Cambridge International AS & A Level

COMPUTER SCIENCE **9608/21**

Paper 2 Written Paper **May/June 2020**

MARK SCHEME

Maximum Mark: 75

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

[Turn over

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:

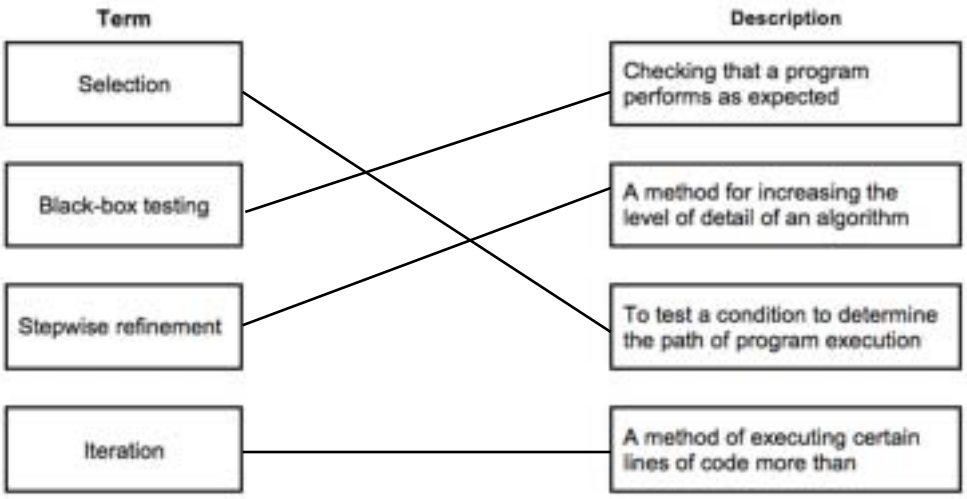
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

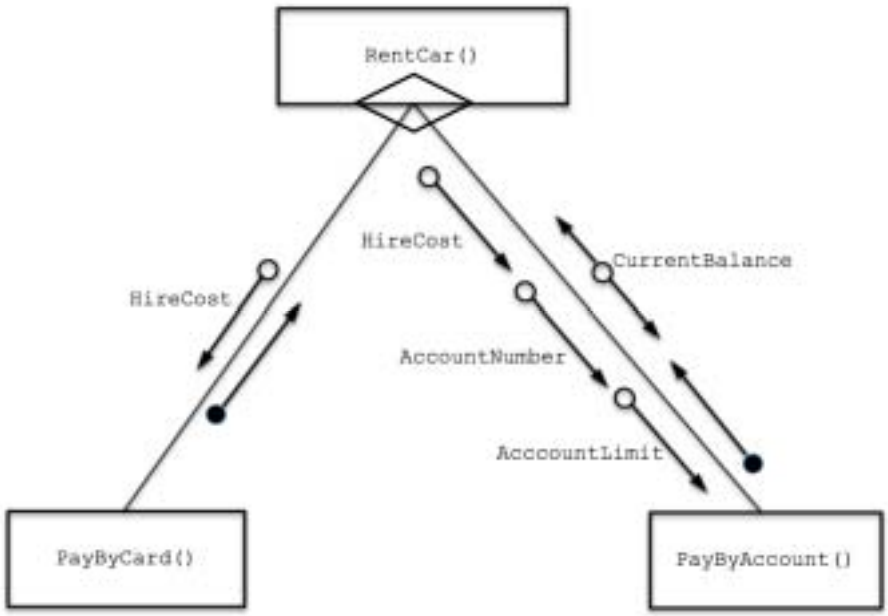
GENERIC MARKING PRINCIPLE 5:

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)	An algorithm is a solution to a problem expressed as: a sequence of defined steps / stages / instructions / lines of code 1 mark for each underlined term (or equivalent)	2
1(b)	• Allows the subroutine code to be called from many/multiple places • Subroutine code may be (independently) tested and debugged • If the subroutine task changes the change needs to be made only once • Reduces unnecessary duplication / program lines • Enables sharing of development between programmers Or equivalent points that relate to a PROGRAM (not an algorithm) Max 3	3
1(c)	 One mark for each correct line to max 3	3

