11.1 Programming Basics

Name: _____ Class: _____ Date: _____ **Total: 53 marks**

KEY WORDS variables • constants • data type • assignment • identifier

Objective

Write your first **pseudocode** statements: declare **variables** and **constants**, give them values with **assignment**, and use `INPUT` and `OUTPUT`. This is the first sheet of 11.1 and it needs no earlier programming. Sheet 11.1.1 then deals with operators and expressions, and sheet 11.1.2 with built-in functions.

You must be able to:

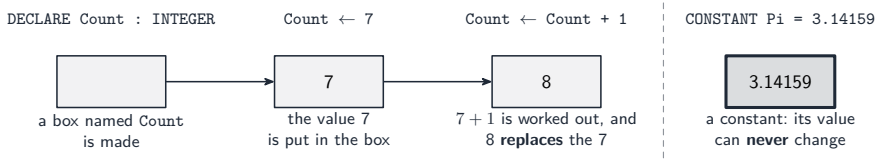
- write pseudocode statements that declare variables, and that declare and initialise constants
- choose the correct **data type** for a variable, and write a value of each type correctly
- write assignment statements, and follow what a sequence of assignments does
- write statements for input from the keyboard and output to the console

1 Worked examples

Study these first. Each one shows a **method** that a question later on this sheet needs.

Variables and constants

A **variable** is a named place in memory. Its value **can change** while the program runs. A **constant** has a value that is set once and **never changes**.




```
DECLARE Count : INTEGER
DECLARE Price : REAL
DECLARE Name : STRING
CONSTANT TaxRate = 0.2
```

- A variable is declared with `DECLARE`, its **identifier**, a colon and its **data type**.
- A constant is declared with `CONSTANT`, its identifier, the sign `=` and its value. It has no arrow, and its type is not written.
- **Why use a constant?** The value has a meaningful name, it cannot be changed by mistake, and if the tax rate changes it is changed in **one** place only.

The data types, and how to write a value

data type	holds	a value is written like this
`INTEGER`	a whole number	`25 -3`
`REAL`	a number with a fraction part	`4.5 -0.01`
`CHAR`	one character	`'A' '7'` (single quotes)
`STRING`	text: zero or more characters	`"Hello" ""` (double quotes)
`BOOLEAN`	true or false	`TRUE FALSE`
`DATE`	a date	`25/12/2026`

`"25"` is a `STRING`, not a number: it is text that happens to contain digits. You cannot do arithmetic with it.

Assignment

```
Count ← 0
Price ← 4.50
Name ← "Ada"
Count ← Count + 1
```

- The arrow ← means "**becomes**". The **right** side is worked out first, and the result is stored in the variable on the **left**.
- `Count ← Count + 1` is not an equation. It means: take the value in `Count`, add 1, and store the result back in `Count`.
- The left side is always **one variable**. `5 ← Count` and `A + B ← 10` are errors.
- Give a variable a value before you use it. This first value is its **initial value**; setting it is called **initialising** the variable.

Method: follow a sequence of assignments. Use one column for each variable, and one row for each statement.

statement	A	B	Temp
`A ← 3`	3		
`B ← 8`	3	8	
`Temp ← A`	3	8	3
`A ← B`	8	8	3
`B ← Temp`	8	3	3

The last three statements **swap** the values of `A` and `B`. The third variable is needed: after `A ← B` the old value of `A` would be lost.

Input and output

```
OUTPUT "Enter your name"
INPUT Name
OUTPUT "Hello, ", Name
OUTPUT "You have ", Count, " messages"
```

- `INPUT` waits for the user to type a value, and stores it in the variable.
- `OUTPUT` displays one or more values, separated by **commas**. Text is in double quotes; a variable is not.
- An `OUTPUT` before an `INPUT` that tells the user what to type is called a **prompt**.

A whole program: declare, input, process, output

Input the price of a meal. Add a service charge of 10%, and output the amount to pay.

```
CONSTANT ServiceRate = 0.1
DECLARE MealPrice : REAL
DECLARE AmountToPay : REAL
OUTPUT "Enter the price of the meal"
INPUT MealPrice
AmountToPay ← MealPrice + MealPrice * ServiceRate
OUTPUT "Amount to pay: ", AmountToPay
```

Past-paper practice: complete sheets 11.1, 11.1.1 and 11.1.2 before attempting past-paper set 11.1.2.

2 Practice

Now use the methods above. The first questions need one idea each.

2.1 State whether each item should be a **variable** or a **constant** in a program for a school shop. [4]

(a) the number of pens left in the shop

(b) the number of days in a week

(c) the name of the customer who is being served

(d) the value of π, used to find the area of a round badge

(a) (b) 7 (c) (d)

2.2 State the data type of each value. [5]

(a) `"Computer"`

(b) `'C'`

(c) `18`

(d) `18.0`

(e) `FALSE`

(a) `"Computer"`
(b) `'C'`
(c) `18`
(d) `18.0`
(e) `FALSE`

2.3 Write a pseudocode statement for each of these. [4]

(a) declare a variable `Age` that holds a whole number

`Age` `Height` `Surname` `MaxPlayers`

(b) declare a variable `Surname` that holds text

(c) declare a constant `MaxPlayers` with the value 11

(d) store the value 3.5 in the variable `Height`

2.4 Each statement contains an error. Write the correct statement. [4]

(a) `DECLARE Total = INTEGER`

(b) `CONSTANT Rate : 0.05`

(c) `10 ← Score`

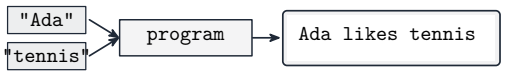
(d) `OUTPUT "The total is, Total"`

2.5 Complete the table to show the value of each variable after each statement. [4]

X
Y

statement	X	Y
`X ← 4`		
`Y ← X + 2`		
`X ← X * Y`		
`Y ← X - Y`		

2.6 Write pseudocode that asks the user for their name and their favourite sport, and then outputs one sentence that contains both. Declare your variables. [4]



3 Exam-style questions

3.1 A program for a cinema uses these values: the name of a film, the number of tickets sold, the price of one ticket, whether the film is in 3D, and the letter of the row of a seat.

