1(a)

Expression
`MyString ← 'X' & MyString`
`MyChar ← MID ("ABCD", 1 / 2 / 3 / 4 , 1)`
`MyString ← NUM_TO_STR (DAY / MONTH / YEAR / DAYINDEX (MyDOB))`
`MyInt ← INT (LENGTH (MyString) / 2)`

One mark per row

1(b)

Test description	Test method
carried out as soon as a program module has been coded	alpha
carried out as program modules are being combined	**integration**
completed by the developers without referring to the code	**black-box**
completed by the customer	**acceptance** / beta

One mark per row (2 to 4)

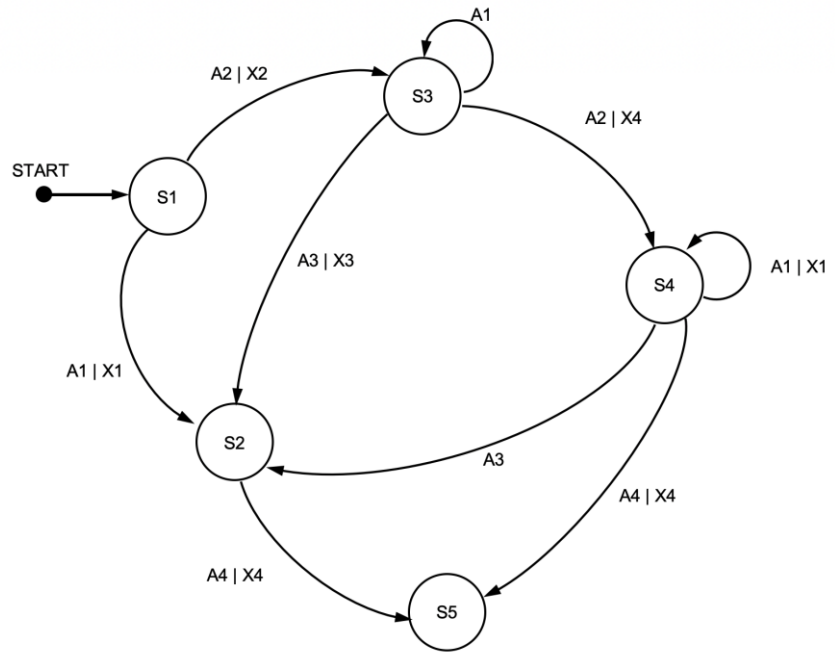
1(c)

One mark per point:

1 reference to a **breakpoint**
2 reference to **single stepping**
3 Correct explanation of **both** e.g. to stop program execution at specific point / line / statement / instruction and to execute one line / statement / instruction at a time to (locate an/the error)

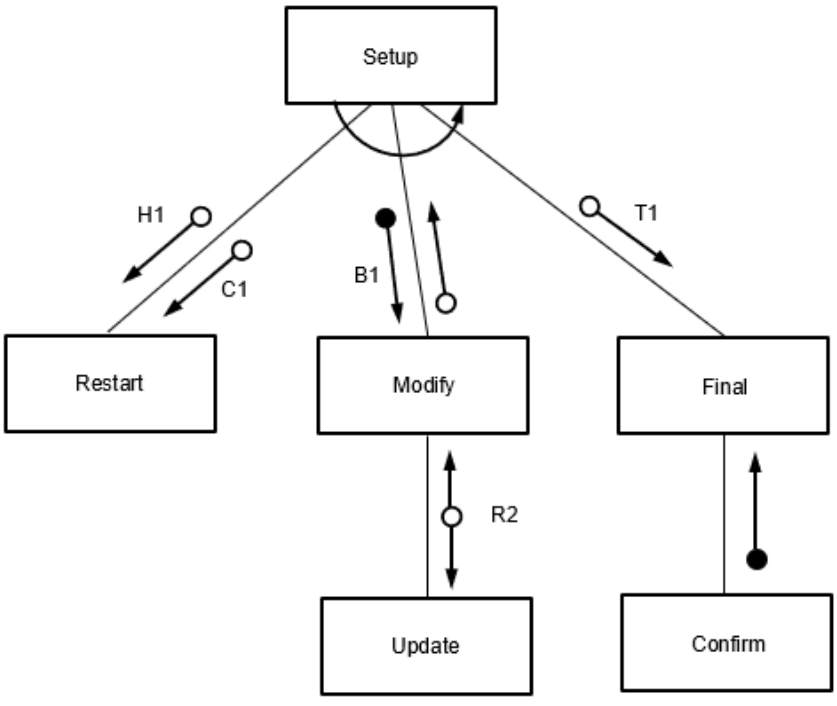
One mark for each bulleted point

7(a)



One mark for each:
1 Label A1 | X1 added on line from S1 to state labelled S2
2 States S3, S4 and S5 labelled
3 Line from S2 to S5 with event label A4|X4
4 Lines from S3 with correct event labels including 'loop' label
5 Lines from S4 with correct event labels including 'loop'