Question	Answer	Marks
2(a)	 Mark as follows: 1 One mark for all three boxes correctly labelled 2 One mark for selection diamond 3 One mark for passing value **and** return Boolean from `PayByCard()` 4 One mark for passing `Value`, `AccountNUmber` **and** `AccountLimit` to `PayByAccount()` 5 One mark for passing `CurrentBalance` ByRef	**5**
2(b)(i)	Trace table shows: • 'A' is not treated as an upper case character (row 7) • `NumUpper` not incremented as expected • Incorrect final value for `NumUpper` (should be 1) Max 2	**2**
2(b)(ii)	One mark per point: • Line number: 33 • Correction: `IF NextChar >= 'A' AND NextChar <= 'Z'`	**2**

Question	Answer	Marks

2(b)(iii)	`CASE OF NextChar`
	
	`>= 'a' AND <= 'z' : NumLower ← NumLower + 1`
	`> 'A' AND <= 'Z' : NumUpper ← NumUpper + 1`
	`OTHERWISE NumNonAlpha ← NumNonAlpha + 1`
	
	`ENDCASE`
	
	One mark for `CASE OF NextChar ... ENDCASE`
	One mark for each remaining line
	
	Accept alternative range description. E.g. 'a' to 'z'
	
	Accept corrected version for the second range.
		4

Question	Answer	Marks

3(a)	`PROCEDURE AddCredit(TopUp : REAL, PhoneNum : STRING)`
	`  DECLARE Multiple : REAL`
	`  DECLARE Balance : REAL`
	
	`  Multiple ← 1`
	`  Balance ← GetBalance(PhoneNum)`
	
	`  IF Balance > 10`
	`  THEN`
	`  Multiple ← 1.125`
	`  ELSE`
	`  IF Balance > 5`
	`  THEN`
	`  Multiple ← 1.1`
	`  ENDIF`
	`  ENDIF`
	
	`  TopUp ← TopUp * Multiple`
	
	`  SetBalance(PhoneNum, Balance + TopUp)`
	
	`ENDPROCEDURE`
	
	1 mark for each of the following:
	
	1 `PROCEDURE` heading and ending including parameters
	2 Initialise `Multiple`
	3 Assign value to `Balance` using `GetBalance()`
	4 Check for `Balance > 10` **and** assignment: `Multiple ← 1.25`
	5 Check for `Balance > 5` **and** assignment: `Multiple ← 1.1`
	6 Assignment: `TopUp ← TopUp * Multiple`
	7 Calling `SetBalance()` with correct parameters
	
	Note:
	MP6 could be included in MP7 statement
		7

Question	Answer	Marks

3(b)	`PROCEDURE Search(SearchString : STRING)`
	`  DECLARE Index, Msg : STRING`
	
	`  Msg ← "Found at:" //initial value`
	
	`  FOR Index ← 1 TO 100`
	`  IF NameList[Index, 1] = SearchString__`
	`  AND NameList[Index, 2] = "Active"`
	`  THEN`
	`  Msg ← Msg & " " & NUM_TO_STRING(Index)`
	`  ENDIF`
	`  ENDFOR`
	
	`  IF Msg = "Found at:" // no change to initial value`
	`  THEN`
	`  OUTPUT "Search String not found"`
	`  ELSE`
	`  OUTPUT Msg`
	`  ENDIF`
	`ENDPROCEDURE`
	
	1 mark for each of the following:
	
	1 `PROCEDURE` heading and ending including parameter
	2 Declare local variables for `Index` and `Msg` **and** initialise `Msg` to appropriate string
	3 Loop structure
	4 Compare `SearchString` to name (column 1)...
	5 ... **AND** Compare status to `"Active"` (column 2) **in a loop**
	6 Add `Index` to `Msg` when a match is encountered (using type conversion)
	7 Condition to determine which string is output **after loop**
	8 Correct output of single message
	
	Note:
	Credit alternative solutions for forming and checking a single output string
		8

Question	Answer	Marks
4(a)	A program fault is something that makes the program not do what it is supposed to do under certain circumstances One mark per underlined phrase or equivalent	**2**

