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COMPUTER SCIENCE

9608/22

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 2020

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Blank pages are indicated.

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1 (a) Selection and repetition are basic constructs of an algorithm.

Name **and** describe **one other** construct.

Name

Description

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[3]

(b) Program coding is a transferable skill.

Explain the term **transferable skill**.

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..... [2]

(c) Count-controlled and post-condition are two types of loop.

Describe the characteristics of each of these types of loop.

Count-controlled

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Post-condition

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[2]

(d) Name **three** features provided by an Integrated Development Environment (IDE) that assist in the coding and **initial** error detection stages of the program development cycle.

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2

3

[3]

- 2 (a) A structure chart is often produced as part of a modular program design. The chart shows the hierarchy of modules and the sequence of execution.

Give **two other** features the structure chart can show.

Feature 1

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Feature 2

.....

[2]

- (b) Six program modules implement part of an online shopping program. The following table gives the modules and a brief description of each module:

Module	Description
Shop()	Allows the user to choose a delivery slot, select items to be added to the basket and finally check out
ChooseSlot()	Allows the user to select a delivery time. Returns a delivery slot number
FillBasket()	Allows the user to select items and add them to the basket
Checkout()	Completes the order by allowing the user to pay for the items. Returns a Boolean value to indicate whether or not payment was successful
Search()	Allows the user to search for a specific item. Returns an item reference
Add()	Adds an item to the basket. Takes an item reference and a quantity as parameters

- (i) The online shopping program has been split into sub-tasks as part of the design process.

Explain the advantages of decomposing the program into modules. Your explanation should refer to the scenario and modules described in **part (b)**.

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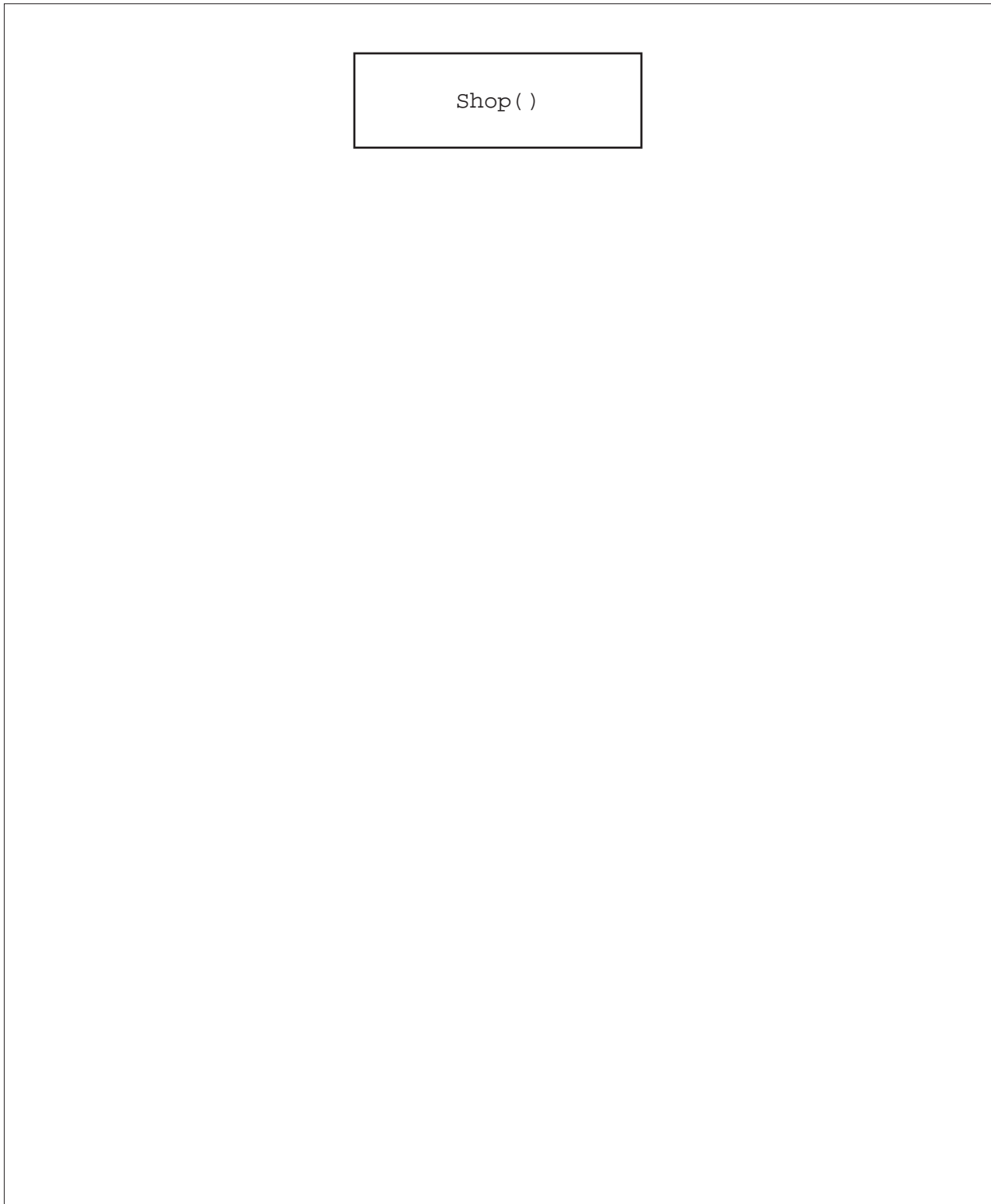
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(ii) Complete the structure chart for the six modules described in **part (b)**.

