be inserted wherever desired to improved readability of the program.

Each line number must be followed by a BASIC keywords which indicates the type of instruction that is to be carried out in the line.

Successive statements must have increasing statement numbers.

Although these rules are relaxed in some versions of BASIC, programs written with adherence to these rules remain valid.

Example

Developed a BASIC programs the computers the area of a rectangle whose length is 10cm and its width is 8cm.

Program

```
10 LET LENT=10
20 LET WID=8
30 LET AREA=LENT *WID
40 PRINT AREA, LENT, WID
50 END
```

Identifiers (or Names) in BASIC

There are two types of identifiers in BASIC:

BASIC Keyboard or reserved names- these are identifies that have predefined meanings e.g . LET, PRINT, END, etc

BASIC User-defined names-these are identifiers created by the programmers according to his needs and following Basic rules for creating such e.g. NAME$, SCORES%, "CATERORY A" etc.

Types of User-defined Names in BASIC

There are two types of user defined names or identifiers in BASIC, namely:

Variables and constants.

Variables in BASIC

A variable is a name or identifier that represents number or a string of characters whose value can change during or after the execution of a BASIC program.

There are two types of variable valid in BASIC, they are:

Numeric Variables

String Variables

Each of the following variables represents a numerical quantity:

A SCORE1   AGE% PRICE2# TOTCOST! K3   RMNUMX

The following variables represent non-numeric (i.e. string, also called alphanumeric) values each

A$ ADDRESS   AGE2$ COURSES$

TITLE$ X45$ DEPT$ REMARKS   RULE0$ NAMES. The rule is that every alphanumeric, that is string variable must end with the data-type symbol $. When a variable name has no $ symbol after it, it is taken to be a numeric variable. The type of numeric variable it is can further (optionally) be indicated by attaching % (for integers),! '(for single precision numeric variables) or # (for double precision numeric variables) to the right end side of the variable name.

Constants in BASIC

A constant is an identifier, a number, a string of characters whose value cannot change during or after the execution of a BASIC program.

The Two types of constants we have are:

Numeric constants e.g. 0, epilson, TOT etc

Alphanumeric or string constants e.g. "The bride's age is", "Final Score is" etc.

The rule is that a string constant must be quoted with double question marks.

Operations in BASIC

BASIC recognizes the following different types of operations in a BASIC program.

Arithmetic Operations

Arithmetic operators are used to carry out arithmetic operations in BASIC. These operators are executed according to their hierarchy or what is called precedence rule. Table 16.1 below shows these operators according to their hierarchy.

Table 6.1: Hierarchy of arithmetic Operators in BASIC

Hierarchy	Operation	Operators used	Examples
4	P – Parenthesis	,	Ans = a* (b-x)/2
3	E – Exponentiation	A	M = a + (b 4) Or M. = a + (bA4)
2	M – Multiplication	*	a*b=b*a
2	D – Division (Real)	/	7/3=2.5
2	Division (Integer)	\	7\3=2
1	A - Addition	+	a + b=b + a
1	S - Subtraction	-	9 – 6 =3

The hierarchy determines the sequence Basic follows in executing a group of arithmetic operators found in an arithmetic expression. The operation with the highest hierarchy is executed first and the

one with operators; this can be altered during execution by introducing parenthesis (i.e. a pair of brackets) in the appropriate place(s) in expression. The content of the bracket will be evaluated first. This overriding rule is applicable to all other arithmetic operators as well.

Multiplication and division come next to exponentiation in hierarchy with multiplication not necessarily preceding division.

Addition and subtraction comes last in the hierarchy of arithmetic operators with addition not necessarily preceding subtraction in execution.

As shown in the table above, multiplication and addition operators are commutative while others are not.

PEMDAS summarizes both the hierarchy of operators and the order followed in execution.

Example

Write a BASIC expression that will evaluate this mathematical expression.

$[(3(x + y)^2 + (4Z)^2)^{m/(n-3)}]/5$

A corresponding BASIC formula for the above algebraic expression is:

$(3 *(X + Y)$ ^2 $+ (4 *Z)$ ^ $(M I\{N – 3))$ 15

Relational Operations in BASIC

These involve the use of relational operators listed below (Table 16.2):

Table 6.2: Relational Operators in BASIC

Operator symbol	Operation performed
=	Equals to
>	Greater than
<	Less than
>=	Greater than or equals to
<=	Less than or equals to
< >	Not equals to

Please note the difference between the symbols used in mathematics and those used in BASIC for relational operation.