7(b)



One mark per point:
1 All boxes correctly labelled
2 Iteration arrow
3 Parameter to Restart
4 Return value from Modify **and** parameter to Final
5 BYREF parameter to Update

8(a)

Example solution:

```
PROCEDURE OKToBorrow(ThisStudentID : STRING)
   DECLARE Index, Count : INTEGER

   CONSTANT Max = 5
   Count ← 0
   Index ← 1 / 0

   WHILE Index <= 5000 / Index <= 4999 AND Count < Max
      IF Loan[Index].StudentID = ThisStudentID AND __
                                 Loan[Index].OnLoan =
TRUE THEN
         Count ← Count + 1
      ENDIF
      Index ← Index + 1
   ENDWHILE

   IF Count < Max THEN
      OUTPUT "Student may borrow another book"
   ELSE
      OUTPUT "Student may not borrow another book"
   ENDIF

ENDPROCEDURE
```

Mark as follows:

1 Procedure heading, parameter and ending
2 Loop through **all elements** in `Loan` array
3 ... terminating if `Max` reached

4 Test for correct `StudentID` field **in a loop**
5 ... and that `OnLoan = TRUE` **in a loop**
... if so, then increment `Count` **in a loop**
6 Output an appropriate **message** in both cases **after the loop**

8(b)

Example solution:

```
FUNCTION ReturnBook(ThisStudentID, ThisBookID : STRING)
                                                RETURNS BOOLEAN
   DECLARE Index : INTEGER

   Index ← 1

   WHILE Index < 5001
      IF Loan[Index].StudentID = ThisStudentID  AND __
         Loan[Index].BookID = ThisBookID THEN
         IF Loan[Index].OnLoan = TRUE THEN // Not
                                                    returned
            Loan[Index].OnLoan  ← FALSE // Mark as
                                                  returned now
            RETURN TRUE  //Found and not already returned
         ELSE
            RETURN FALSE  // Found and already returned
         ENDIF
      ENDIF
      Index ← Index + 1
   ENDWHILE

   RETURN False // loan not found
ENDFUNCTION
```

Mark as follows:

1 Loop through **all elements** in `Loan` array
2 ...and book loan not found
3 Attempt to reference an individual data item **in a loop**
4 Correct test for `StudentID` **and** correct `BookID` **in a loop**
5 **…** If book not returned yet, then set `OnLoan` field to `FALSE`
6 RETURN TRUE if book loan Found and not already returned
7 RETURN FALSE if book loan Found and loan already returned
8 RETURN FALSE if book loan not found

Alterantive example solution – not immediate return

```
FUNCTION ReturnBook(ThisStudentID, ThisBookID : STRING)
                                                RETURNS BOOLEAN
   DECLARE Index : INTEGER
   DECLARE Found, OK : BOOLEAN

   Index ← 1
   Found ← FALSE
   OK ← TRUE
```

8(b)	`WHILE Index < 5001 AND NOT Found`
	`  IF Loan[Index].StudentID = ThisStudentID  AND __`
	`  Loan[Index].BookID = ThisBookID THEN`
	`  Found ← TRUE`
	`  IF Loan[Index].OnLoan = FALSE THEN // Already returned`
	`  OK ← FALSE`
	`  ELSE`
	`  Loan[Index].OnLoan ← FALSE // Mark as returned now`
	`  ENDIF`
	`  ENDIF`
	`  Index ← Index + 1`
	`ENDWHILE`
	
	`RETURN Found AND OK`
	`ENDFUNCTION`

8(c)	Award marks for reference to following design features: Change to existing Record: 1 Store date due back as a new data item / in the loan record 2 Store date of loan **and** the loan length category as new data items / in the loan record **Max 1** New Record 3 **New** Records with Category (and Loan length field) Change to Program: 4 (Use the loan length category of a book to) calculate the date due date 5 Compare due date with today's date (to check if overdue / to calculate fine) 6 Map loan length category to length of loan / date due back **Max 1** **Max 2 marks**

3(a)	**One** mark per mark point (**Max 2**) MP1 Protocols set a standard for communication // Protocols establish a standard set of rules for communication MP2 Protocols enable compatibility between devices from different manufacturers/platforms MP3 Two devices wouldn't be able to communicate/send messages to each other if they were using different protocols

3(b)	**One** mark for a protocol and **one** mark for a description (**Max 4**) Example answers: SMTP [1] a protocol used to send emails **between mail servers** // a protocol used to send emails **from a computer to a mail server** [1] IMAP [1] allows users to access/read their emails **from any device without removing** the message from the mail server // **synchronises** emails **on any device** [1]
3(c)	**Two** marks for each description mark as 2 x 2 (**Max 4**) Example answers: Packets checked at receiving end / on arrival [1] … if packets arrive damaged or don't arrive at all, a re-send request is sent [1] Packets routed through different paths / sent individually [1] … if a route is blocked, the packet is sent through a different route to ensure it arrives [1] If the packet's hop count is exceeded [1] … the packet will be retired, which can generate a re-send request [1]

