

IGCSE Computer Science 0478

Level 1: Programming Basics

Exercises and Corrections

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Level 1 topics

- Basic data types: Integer, Real, Char, String, Boolean
- Variables, constants and meaningful identifiers
- Input and output
- Maintainability: meaningful names and comments
- Sequence and order of statements
- Flowchart symbols for START, STOP, process, input and output
- Arithmetic operators and expression precedence
- Library routines: DIV, MOD, ROUND and RANDOM
- Relational operators and Boolean results
- Logical operators: AND, OR and NOT

Exercises and Corrections

Each exercise contains a question, its correction, and a short explanation to support revision.

Exercise 1: Basic data types

Question

Identify the best data type for each literal:

- a) 27
- b) -3.5
- c) 'Q'
- d) "Q"
- e) TRUE

Correction

- a) Integer
- b) Real
- c) Char
- d) String
- e) Boolean

Explanation

Choose the most precise built-in type. Whole numbers use Integer, decimals use Real, a single character uses Char with single quotes, text uses String with double quotes, and TRUE/FALSE uses Boolean.

Exercise 2: Char values

Question

Select all the values that can be stored as Char:

- i) 'A' ii) "A" iii) '7' iv) 'AB'

Correction

- i) and iii)

Explanation

Char holds exactly one character in single quotes like 'A' or '7'. "A" is a String and 'AB' has two characters.

Exercise 3: Choosing data types for identifiers

Question

For each identifier, write a suitable data type:

- a) AgeInYears
- b) StudentFullName
- c) PiApprox
- d) IsPassed

Correction

- a) Integer
- b) String
- c) Real
- d) Boolean

Explanation

Use Integer for whole-number counts like age, String for names, Real for decimal approximations, and Boolean for yes/no states.

Exercise 4: Variables and constants

Question

Describe how variables and constants are used in programming. Distinguish clearly between them and give one simple example of each.

Correction

Both store data values. A variable can change during program execution, for example total or score. A constant does not change once defined, for example $PI = 3.14159$ or $DAYS_IN_WEEK = 7$. Use meaningful identifiers.

Explanation

Variables model values that vary at runtime, while constants fix a value for clarity and safety. Names should indicate purpose.

Exercise 5: Constant and tax calculation

Question

Read a real number Base, declare TAX_RATE as 0.19, compute TotalWithTax, and output the result.

Correction

```
INPUT Base
CONSTANT TAX_RATE ← 0.19
TotalWithTax ← Base * (1 + TAX_RATE)
OUTPUT "TotalWithTax:", TotalWithTax
```

Explanation

Declare constants once and reuse them. Read Base, apply the formula, then output the result.

Exercise 6: Input and output message

Question

Write pseudocode that prompts the user to enter their name, stores it, and outputs a welcome message that includes the name.

Correction

```
OUTPUT "Enter your name:"  
INPUT userName  
OUTPUT "Welcome ", userName
```

Explanation

Prompt the user, read the value with INPUT, then OUTPUT a message that includes the stored name.

Exercise 7: Sum and rounded average

Question

Write pseudocode that reads two integers A and B, then outputs their sum and the average rounded to 2 decimal places.

Correction

```
INPUT A  
INPUT B  
Sum ← A + B  
Average ← (A + B) / 2  
OUTPUT "Sum:", Sum, "Average:", ROUND(Average, 2)
```

Explanation

Use INPUT to read values, compute results using variables, and OUTPUT multiple parts separated by commas. ROUND(..., 2) formats to two decimals.

Exercise 8: Meaningful identifiers and comments

Question

Rewrite the code using meaningful identifiers and add one brief comment.
Start from:
INPUT a
INPUT b
c ← a*b
OUTPUT "ans", c

Correction

```
INPUT Length  
INPUT Width  
Area ← Length * Width  
OUTPUT "Area:", Area // compute rectangle area
```

Explanation

Meaningful names and a short comment improve readability without changing behavior.

Exercise 9: Sequence of steps

Question

Arrange the steps in the correct order to read a radius, compute the area of a circle, and then display it.

- A. OUTPUT "Area:", Area
- B. INPUT Radius
- C. $\text{Area} \leftarrow \text{PI} * \text{Radius}^2$

Correction

B, C, A

Explanation

Read inputs before calculations, then output the result. Sequence means the program runs statements in the written order.

