Cambridge International AS & A Level

Cambridge Assessment International Education
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COMPUTER SCIENCE **9608/22**

Paper 2 Written Paper **October/November 2019**

MARK SCHEME

Maximum Mark: 75

Published

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

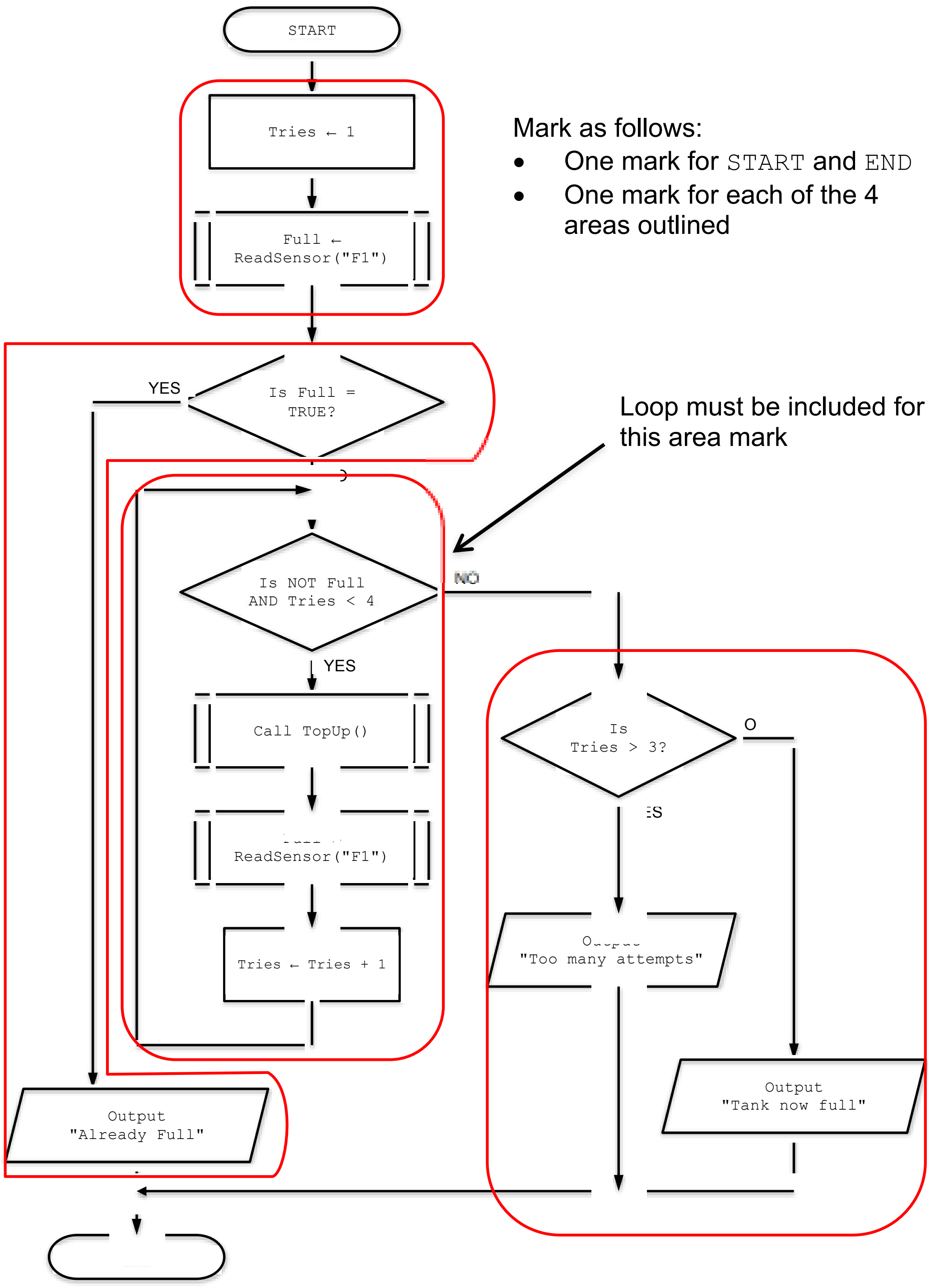
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	Any **three** from: 1. Indentation 2. Blank lines / white space 3. Sensible identifier names / use of Camel Case for identifier names 4. Capitalised keywords	**3**
1(a)(ii)	 START Tries ← 1 Full ← ReadSensor("F1") YES Is Full = TRUE? Is NOT Full AND Tries < 4 NO YES Call TopUp() ReadSensor("F1") Tries ← Tries + 1 Is Tries > 3? O ES "Too many attempts" Output "Tank now full" Output "Already Full" Mark as follows: • One mark for `START` and `END` • One mark for each of the 4 areas outlined Loop must be included for this area mark	**5**