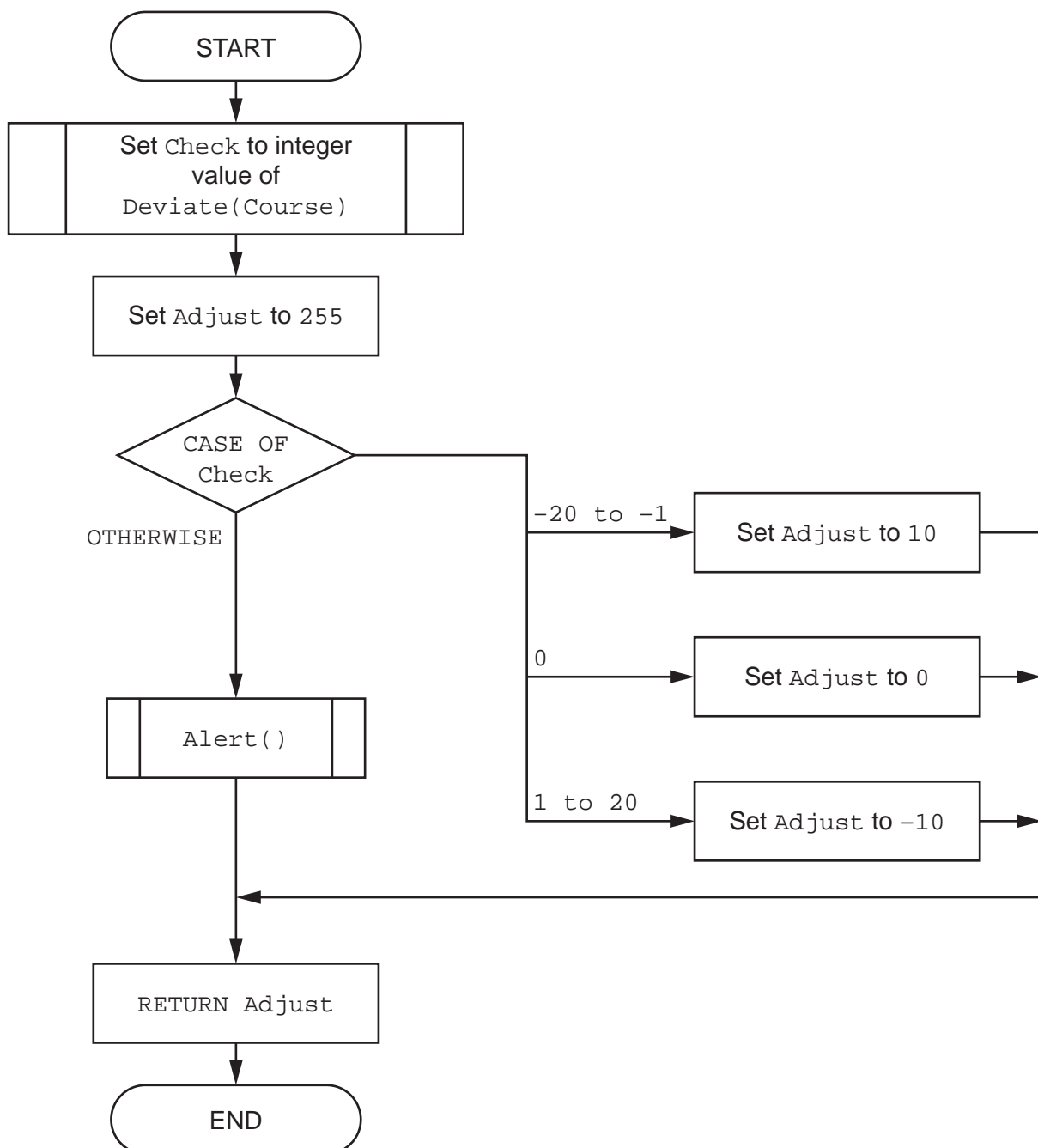


[6]

- 3 A navigation program includes a function, `CheckCourse()`. This function is called with a real value, `Course`, and returns an integer value.

The identifier table and the program flowchart for the function are shown as follows:

Identifier	Type	Description
Course	REAL	The value passed to <code>CheckCourse()</code>
Adjust	INTEGER	The value returned by <code>CheckCourse()</code>
Check	INTEGER	A local variable
<code>Deviate()</code>	FUNCTION	A function that is passed a REAL value representing the course and returns a REAL value representing the current deviation
<code>Alert()</code>	PROCEDURE	A procedure that generates a warning



9

- (b) The changes made to the pseudocode in **part (a)** were as a result of changes to the program requirement.

