

1 A program is being developed to meet a particular customer requirement.

(a) The program contains these variables:

Variable	Data type
MyChar	CHAR
MyString	STRING
MyInt	INTEGER
MyDOB	DATE

Complete the table by filling in the gaps using functions and/or operators from the **insert**.

Each expression must be valid.

Expression
MyString ← 'X' MyString
MyChar ← ("ABCD", ,)
MyString ← (..... (MyDOB))
MyInt ← (..... (MyString) / 2)

[4]

(b) Different test methods will be used at different stages of the program development.

Complete the table by identifying the test method that matches the test description.

The first row has been completed for you.

Test description	Test method
carried out as soon as a program module has been coded	alpha
carried out as program modules are being combined	
completed by the developers without referring to the code	
completed by the customer	

[3]

(c) During the alpha testing stage, an Integrated Development Environment (IDE) is used to help locate an error that has been identified. The IDE report window feature is used to examine the values assigned to variables.

Explain how **two** other IDE features are used together with the report window feature to help locate the error.

.....

.....

.....

.....

.....

.....

..... [3]

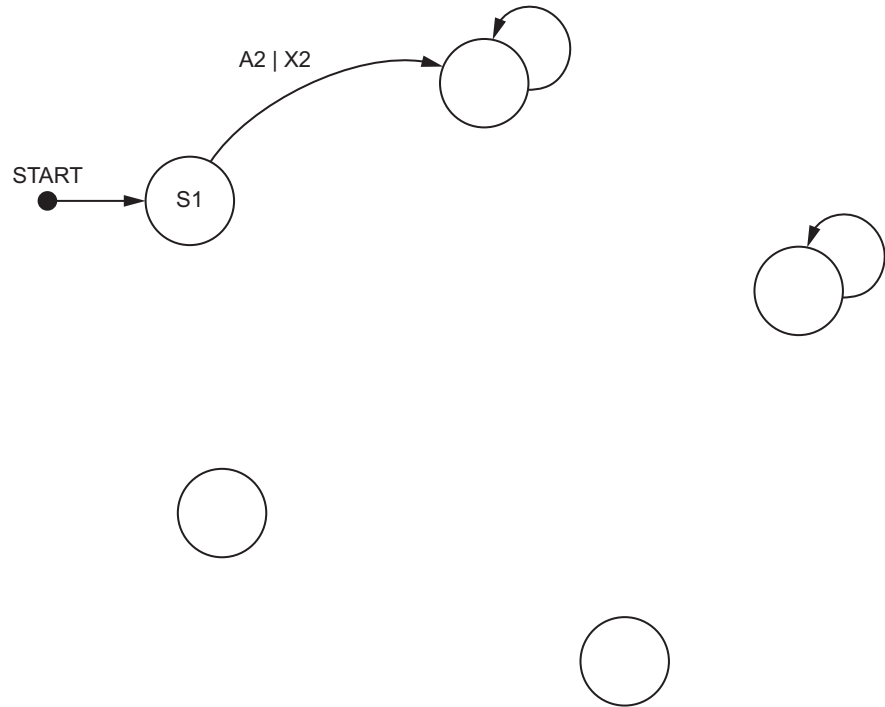
7 There are several different ways to express an algorithm during the design of a program.

(a) One part of the program contains an algorithm which is represented by a state-transition diagram.

The table shows the inputs, outputs and states for the algorithm:

Current state	Input	Output	Next state
S1	A2	X2	S3
S1	A1	X1	S2
S2	A4	X4	S5
S3	A1		S3
S3	A3	X3	S2
S3	A2	X4	S4
S4	A1	X1	S4
S4	A3		S2
S4	A4	X4	S5