4(a)	**One** mark per scheduling routine (**Max 2**) from: • Round robin • Shortest job first • First come first served • Shortest remaining time
4(b)	**One** mark for identification and one mark for a description (**Max 4**) **Two** from: Provision of a User Interface // Provision of a Graphical User Interface [1] Allows the user to interact with the computer in a more intuitive way // Icons and menus are used to control devices by simply 'pointing and clicking' [1] Use of device drivers [1] Makes it easier to control peripherals such as printers within the operating system of the computer rather than on the separate device itself [1] Device mapping [1] Different devices (physical and virtual) are easy to identify on the network, check their status, or use [1] The user interacts only with the Application / top layer (of the TCP/IP protocol suite) [1] leaving the lower layers and their complexities hidden from the user [1]

6(a)

- **One** mark for working, (all four columns P, Q, R and S)
- **One** mark for first four rows of column Z
- **One** mark for second four rows of column Z

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

6(b)(i)

Two marks if no errors present
One mark if only one error present

A \ **BC**	**00**	**01**	**11**	**10**
0	0	1	1	0
1	0	1	0	1

6(b)(ii)

One mark for each correct loop **(Max 2)**

A \ **BC**	**00**	**01**	**11**	**10**
0	0	1	1	0
1	0	1	0	1

6(b)(iii)

One mark for each mark point (**Max 2**)

- One correct Boolean term with a + / OR sign
- All Boolean terms and operators correct and no other terms present

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

2(a)

One mark for two's complement version and **one** mark for denary version

Mantissa

0	1	1	1	1	1	1	1

Exponent

0	1	1	1	1	1	1	1

127×2^{120} // 0.9921875×2^{127} // $127/128 \times 2^{127}$

2(b)

One mark per mark point for working (**Max 2**)

- number converted to binary e.g., positive binary version of 3.59375 = (0)11.10011
- negative two's complement version -

bits flipped and 1 added = 100.01101

- -4 + 1/4 + 1/8 + 1/32 // -4 + 025 +0.125 + 0.03125 // -(64 + 32 + 16 + 2 + 1)/32
- $-2^2 + 2^{-2} + 2^{-3} + 2^{-5}$
- $2^2 (- 2^0 + 2^{-4} + 2^{-5} + 2^{-7})$

One mark per mark point

- correct mantissa
- correct exponent, with working seen.

Mantissa

1	0	0	0	1	1	0	1

Exponent

0	0	0	0	0	0	1	0

8(a)

```
FUNCTION DeleteComment(Line : STRING) RETURNS STRING
   DECLARE NewLine, TwoChars : STRING
   DECLARE Count, TrimTo : INTEGER
   CONSTANT Comment = "//"

   NewLine ← Line
   TrimTo ← 0
   Count ← 1
   WHILE Count < LENGTH(Line) AND TrimTo = 0
      TwoChars ← MID(Line, Count, 2) // extract 2 chars
      IF TwoChars = Comment THEN
         TrimTo ← Count
      ENDIF
      Count ← Count + 1
   ENDWHILE

   IF TrimTo <> 0 THEN
      NewLine ← LEFT(Line, TrimTo - 1)
   ENDIF

   RETURN NewLine

ENDFUNCTION
```

Mark as follows:

1 Loop to length of `Line` (parameter) // length of `Line -1`
2 Terminate loop on first double slash
3 Attempt to extract one/two characters **in a loop**
4 Check for "//" after attempt at extraction **in a loop**
5 Record start position of comment // Calculate amount of trim required
6 Attempt to trim `Line` from start of comment
7 Completely correct trimmed `Line` from start of comment
8 Return `Line` after a reasonable overall attempt

8(b)

Example:

```
FUNCTION Stage_1(StudentName : STRING) RETURNS INTEGER

   DECLARE OldFile, NewFile, Line : STRING
   DECLARE Count : INTEGER

   OldFile ← StudentName & "_src.txt"
   NewFile ← StudentName & "_S1.txt"
   OPENFILE OldFile FOR READ
   OPENFILE NewFile FOR WRITE
   Count ← 0

   WHILE NOT EOF(OldFile)
      READFILE OldFile, Line
      Line ← DeleteComment(Line)
      IF LENGTH(Line) <> 0 THEN
         WRITEFILE NewFile, Line
         Count ← Count + 1
      ENDIF
   ENDWHILE

   CLOSEFILE OldFile
   CLOSEFILE NewFile

   RETURN Count
ENDFUNCTION
```

Mark as follows:

1 Generate filenames condone missing "_"
2 Open both files in correct modes **and** subsequently close
3 Loop to `EOF(OldFile)`
4 Read a line from `OldFile` **and** execute `DeleteComment()` **in a loop**
5 Skip blank lines after `DeleteComment()` **in a loop**
6 Write `Line` to stage 1 file **and** increment Count
7 Return the number of lines after a reasonable attempt at counting