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COMPUTER SCIENCE

9618/22

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 2023

2 hours

You must answer on the question paper.

You will need: Insert (enclosed)

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.
- The insert contains all the resources referred to in the questions.

Refer to the **insert** for the list of pseudocode functions and operators.

1 A program calculates the postal cost based on the weight of the item and its destination. Calculations occur at various points in the program and these result in the choice of several possible postal costs. The programmer has built these postal costs into the program.

For example, the postal cost of \$3.75 is used in the following lines of pseudocode:

	IF ENI	Weight < 250 AND ValidAddress = TRUE THEN ItemPostalCost ← 3.75 // set postal cost for item to \$3.75 ItemStatus ← "Valid" // item can be sent DIF	
(a)	(i)	Identify a more appropriate way of representing the postal costs.	
			[1]
	(ii)	Describe the advantages of your answer to part (a)(i) with reference to this program.	
			[3]
(b)	The	e lines of pseudocode contain features that make them easier to understand.	
	Sta	te three of these features.	
	1		
	2		
	3		 [3]
			[0]
(c)	Giv	e the appropriate data types for the following variables:	
	Val	idAddress	
	Ite	emPostalCost	
	Ite	emStatus	 [3]

2

corresponding to 17/11/2007 to MyDOB. (b) MyDOB has been assigned a valid value representing the user's date of birth. Write a pseudocode statement to calculate the number of months from the month of user's birth until the end of the year and to assign this to the variable NumMonths. For example, if MyDOB contains a value representing 02/07/2008, the value 5 would assigned to NumMonths. (c) The program will output the day of the week corresponding to MyDOB. For example, given the date 22/06/2023, the program will output "Thursday". An algorithm is required. An array will be used to store the names of the days of the wee Define the array and describe the algorithm in four steps. Do not use pseudocode statements in your answer. Array definition Step 1 Step 2	MyDOB has been assigned a valid value representing the user's date of birth. Write a pseudocode statement to calculate the number of months from the month of the user's birth until the end of the year and to assign this to the variable NumMonths. For example, if MyDOB contains a value representing 02/07/2008, the value 5 would be assigned to NumMonths. [2] The program will output the day of the week corresponding to MyDOB. For example, given the date 22/06/2023, the program will output "Thursday". An algorithm is required. An array will be used to store the names of the days of the week. Define the array and describe the algorithm in four steps. Do not use pseudocode statements in your answer. Array definition	ιρι	ogram stores a user's date or birth using a variable MyDOB or type DATE.
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Step 1	Step 1		Do not use pseudocode statements in your answer.
Step 2 Step 3	Step 1		Array definition
Step 2	Step 2		
Step 2	Step 2		Step 1
Step 2	Step 2		
Step 3	Step 3		
Step 3	Step 3		
Step 3	Step 3		
	Step 4		
	Step 4		
	Step 4		
Step 4			
			Step 4

[6]

- 3 A program stores data in a text file. When data is read from the file, it is placed in a queue.
 - (a) The diagram below represents an Abstract Data Type (ADT) implementation of the queue. Each data item is stored in a separate location in the data structure. During initial design, the queue is limited to holding a maximum of 10 data items.

The operation of this queue may be summarised as follows:

- The Front of Queue Pointer points to the next data item to be removed.
- The End of Queue Pointer points to the last data item added.
- The queue is circular so that locations can be reused.

0		
1		
2		
3		
4		
5	Red	← Front of Queue Pointer
6	Green	
7	Blue	
8	Pink	← End of Queue Pointer
9		

(i)

Describe how the data items Orange and Yellow are added to the queue shown in th diagram.	е
	••
[2	ŧ]

performed. All queue locations have been used at least once.

The following diagram shows the state of the queue after several operations have been

(ii)

	0	D4	
	1	D3	← End of Queue Pointer
	2	D27	
	3	D8	
	4	D33	
	5	D17	← Front of Queue Pointer
	6	D2	
	7	D1	
	8	D45	
	9	D60	
(b)			er of data items in the queue[1] ueue is completed and the number of locations is increased.
	the que	edure FileTo	eue () has been written. It takes a string as a parameter and adds this to tion will return TRUE if the string was added successfully. DQueue () will add each line from the file to the queue. This procedure is have been added or when the queue is full.
		_	nm for procedure FileToQueue().
			[5]

- 4 A function GetNum() will:
 - 1. take two parameters: a string and a character
 - 2. count the number of times that the character occurs in the string
 - 3. return the count.

Any comparison between characters needs to be case sensitive. For example, character 'a' and character 'A' are not identical.

Write pseudocode for function ${\tt GetNum}()$.
re

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5 A programmer has produced the following pseudocode to output the square root of the numbers from 1 to 10.

Line numbers are for reference only.

```
10 DECLARE Num : REAL
11 Num \leftarrow 1.0
40 REPEAT
41
     CALL DisplaySqrt (Num)
42
       Num \leftarrow Num + 1.0
43 UNTIL Num > 10
50
   PROCEDURE DisplaySqrt (BYREF ThisNum : REAL)
51
       OUTPUT ThisNum
52
       ThisNum \leftarrow SQRT (ThisNum) // SQRT returns the square root
       OUTPUT " has a square root of ", ThisNum
53
54 ENDPROCEDURE
```

The pseudocode is correctly converted into program code.