Logical Operations in BASIC

Logical operations in BASIC involve use of logical operators NOT. AND OR which must yield logical values TRUE (T) or FALSE (F). The use of operators discussed below.

NOT – this logical operator has the highest precedence or priority over others and affects only one operand or variable at a time. There could only be two possible combinations and outcomes as shown in the truth table below:

INPUT OUTPUT   FALSE (F)   TRUE (T)
 TRUE (T)   FALSE (F)

NOT operator is an inverter, that is, it gives the reverse of the input upon which it is applied.

AND – this is another logical operator that affects two variables at a time thus providing four possible combinations as shown below.

Table 6.3: Truth Table for AND Operator

Input A	AND	Input B	OUTPUT
T	X	T	T
T	X	F	F
T	X	T	F
T	X	F	F

As shown in the table above, the result is TRUE only when both input variables are TRUE, else it is FALSE.

OR – this logical operator with the lowest precedence affects two operators at a time giving rise to four possible combinations as shown in the table below.

Table 6.4: Truth Table for OR Operator

Input A	OR	Input B	OUTPUT
T	+	T	T
T	+	F	T
F	+	T	T
F	+	F	F

Thus OR operators yields FALSE output only if both input variables are FALSE else it yields TRUE

Examples

Simplify the followings:

NOT T OR NOT F AND T OR T

T OR T AND (F OR T) AND NOT F

NOT T AND NOT F AND NOT AND T OR F

T OR T AND NOT F AND T OR NOT T

T AND F OR NOT T OR F OR (NOT F OR F)

NOT T AND T AND (F OR F) AND T OR F

Solutions

T NOT T OR NOT F AND T OR T

F OR NOT F AND T OR T

F OR T AND T OR T

F OR T OR T

T OR T

T

T OR T AND (F OR T) AND NOT F

T OR T AND T AND NOT F

T OR T AND T AND T

T OR T AND T

T OR T

T

Do the rest as exercises, bearing in mind that content or bracket supersedes even the NOT operator in precedence.

String operations (Concatenation)

Numerical operations cannot be performed cannot be performed on strings or string variables, However, concatenation (i.e. literal combination, one behind the other) of strings and string variables is allowed on several versions of BASIC.

Example

10 LET AS = "FIVE HUNDRED" 20 LET BS = "THOUSAND"

30 LET C$ = A$ + " " + B$ + " NAIRA" 40 PRINTC$

50 END

The above program will cause FIVE HUNDRED THOUSAND NAITA to be displayed on the screen as a single string as output.

Functional Operations

Functional operators are inbuilt operators that the programmer can call or invoke from BASIC functions library to solve some programming related problems instead of writing the code that will solve such problems himself. Examples of such functions include: COS, SIN, ABS, SORT, TAN, SUM, LEN, etc for cosine, sine, absolute, square root, tangent, summation, and word- length functions respectively.

Example:

Given that x = 45°, Develop a BASIC program that generate and display the sine, cosine and Tan of x.

Solution

```
10 LET X = 45
20 LET P = SINE (X)
30 LET Q = COS (X)
40 LET R = TAN (X)
50 PRINT P, Q, R
60 END
```

REVIEW QUESTIONS

1. Express the following in accordance with BASIC syntax:

$$Y = (L + M)/3$$

$$c = \frac{3}{4}\pi\sqrt{p^2 - mn}$$

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Describe the functions of the following BASIC statements
   (a) REM   (b) LET(c) PRINT   (d) INPUT   (e) READ   (f) DIM

3. With the aid of algorithm and flowchart, write a program to input the radius of the base of a cone at the keyboard of a computer, calculate the base area, volume and output these values to the screen of a monitor.

4. A customer deposited N50,000 at Skye Bank PLC, for 4 years at 6% interest rate annually. Write a BASIC program to find the compound interest on the amount deposited over the period of time in review.

References

Abass, O.A. (2007), Computer and BASIC Programming Concepts. Over to God Press, No.22, Bonojo street, Ijebu-Ode, Ogun State, Nigeria. ISBN: 978-40296-5-3-3.

French, C.S. (2002), Computer Science. BookPower/ELST Edition first published 2002. Reprinted 2004, 2005, and 2006. ISBN-13: 978-0-8264-6761-4.

Holmes, B.J. (1989), BASIC Programming- A Complete Course Text. DP Publications Ltd., London.