Question	Answer	Marks
1(b)(i)	One mark per row **Example value** | **Data type** `43` | INTEGER `TRUE` | BOOLEAN `–273.16` | REAL `"–273.16"` | STRING	**4**

1(b)(ii)	One mark per row
	
	Expression | **Evaluates to**
	`RIGHT("Stop", 3) & LEFT("ich",2)` | **`"topic"`**
	`MID(NUM_TO_STRING(2019), 3, 1)` | **`"1"`**
	`INT(NUM_TO_STRING(-273.16))` | **`ERROR`**
	`INT(13/2)` | **6**
		4

Question	Answer	Marks
2(a)	One mark per point: 1. The source code represents a solution / design / algorithm expressed in a high-level language 2. The Object code is produced (by the compiler) during the translation stage // The Object code is produced by translating the source code (NOT produced by Interpreter) 3. Corrective maintenance occurs when testing reveals a fault (or error) in the program **and** this is corrected // Corrective maintenance is when errors are found and fixed // Corrective maintenance is when a program is debugged Accept alternative answers provided they relate to the **program development cycle**	**3**
2(b)	Any **three** from: 1. Dynamic syntax checking // Identification of syntax errors 2. Highlighting undeclared variables // incorrect variable usage... 3. Parameter checking 4. Type checking 5. Auto-indentation 6. PrettyPrint	**3**

Question	Answer	Marks

3(a)	`DECLARE Result : ARRAY [0:9] OF INTEGER`
	`DECLARE Index : INTEGER`
	
	`FOR Index ← 0 TO 9`
	`   Result[Index] ← 0`
	`ENDFOR`
	
	One mark for each of the following:
	
	1. Declaration of `RESULT` array (10 elements of type `INTEGER`)
	2. Loop
	3. Assignment **within a** loop
		3

3(b)	`DECLARE Index : INTEGER`
	`DECLARE NextChar : CHAR`
	`DECLARE NextCharValue : INTEGER`
	
	`FOR Index ← 1 TO LENGTH(InString)`
	`   NextChar ← MID(InString, Index, 1)`
	`   NextCharValue ← STRING_TO_NUM(NextChar)`
	`   Result[NextCharValue] ← Result[NextCharValue] + 1`
	`ENDFOR`
	
	`FOR Index ← 0 TO 9`
	`   OUTPUT "Count of digit " & NUM_TO_STRING(Index) & " : "`
	`                            & NUM_TO_STRING(Result[Index])`
	`ENDFOR`
	
	One mark for each of the following:
	
	1. Declaration of `INTEGER` variable for `Index` (or equivalent) to index `Result` array
	2. **First** loop from 1 to length of `InString`:
	3. Select each character (e.g `MID`) **in first loop**
	4. Apply type conversion to obtain integer value for `index` **in first loop**
	5. Increment element of `Result` array **in a loop**
	6. Separate second loop to repeat 10 times:
	7. Attempt to `OUTPUT` two items (digit 0 to 9 plus corresponding count) **in any loop**
	8. `OUTPUT` statement including index and count **in any loop** including type conversion of element from array if required **in a loop**
		8