Exercise 10: Arithmetic precedence

Question

Evaluate the expression: $8 + 12 / 3 * 2 - 5$.

Correction

11

Explanation

$8 + (12 / 3) * 2 - 5 = 8 + 4 * 2 - 5 = 8 + 8 - 5 = 11$.

Exercise 11: Parentheses and division

Question

Evaluate both expressions:

- a) $20 / 4 * 5$
- b) $20 / (4 * 5)$

Correction

- a) 25
- b) 1

Explanation

Without parentheses evaluate left to right at equal precedence; with parentheses do the grouped multiplication first.

Exercise 12: Power and multiplication precedence

Question

Evaluate the expression and show working: $4 + 3 * 2 ^ 2$.

Correction

$2 ^ 2 = 4$
 $3 * 4 = 12$
 $4 + 12 = 16$
Final answer: 16

Explanation

Use precedence: exponentiation (^), then multiplication (*), then addition (+).

Exercise 13: DIV and MOD

Question

Complete the values of DIV and MOD:

- a) $DIV(17, 5) = ?$, $MOD(17, 5) = ?$
- b) $DIV(20, 4) = ?$, $MOD(20, 4) = ?$
- c) $DIV(0, 7) = ?$, $MOD(0, 7) = ?$

Correction

- a) $DIV = 3$, $MOD = 2$
- b) $DIV = 5$, $MOD = 0$
- c) $DIV = 0$, $MOD = 0$

Explanation

DIV returns the integer quotient; MOD returns the remainder. For any A and B, $A = (A \text{ DIV } B) * B + (A \text{ MOD } B)$.

Exercise 14: ROUND routine

Question

Compute the results of rounding:

- a) $ROUND(3.14159, 2)$
- b) $ROUND(2.675, 2)$
- c) $ROUND(-1.49, 0)$

Correction

- a) 3.14
- b) 2.68
- c) -1.0

Explanation

ROUND(number, places) rounds to the specified number of decimal places. For two decimal places, look at the third decimal digit to decide whether to round up or down.

Exercise 15: RANDOM integer expression

Question

Write a single expression that yields a uniformly distributed integer from 1 to 6 inclusive using RANDOM().

Correction

`ROUND(RANDOM() * 5 + 1, 0)`

Explanation

RANDOM() returns a real in [0, 1]. Multiply by 5 and add 1 to shift to [1, 6], then ROUND to an integer.

Exercise 16: Relational operators

Question

Given $X \leftarrow 7$, $Y \leftarrow 7$, $Z \leftarrow 10$, state TRUE or FALSE for each:

- a) $X = Y$
- b) $X < Z$
- c) $Z \leq Y$
- d) $X \neq Y$

Correction

- a) TRUE
- b) TRUE
- c) FALSE
- d) FALSE

Explanation

Compare values using $=$, $<$, $\leq$, and $\neq$.

Exercise 17: DIV, MOD and AND

Question

Given $A \leftarrow 12$ and $B \leftarrow 5$, evaluate: $(A \text{ DIV } B) = 2 \text{ AND } (A \text{ MOD } B) = 2$.

Correction

TRUE

Explanation

DIV gives 2 and MOD gives 2 for 12 divided by 5. Both sub-expressions are TRUE, so the AND is TRUE.

Exercise 18: Boolean operators

Question

Let $P \leftarrow \text{TRUE}$, $Q \leftarrow \text{FALSE}$. Fill in the results:

- a) $P \text{ AND } Q = ?$
- b) $P \text{ OR } Q = ?$
- c) $\text{NOT } Q = ?$

Correction

- a) FALSE
- b) TRUE
- c) TRUE

Explanation

AND is TRUE only when both are TRUE. OR is TRUE if at least one is TRUE. NOT flips the truth value.

Exercise 19: Combined logical expression

Question

Let $A \leftarrow 4$, $B \leftarrow 9$, $C \leftarrow -2$. Evaluate: $(A < B) \text{ AND NOT } (C \geq 0 \text{ OR } B = 10)$.

Correction

TRUE

Explanation

$A < B$ is TRUE. Inside the parentheses both comparisons are FALSE, so the OR is FALSE; NOT FALSE is TRUE; overall TRUE AND TRUE is TRUE.