(a) Write a pseudocode declaration for a variable to hold **each** of the five values. [5]

(b) The booking fee is always 1.50. Write the pseudocode statement that declares this as a constant. [1]

(c) Give **two** benefits of using a constant for the booking fee. [2]

3.2 Study this pseudocode.

```
DECLARE First : INTEGER
DECLARE Second : INTEGER
First ← 6
Second ← First * 2
First ← First + Second
Second ← Second - 2
OUTPUT First, " ", Second
```

(a) State what is output. [2]

(b) A student adds the statement `Second ← "ten"` at the end. Explain why this is an error. [2]

3.3 Two variables `Left` and `RightValue` hold the strings `"red"` and `"blue"`. A student tries to swap the two values with this pseudocode:

```
Left ← RightValue
RightValue ← Left
```

Left	"red"
Right	"blue"

(a) State the value of `Left` and the value of `RightValue` after the two statements. [1]

(b) Explain why the swap does not work. [2]

(c) Write pseudocode that swaps the two values correctly. Declare any extra variable you use. [3]

3.4 A mobile phone company charges 0.08 for each text message and 0.15 for each minute of calls. These two prices do not change. A program inputs a customer's name, the number of text messages and the number of minutes of calls. It outputs the customer's name and the total cost.

(a) Complete the identifier table for the program. [3]

identifier	data type	description
`CustomerName`		the customer's name
`Texts`		the number of text messages
`Minutes`		the number of minutes of calls
`TotalCost`		the total cost

(b) Write pseudocode for the program. Use constants for the two prices, and declare your variables. [7]

Solutions

Each answer shows the steps, then the **result**.

2.1

(a) it changes each time a pen is sold → **variable**

(b) it never changes → **constant**

(c) it changes with each customer → **variable**

(d) it never changes → **constant**

2.2

(a) text in double quotes → **`STRING`**

(b) one character in single quotes → **`CHAR`**

(c) a whole number → **`INTEGER`**

(d) it has a fraction part (a decimal point) → **`REAL`**

(e) **`BOOLEAN`**

2.3

(a) `DECLARE Age : INTEGER`

(b) `DECLARE Surname : STRING`

(c) `CONSTANT MaxPlayers = 11`

(d) `Height ← 3.5`

2.4

(a) a declaration uses a colon, not `=`: `DECLARE Total : INTEGER`

(b) a constant is given its value with `=`, not with a colon: `CONSTANT Rate = 0.05`

(c) the variable is on the left of the arrow: `Score ← 10`

(d) the variable must be outside the quotes, after a comma: `OUTPUT "The total is ", Total`

2.5

- work down the table, one statement at a time; a variable keeps its value until it is assigned again (one mark for each correct row)

statement	X	Y
`X ← 4`	4	
`Y ← X + 2`	4	6
`X ← X * Y`	24	6
`Y ← X - Y`	24	18

2.6

- two `STRING` variables declared
- a prompt and an `INPUT` for each value
- one `OUTPUT` that joins text and both variables with commas

```
DECLARE Name : STRING
DECLARE Sport : STRING
OUTPUT "Enter your name"
INPUT Name
OUTPUT "Enter your favourite sport"
INPUT Sport
OUTPUT Name, " likes ", Sport
```

3.1

(a) one mark for each declaration with a meaningful identifier and the correct type, for example:

```
DECLARE FilmName : STRING
DECLARE TicketsSold : INTEGER
DECLARE TicketPrice : REAL
DECLARE Is3D : BOOLEAN
DECLARE RowLetter : CHAR
```

(b) `CONSTANT BookingFee = 1.50`

(c) any **two** of:

- the value cannot be changed by mistake while the program runs
- if the fee changes, the program is changed in one place only
- the name makes the program easier to read than the number 1.50

3.2

(a) `First` becomes 6, `Second` becomes 12, `First` becomes $6 + 12 = 18$, `Second` becomes $12 - 2 = 10$

- the output is **18 10**

(b) `Second` was declared as an `INTEGER`

- `"ten"` is a `STRING`, and a value of one data type cannot be stored in a variable of another

3.3

(a) both variables hold **`"blue"`**

(b) the first statement replaces the value of `Left` with `"blue"`, so the value `"red"` is lost

- the second statement then copies `"blue"` back into `RightValue`

(c) a third variable of the same type is declared

- the value of `Left` is saved first
- then `Left ← RightValue`, and the saved value goes into `RightValue`

```
DECLARE Temp : STRING
Temp ← Left
Left ← RightValue
RightValue ← Temp
```

3.4

(a) `CustomerName` is a **`STRING`**; `Texts` and `Minutes` are **`INTEGER`**

- `TotalCost` is a **`REAL`**

(b) two constants declared with `=` and the correct values

- the four variables declared
- the three inputs
- the cost worked out as texts × text price + minutes × minute price
- the result stored in `TotalCost`
- the name and the total cost output

```
CONSTANT TextPrice = 0.08
CONSTANT MinutePrice = 0.15
DECLARE CustomerName : STRING
DECLARE Texts : INTEGER
DECLARE Minutes : INTEGER
DECLARE TotalCost : REAL
INPUT CustomerName
INPUT Texts
INPUT Minutes
TotalCost ← Texts * TextPrice + Minutes * MinutePrice
OUTPUT CustomerName, " ", TotalCost
```