Question	Answer	Marks
4(b)	Answers include the use of: • Tried and tested (library) subroutines / code • Modular programming techniques (to break the problem down and make it easier to solve) • Good programming practice (formatting, sensible variable names, comments etc) • IDE features (parameter type-checking, auto-complete) Max 3	**3**
4(c)	Syntax error: A construct / statement in the source code that breaks the rules of the language Logic Error: An error in the algorithm that causes the program not to behave as intended Run-time: A program performs an invalid operation / tries to divide by zero // enters an infinite loop / stops unexpectedly	**3**

Question	Answer	Marks

5(a)(i)	`PROCEDURE SortContacts()`
	`DECLARE Temp : STRING`
	`DECLARE FirstName, SecondName : STRING`
	`DECLARE NoSwaps : BOOLEAN`
	`DECLARE Boundary, J : INTEGER`
	`Boundary ← 999`
	`REPEAT`
	`  NoSwaps ← TRUE`
	`  FOR J ← 1 TO Boundary`
	`  FirstName ← RIGHT(Directory[J],__`
	`  LENGTH(Directory[J]) - 4)`
	`  SecondName ← RIGHT(Directory[J + 1],__`
	`  LENGTH(Directory[J + 1]) - 4)`
	`  IF FirstName > SecondName`
	`  THEN`
	`  Temp ← Directory[J]`
	`  Directory[J] ← Directory[J + 1]`
	`  Directory[J + 1] ← Temp`
	`  NoSwaps ← FALSE`
	`  ENDIF`
	`  ENDFOR`
	`  Boundary ← Boundary - 1`
	`UNTIL NoSwaps = TRUE`
	`ENDPROCEDURE`
	
	One mark per highlighted phrase
		8

5(b)	**Description**: • uses a flag variable to stop the outer loop • after no more swaps made during one pass of the inner loop • the flag is reset before the inner loop starts, and set whenever a swap is made • decreases the loop size at end of inner loop (`Boundary` decremented) Max 3 for description **Effective because**: • It prevents unnecessary iterations / passes through the array (i.e. when the array is already sorted) // terminates the algorithm when all elements are in order // reduces the number of unnecessary comparisons	**4**

Question	Answer	Marks
6(a)		8

```
PROCEDURE ListAvailable(StartTime : STRING)
   DECLARE NumAvailable, Index : INTEGER
   DECLARE TimeBack : STRING
   DECLARE Available : BOOLEAN

   NumAvailable ← 0

   FOR Index ← 1 TO 10
      Available ← FALSE // initialise
      IF HireTime[Index] = "Available" // not on hire
         THEN
            Available ← TRUE // available now
         ELSE
            TimeBack ← AddTime(HireTime[Index],__
                               Duration[Index])
            IF TimeBack < StartTime // < or <=
               THEN
                  Available ← TRUE // will be available
            ENDIF
      ENDIF

      IF Available = TRUE
         THEN
            OUTPUT "Boat " , Index , " is available"
            NumAvailable ← NumAvailable + 1
      ENDIF
   ENDFOR

   IF NumAvailable > 0
      THEN
         OUTPUT "There are " , NumAvailable ,__
                " boats available."
      ELSE
         OUTPUT "Sorry, there are no boats available"
   ENDIF

ENDPROCEDURE
```

1 mark for each of the following:

1 Procedure heading and ending including input parameter
2 Declare local variable for the count of available boats **and** initialise to 0
3 Loop through all 10 boats
4 Use of `AddTime()` to calculate `TimeBack`
5 Check for boats that are not on hire **OR** those due back in time **in a loop**
6 Increment count for number of available boats **in a loop**
7 Output a message for each available boat **in a loop**
8 Output both messages as appropriate **outside a loop**

Question	Answer	Marks

6(b)	'Pseudocode' solution included here for development and clarification of mark scheme.
	Programming language example solutions appear in the Appendix.
	