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



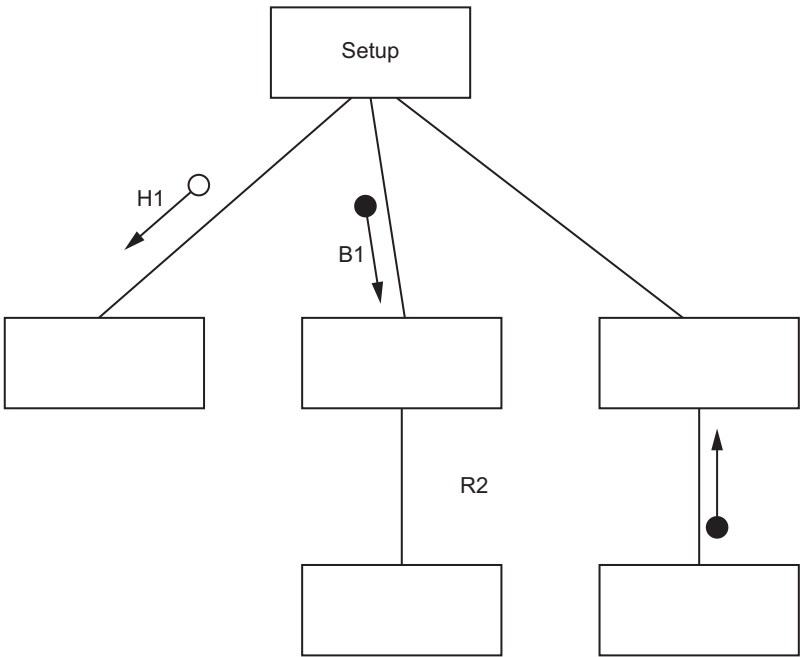
(b) A structure chart is used to document a different part of the program.

This part of the program contains six modules:

Pseudocode module header
PROCEDURE Setup()
PROCEDURE Restart(H1 : STRING, C1 : INTEGER)
FUNCTION Modify(B1 : BOOLEAN) RETURNS INTEGER
PROCEDURE Final(T1 : INTEGER)
PROCEDURE Update(BYREF R2 : STRING)
FUNCTION Confirm() RETURNS BOOLEAN

Module Setup will repeatedly call **three** of the modules.

Complete the structure chart to document the information given in the table.



8 A program is being developed to manage student book loans from a college library. Students may borrow up to five books at a time from the library.

The programmer has defined a record type to define each loan.

The record data items are:

Data item	Data type	Comment
StudentID	STRING	the unique ID of the student who has borrowed the book
BookID	STRING	the unique ID of the book being borrowed
OnLoan	BOOLEAN	TRUE if the book has not been returned

The programmer has defined a global array `Loan` to store 5000 loan records.

There are more elements in the array than books in the library. Unused elements have the `StudentID` set to an empty string. These may occur anywhere in the array.

The programmer has defined the first program module:

Module	Description
OKToBorrow()	- called with a parameter of type <code>STRING</code> representing a <code>StudentID</code> - search the array for loan records for the specified student - output a suitable message to say whether the student may, or may not, borrow another book

(a) Write efficient pseudocode for the module `OKToBorrow()`

[illegible]

(b) A second module is defined:

Module	Description
ReturnBook()	- called with two parameters of type <code>STRING</code> representing a <code>StudentID</code> and a <code>BookID</code> - searches the array for the relevant loan record - when found, sets <code>OnLoan</code> to <code>FALSE</code> and returns <code>TRUE</code> - if a loan record is not found, or the book has already been returned, then returns <code>FALSE</code>

Write efficient pseudocode for the module `ReturnBook()`

Assume that each student is only allowed to borrow each book only once. That means that there will be no more than **one** loan record for a given combination of student and book.

⑦

[8]

(c) It is decided to introduce a system of fines for books that have been borrowed for too long.

Two new requirements are defined:

1. Each loan has a maximum length, represented as a number of days.
2. Each book in the library will be assigned one of three categories. Each category has a different maximum loan length.

Record structure and program design changes are needed to meet these two requirements.

Outline the changes that are necessary to meet the **two** requirements.

[2]

- 3 (a) Explain why protocols are essential for communication between computer systems.

.....

.....

.....

..... [2]

- (b) POP3 is an email communication protocol.

Identify and describe **two** other communication protocols that are used when sending or receiving emails.