Exercise 20: Correcting basic pseudocode errors

Question

Find and correct three errors in the snippet and write a corrected version that follows the rules:

```
CONSTANT Pi ← 3.142
letter ← "X"
Area ← Pi * r ^ 2
OUTPUT "Area=", Area
```

Correction

```
CONSTANT PI ← 3.142
INPUT Radius
Letter ← 'X'
Area ← PI * Radius ^ 2
OUTPUT "Area=", Area
```

Explanation

Use consistent uppercase for the constant, read or assign values before use, and use single quotes for Char.

Exercise 21: Flowchart symbols

Question

Match each standard flowchart symbol name to its most appropriate purpose. Symbols: Terminator (oval), Process (rectangle), Input/Output (parallelogram). Purposes: Start/Stop, Process, Input or Output. Write your three pairings.

Correction

Terminator → Start/Stop
Process (rectangle) → Process
Input/Output (parallelogram) → Input or Output

Explanation

In standard flowcharts, the oval marks program start or end, the rectangle represents a processing step, and the parallelogram is used for input or output.

Exercise 22: Building a logical expression

Question

Let A, B, and C be Boolean variables. Define X using a logic expression that represents: A is TRUE and either B is TRUE or C is TRUE.

Correction

$X \leftarrow A \text{ AND } (B \text{ OR } C)$
Any logically equivalent form is acceptable.

Explanation

The phrase either B or C means B OR C. Requiring A as well means A AND (B OR C).

Exercise 23: Truth table for A AND (B OR C)

Question

Using $X \leftarrow A \text{ AND } (B \text{ OR } C)$, fill X for each row.

A	B	C	X
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Correction

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Explanation

Evaluate X row by row. When $A = 0$, $X = 0$. When $A = 1$, X equals B OR C.

Exercise 24: Hotel table data types

Question

Complete the DataType column for each field in the Hotel table. Use only: String, Integer, Real, Boolean.

Field	Meaning	DataType
RoomNo	Room identifier	
Guests	Number of guests	
Rate\$	Price per night	
Mon	Monday available (T/F flag)	

Correction

RoomNo → String
 Guests → Integer
 Rate\$ → Real
 Mon → Boolean

Explanation

Room numbers often include letters, guest counts are whole numbers, rates require decimals, and Mon is a true/false flag.

Exercise 25: Storage unit data types

Question

For the table StorageUnits, choose the most appropriate data type for each field using only Integer, Real, Boolean, or String. Fields: SizeMetres, Position, Hoist, StorageID.

Correction

SizeMetres → Real
 Position → Integer
 Hoist → Boolean
 StorageID → String

Explanation

Sizes use decimals, positions are whole-number indices, hoist is a true/false state, and identifiers combine letters and digits.

Exercise 26: Maintainable code practices

Question

State two programming practices that make code easier to maintain by another programmer. Focus on identifier naming and documentation.

Correction

Use meaningful identifier names throughout, for example `averageScore`. Include concise comments that explain purpose or non-obvious logic.

Explanation

Descriptive names and helpful comments improve readability and reduce maintenance errors.

Exercise 27: Operators and Boolean data type

Question

For each item, state how it is used and give one short pseudocode example that uses only the named item. Items: Arithmetic operator, Boolean data type, Logical operator.

Correction

Arithmetic operator: used for numeric calculation; example `X ← 2 + 3`.
Boolean data type: stores TRUE or FALSE; example `A ← TRUE`.
Logical operator: combines Boolean values; example `X ← B AND C`.

Explanation

Arithmetic operates on numbers, Boolean represents truth values, and logical operators combine truth values.

Exercise 28: StorageUnits table data types

Question

Complete the DataType column for each field in the StorageUnits table. Use only: Integer, Real, Boolean, String.

Field	Meaning	DataType
SizeMetres	Physical size in metres	
Position	Shelf or slot number	
Hoist	Hoist available (TRUE or FALSE)	
StorageID	Identifier code (for example A17)	

Correction

SizeMetres → Real
Position → Integer
Hoist → Boolean
StorageID → String

Explanation

Sizes may have decimals, positions are whole-number indices, hoist is a TRUE or FALSE flag, identifiers combine letters and digits so String is appropriate.