Give the term used to describe changes made for this reason.

..... [1]

- (b) (i) The array is to be sorted using an efficient bubble sort algorithm. An efficient bubble sort reduces the number of unnecessary comparisons between elements.

Describe how this could be achieved.

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..... [4]

Question 6 begins on the next page.

6 A company hires out rowing boats on a lake. The company has 17 boats numbered from 1 to 17. Boats may be hired between 9:00 and 18:00, with a maximum hire duration of 90 minutes.

The company is developing a program to help manage and record the boat hire process.

The programmer has decided to store all values relating to hire time as strings. The program will use a 24-hour clock format. For example:

Time (in words)	String value
Nine o'clock in the morning	"09:00"
Five minutes past ten o'clock in the morning	"10:05"
Ten minutes before three o'clock in the afternoon	"14:50"

The programmer has defined the first module as follows:

Module	Description
AddTime()	<ul style="list-style-type: none"> • Takes two parameters: <ul style="list-style-type: none"> ◦ StartTime: a STRING value representing a time as described ◦ Duration: an INTEGER value representing a duration in minutes • Adds the duration to the time to give a new time • Returns the new time as a STRING

(a) (i) Write **pseudocode** for the module AddTime(). Assume both input parameters are valid.

Refer to the **Appendix** on page 19 for a built-in list of pseudocode functions and operators.

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- (b) The user will input the desired start time of a hire. A new module will be written to validate the input string as a valid time in 24-hour clock format.

The string is already confirmed as being in the format "NN:NN", where N is a numeric character.

Give an example of suitable test data that is in this format but which is **invalid**. Explain your answer.

Test data

Explanation

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[2]

- (c) Each time a boat is hired out, details of the hire are added to a text file, `Hirelog.txt`. Each line of the text file corresponds to information about one hire session.

The format of each line is as follows:

`<BoatNumber><Date><AmountPaid>`

- `BoatNumber` is a two-digit numeric string
- `Date` is a six-digit numeric string in the format `DDMMYY`
- `AmountPaid` is a variable-length string representing a numeric value, for example `"12.75"`

The total hire amount from each boat is to be stored in a global array, `Total`. This array is declared in pseudocode as follows:

```
DECLARE Total : ARRAY [1:17] OF REAL
```

The programmer has defined module `GetTotals()` as follows:

Module	Description
<code>GetTotals()</code>	<ul style="list-style-type: none"> • Search through the file <code>Hirelog.txt</code> • Extract the <code>AmountPaid</code> each time a boat is hired • Store the total of <code>AmountPaid</code> for each boat in the array

Appendix

Built-in functions (pseudocode)

Each function returns an error if the function call is not properly formed.

LENGTH(ThisString : STRING) RETURNS INTEGER
returns the integer value representing the length of ThisString

Example: LENGTH("Happy Days") returns 10

LEFT(ThisString : STRING, x : INTEGER) RETURNS STRING
returns leftmost x characters from ThisString

Example: LEFT("ABCDEFGH", 3) returns "ABC"

RIGHT(ThisString: STRING, x : INTEGER) RETURNS STRING
returns rightmost x characters from ThisString

Example: RIGHT("ABCDEFGH", 3) returns "FGH"

INT(x : REAL) RETURNS INTEGER
returns the integer part of x

Example: INT(27.5415) returns 27

RAND(x : INTEGER) RETURNS REAL
returns a real number in the range 0 to x (not inclusive of x)

Example: RAND(87) could return 35.43

MOD(ThisNum : INTEGER, ThisDiv : INTEGER) RETURNS INTEGER
returns the integer value representing the remainder when ThisNum is divided by ThisDiv

Example: MOD(10,3) returns 1

DIV(ThisNum : INTEGER, ThisDiv : INTEGER) RETURNS INTEGER
returns the integer value representing the whole number part of the result when ThisNum is divided by ThisDiv

Example: DIV(10,3) returns 3

NUM_TO_STRING(x : REAL) RETURNS STRING
returns a string representation of a numeric value.

Example: If x has the value 87.5 then NUM_TO_STRING(x) returns "87.5"

Note: This function will also work if x is of type INTEGER

STRING_TO_NUM(x : STRING) RETURNS REAL
returns a numeric representation of a string.

Example: If x has the value "23.45" then STRING_TO_NUM(x) returns 23.45

Note: This function will also work if x is of type CHAR

Operators (pseudocode)

Operator	Description
&	Concatenates (joins) two strings Example: "Summer" & " " & "Pudding" produces "Summer Pudding"
AND	Performs a logical AND on two Boolean values Example: TRUE AND FALSE produces FALSE
OR	Performs a logical OR on two Boolean values Example: TRUE OR FALSE produces TRUE

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