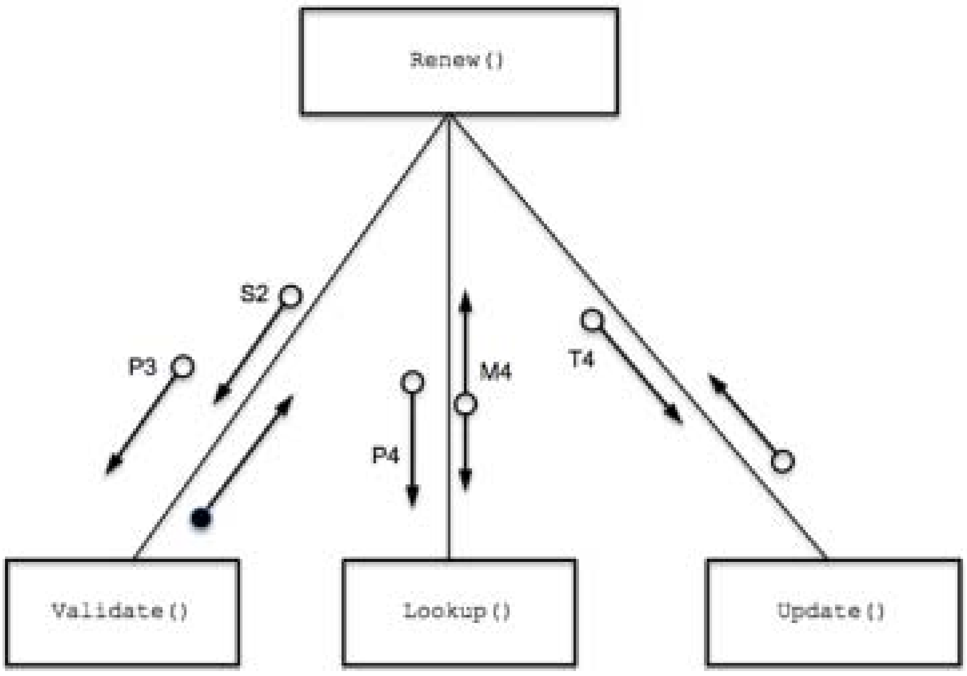
Question	Answer	Marks

4(a)	
	```
	PROCEDURE Button(ButtonNum : INTEGER)
	   DECLARE Limit : INTEGER

	   IF ButtonNum = 10 // increase volume
	      THEN
	         IF MaxVol = 0
	            THEN
	               Limit ← 49
	            ELSE
	               Limit ← MaxVol
	         ENDIF
	         IF VolLevel < Limit
	            THEN
	               VolLevel ← VolLevel + 1
	         ENDIF
	      ELSE // otherwise must be ButtonNum 20 - decrease
	         IF VolLevel > 0
	            THEN
	               VolLevel ← VolLevel - 1
	         ENDIF
	   ENDIF
	ENDPROCEDURE
	```
	Mark as follows:
	
	1. Check if parameter value = 10
	2. Check if parameter value = 20
	3. Check if `MaxVol = 0`
	4. Decrement `VolLevel` **and** ensure still in range
	
	If attempting to increase volume (parameter value was 10):
	
	5. Increment `VolLevel`
	6. Ensure `VolLevel` still in range: for both cases. i.e:
	   `VolLevel <= 49` (for `MaxVol = 0`)
	   `VolLevel <= MaxVol` (for `MaxVol <> 0`)
		6

4(b)	2 independent marks for each test: **Test 1** `MaxVol:` **0/49** `VolLevel expected:` **49** **Test 2** `VolLevel before:` **34** `VolLevel expected:` **34** **Test 3** `Parameter:` **20** `VolLevel expected:` **0**	**6**

Question	Answer	Marks
4(c)(i)	One mark for type, one for description: • Type: Logical Error • Description: Program does not perform as expected • Type: Run-time error • Description: Program executes an invalid instruction / out of bounds error / attempts to divide by zero // program crashes	**2**
4(c)(ii)	One mark per bullet point: • Tests carried out before all the modules / subroutines have been written • Simple / dummy module written to simulate / model / replace the actual module / subroutine / object • Contains an output statement // returns a fixed value to indicate that the call has been made	**3**

Question	Answer	Marks
5	 Renew() S2 P3 M4 T4 P4 Validate() Lookup() Update() One mark for each of: 1. Diagram with boxes as above correctly labelled 2. P3 **and** S2 3. Return Boolean from `Validate()` 4. P4 5. M4 6. T4 7. Return parameter from `Update()`	**7**

Question	Answer	Marks

6(a)	'Pseudocode' solution included here for development and clarification of mark scheme.
	Programming language example solutions appear in the Appendix.
	