Function SQRT () is a library function and contains no errors.

The program code compiles without errors, but the program gives unexpected results. These are caused by a design error.

(a)	Explain why the program gives unexpected results.
	[3]
(b)	Explain why the compiler does not identify this error.
	[1]

(c)	Describe how a typical Integrated Development Environment (IDE) could be used to identify this error.
	[3]
(d)	The pseudocode is converted into program code as part of a larger program.
	During compilation, a complex statement generates an error.
	The programmer does not want to delete the complex statement but wants to change the statement so that it is ignored by the compiler.
	State how this may be achieved.
	[1]

6 A procedure Square () will take an integer value in the range 1 to 9 as a parameter and output a number square.

The boundary of a number square is made up of the character representing the parameter value. The inside of the number square is made up of the asterisk character (*).

Parameter value	1	2	3	4	 9
Output	1	2222	™ ™ ™ ™	4 4 4 4 4 * * 4 4 * * 4 4 4 4 4	 999999999999999999999999999999999999999

The pseudocode OUTPUT command starts each output on a new line. For example, the following three OUTPUT statements would result in the outputs as shown:

```
OUTPUT "Hello"
OUTPUT "ginger"
OUTPUT "cat"
```

Resulting output:

Hello ginger cat

while pseudocode for procedure square ().
Parameter validation is not required.

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- 7 A computer system for a shop stores information about each customer. The items of information include name and address (both postal and email) together with payment details and order history. The system also stores the product categories they are interested in and how they would like to be contacted.
 - (a) The shop wants to add a program module that will generate emails to be sent to customers who may be interested in receiving details of new products.

(i)	State three items of information that the new module would need. Justify your choice in each case.
	Information
	Justification
	Information
	Justification
	Information
	Justification
	[3]
(ii)	Identify two items of customer information that would not be required by the new module. Justify your choice in each case.
	Information
	Justification
	Information
	Justification
	[2]

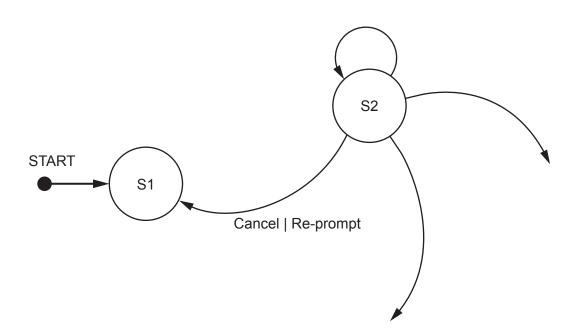
(b) The program includes a module to validate a Personal Identification Number (PIN). This is used when customers pay for goods using a bank card.

A state-transition diagram has been produced for this module.

The table show the inputs, outputs and states for this part of the program:

Current state	Input	Output	Next state
S1	Input PIN		S2
S2	Re-input PIN	Display error	S2
S2	Cancel	Re-prompt	S1
S2	Valid PIN	Enable payment	S4
S2	Too many tries	Block Account	S3

Complete the state-transition diagram to represent the information given in the table.



8 A computer shop assembles computers using items bought from several suppliers. A text file Stock.txt contains information about each item.

Information for each item is stored as a single line in the Stock.txt file in the format:

<ItemNum><SupplierCode><Description>

Valid item information is as follows:

	Format	Comment
ItemNum	4 numeric characters	unique number for each item in the range "0001" to "5999" inclusive
SupplierCode	3 alphabetic characters	to identify the supplier of the item
Description	a string	a minimum of 12 characters

The file is organised in ascending order of ItemNum and does **not** contain all possible values in the range.

A programmer has started to define program modules as follows:

Module	Description
OnlyAlpha()	called with a parameter of type string
(already written)	returns TRUE if the string contains only alphabetic characters, otherwise returns FALSE
CheckInfo()	called with a parameter of type string representing a line of item information
	checks to see whether the item information in the string is valid
	returns TRUE if the item information is valid, otherwise returns FALSE

١	Module OnlyAlpha() should be used as part of your solution.
•	
•	
•	
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•	
•	
_	
•	
-	

A new module is	s defined as follows:
Module	Description
AddItem()	called with a parameter of type string representing valid information for a new item that is not currently in the Stock.txt file
	• creates a new file NewStock.txt from the contents of the Stock.txt and adds the new item information at the appropriace in the NewStock.txt file
As a ramindar +	ho file (the also text is organized in according order of The way and do
	he file Stock.txt is organised in ascending order of ItemNum and doo ible values in the range.
	do for readule 2.1.17 ()
vvrite pseudoco	de for module AddItem().

[7]
The program contains modules <code>SuppExists()</code> and <code>CheckSupplier()</code> . These have been written but contain errors. These modules are called from several places in the main program and testing of the main program (integration testing) has had to stop.
Identify a method that can be used to continue testing the main program before the errors in these modules have been corrected and describe how this would work.
Method
Description
[3]

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