Protocol 1

Description

.....

.....

Protocol 2

Description

.....

..... [4]

- (c) Describe **two** ways in which packet switching ensures a complete message is received when passing messages across a network.

1

.....

.....

.....

2

.....

.....

.....

[4]

- 4 (a) A scheduling routine determines how processes are managed by the operating system.

Identify **two** scheduling routines.

1

2 [2]

- (b) Describe **two** ways in which the complexities of the computer hardware are hidden from the user.

1

.....

.....

.....

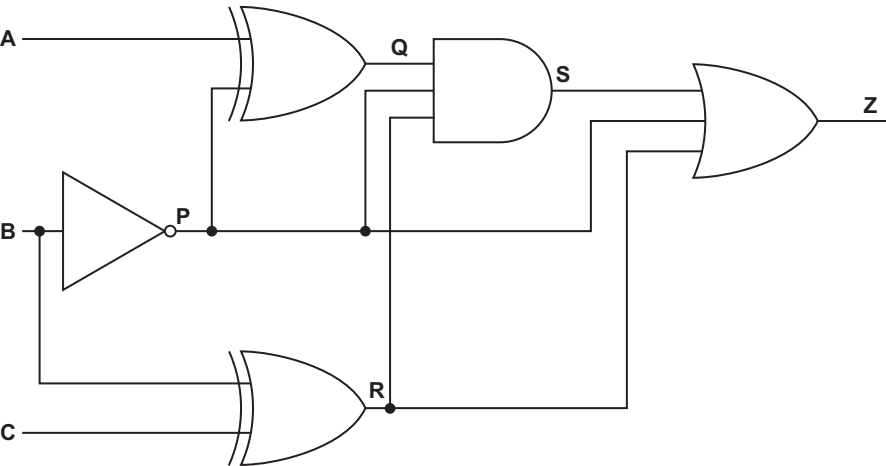
2

.....

.....

..... [4]

6 (a) The diagram shows a logic circuit.



Complete the truth table for the given logic circuit.
Show your working.

			Working space				
A	B	C	P	Q	R	S	Z
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

[3]

(b) (i) Complete the Karnaugh map (K-map) for the Boolean expression:

$$\bar{A}\bar{B}.C + \bar{A}.B.C + A.\bar{B}.C + A.B.\bar{C}$$

		BC			
A		00	01	11	10
	0				
	1				

[2]

(ii) Draw loop(s) around appropriate group(s) in the K-map to produce an optimal sum-of-products. [2]

(iii) Write the Boolean expression from your answer to part b(ii) as a simplified sum-of-products. Do **not** carry out any further simplification.

.....

..... [2]

2 Numbers are stored in a computer using binary floating-point representation with:

- 8 bits for the mantissa
- 8 bits for the exponent
- two's complement form for both the mantissa and the exponent.

(a) Give the largest normalised positive two's complement binary number that can be stored in this system **and** state its denary equivalent.

The denary answer should be expressed in terms of powers of 2.

Mantissa

Exponent

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

Denary [2]

(b) Calculate the normalised binary floating-point representation of -3.59375 in this system. Show your working.

Mantissa

Exponent

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

Working

 [4]

8 A teacher is designing a program to process pseudocode projects written by her students.

Each student project is stored in a text file.

The process is split into a number of stages. Each stage performs a different task and creates a new file named as shown:

File name	Comment
MichaelAday_src.txt	student project file produced by student Michael Aday
MichaelAday_S1.txt	file produced by stage 1
MichaelAday_S2.txt	file produced by stage 2

The teacher has defined the first program module as follows:

Module	Description
DeleteComment()	• called with a parameter of type string representing a line of pseudocode from a student's project file • returns the line after removing any comments Note on comments: A comment starts with two forward slash characters and includes all the remaining characters on the line. The following example shows a string before and after the comment has been removed: Before: IF X2 > 13 THEN //check if limit exceeded After: IF X2 > 13 THEN

.....

.....

.....

.....

.....

.....

.....

[8]

TABLE 1

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]