	`FUNCTION SearchLeavers(Reference : STRING) RETURNS BOOLEAN`
	`    DECLARE Index : INTEGER`
	`    DECLARE Found : BOOLEAN`
	`    Found ← FALSE`
	`    Index ← 0`
	`    WHILE Index < 500 AND NOT Found`
	`        IF Reference = Leavers[Index]`
	`            THEN`
	`                Found ← TRUE`
	`        ENDIF`
	`        Index ← Index + 1`
	`    ENDWHILE`
	`    RETURN Found`
	`ENDFUNCTION`
	
	One mark for each of the following:
	
	1. Function heading (and ending) as above
	2. Initialisation **and** increment of `Index` used to index `Leavers` array **in a loop**
	3. Conditional loop repeating while `Index < 500` **and** exit loop if `Reference` is found:
	4. Compare indexed array element value with `Reference` **in a loop**
	5. Set termination logic if found **in a loop**
	6. Return Boolean value
		6

Question	Answer	Marks

6(b)	`FUNCTION ProcessStudentList() RETURNS INTEGER`
	
	`   DECLARE NotCopied : INTEGER`
	`   DECLARE FileData : STRING`
	`   DECLARE Reference : STRING`
	
	`   NotCopied ← 0`
	
	`   OPENFILE "StudentList.txt" FOR READ`
	`   OPENFILE "UpdatedList.txt" FOR WRITE`
	
	`   WHILE NOT EOF("StudentList.txt")`
	
	`      READFILE "StudentList.txt", FileData`
	
	`      IF MID(FileData, 6, 1) = '*'`
	`         THEN`
	`            Reference ← MID(FileData, 1, 5) // five char reference`
	`         ELSE`
	`            Reference ← MID(FileData, 1, 8) // eight char reference`
	`      ENDIF`
	
	`      IF SearchLeavers(Reference) = FALSE`
	`         THEN`
	`            WriteFile "UpdatedList.txt", FileData`
	`         ELSE`
	`            NotCopied ← NotCopied + 1`
	`      ENDIF`
	
	`   ENDWHILE`
	
	`   CLOSEFILE "StudentList.txt"`
	`   CLOSEFILE "UpdatedList.txt"`
	
	`   RETURN NotCopied`
	
	`ENDFUNCTION`
	
	One mark for each of the following:
	
	1. Function heading **and** ending as above
	2. Declaration and use of three local variables **and** initialisation of count to 0
	3. `OPEN` both files in correct mode **and** `CLOSE`
	4. Pre-Condition loop to go through the file `StudentList.txt` until `EOF()`
	5. Read line from `StudentList.txt` **and** extract correct `Reference` (either 5 or 8 characters) **in a loop**
	6. Call `SearchLeavers()` with `Reference` (after attempted extraction) **in a loop**
	7. If result is `FALSE` then write `FileData` to `UpdatedList.txt` **in a loop**
	8. Otherwise increment `NotCopied` **in a loop**
	9. Return `NotCopied` count
		9

Question	Answer	Marks
6(c)	'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix. One mark per underlined section: `Result ← CountTimes (Leavers, "")` (Space before open bracket to highlight underlined section only)	**3**

Program Code Example Solutions

Q6 (a): Visual Basic

```
Function SearchLeavers(ByVal Reference As String) As Boolean

   Dim Index As Integer
   Dim Found As Boolean

   Found = FALSE
   Index = 0

   Do While Index < 500 And Not Found

      If Reference = Leavers(Index) Then
         Found = TRUE
      End If

      Index = Index + 1

   Loop

   Return Found

End Function
```

Q6 (a): Pascal

```
function SearchLeavers(Reference : String) : boolean;

   var Index : integer;
   var Found : boolean;

   begin
   Found := FALSE;
   Index := 0;

      While Index < 500 And Not Found
      begin
         if Reference = Leavers[Index] Then
            Found := TRUE;

         Index := Index + 1;

      end;

   result := Found; // SearchLeavers := Found

end;
```

Q6 (a): Python

```
def SearchLeavers(Reference):

   ## Index : Integer
   ## Found : Boolean

   Found = False
   Index = 0

   while Index < 500 and not Found:
      if Reference == Leavers[Index]:
         Found = True

      Index = Index + 1

   return Found
```

Q6 (c): Visual Basic

```
Result = CountTimes(Leavers, "")
```

Q6 (c): Pascal

```
Result := CountTimes(Leavers, "");
```

Q6 (c): Python

```
Result = CountTimes(Leavers, "")
```