	`PROCEDURE RecordHire(HBoatNumber, HDuration : INTEGER,__`
	`HTime : STRING, HCost : REAL)`
	
	`DECLARE FileLine : STRING`
	`CONSTANT Comma = ','`
	
	`HireTime[HBoatNumber] ← HTime`
	`Duration[HBoatNumber] ← HDuration`
	`Cost[HBoatNumber] ← HCost`
	
	`DailyTakings ← DailyTakings + HCost`
	
	`OPENFILE "HireLog.txt" FOR APPEND`
	
	`FileLine ← NUM_TO_STRING(HBoatNumber) & Comma`
	`FileLine ← FileLine & HTime & Comma`
	`FileLine ← FileLine & NUM_TO_STRING(HDuration)`
	`FileLine ← FileLine & Comma & NUM_TO_STRING(HCost)`
	
	`WRITEFILE "HireLog.txt", FileLine`
	
	`CLOSEFILE "HireLog.txt"`
	
	`ENDFUNCTION`
	
	One mark for each of the following:
	
	1 Procedure heading and ending (where appropriate), including input parameters (order not essential)
	2 Updating the three arrays from parameter values
	3 Totalling `DailyTakings`
	4 `OPEN "HireLog.txt"` in append mode
	5 Creating file text line including separators
	6 ....making use of type conversion as required
	7 Writing the line to the file
	8 Closing the file
	
	Solutions may combine mark points 5 and 6 (and 7)
	
	Max 7
		7

Question	Answer	Marks
6(c)(i)	'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix. `EndTime ← Addtime (BeginTime, 60)` One mark per underlined section (Space before bracket for mark scheme clarification only)	**2**
6(c)(ii)	One mark for each test: For example: **Test 1** Start time value "10:00", Duration value 30 Expected new time value "10:30" **Test 2** Start time value "10:45", Duration value 30 Expected new time value "11:15" String values (time) must be enclosed in quotation marks, integer values (duration) must not. Penalise once then FT.	**2**

Program Code Example Solutions
To be reviewed at STM

Q6(b)(i): Visual Basic

```
Sub RecordHire(HBoatNumber, HDuration As Integer, HTime As String, HCost As
Real)

  Dim FileLine As String
  Const Comma = ','

  HireTime(HBoatNumber) = HTime
  Duration(HBoatNumber) = HDuration
  Cost(HBoatNumber) = HCost

  DailyTakings = DailyTakings + HCost

  FileOpen(1, "HireLog.txt", OpenMode.Append)

  FileLine = CStr(HBoatNumber) & Comma
  FileLine = FileLine & HTime & Comma
  FileLine = FileLine & CStr(HDuration) & Comma
  FileLine = FileLine & CStr(HCost)

  Print(1, FileLine)
  PrintLine(1)

  Fileclose(1)

End Sub
```

Q6(b)(i): Pascal

```
procedure RecordHire(HBoatNumber, HDuration : integer; HTime : string;
HCost : Real);

var
  Fileline : string;
  ThisFile: TextFile;

const Comma = ',';

begin

  HireTime[HBoatNumber] := HTime;
  Duration[HBoatNumber] := HDuration;
  Cost[HBoatNumber] := HCost;

  DailyTakings := DailyTakings + HCost;

  AssignFile(Thisfile, "HireLog.txt");

  FileLine := IntToStr(HBoatNumber) + Comma;
  FileLine := FileLine + HTime + Comma;
  FileLine := FileLine + IntToStr (HDuration) + Comma;
  FileLine := FileLine + IntToStr (HCost);

  writeln(ThisFile, FileLine);

  CloseFile(ThisFile);

end;
```

Q6(b)(i): Python

```
def RecordHire(HBoatNumber, HDuration, HTime, HCost)

  # FileLine : String
  # File : File handle

  Comma = ','

  HireTime[HBoatNumber] = HTime
  Duration[HBoatNumber] = HDuration
  Cost[HBoatNumber] = HCost

  DailyTakings = DailyTakings + HCost

  File = Open("HireLog.txt", "a")

  FileLine = Str(HBoatNumber) + Comma
  FileLine = FileLine + HTime + Comma
  FileLine = FileLine + Str(HDuration) + Comma
  FileLine = FileLine + Str(HCost)

  File.write(FileLine)

  File.close
```

Q6(c)(i): Visual Basic

```
EndTime = Addtime(BeginTime, 60)
```

Q6(c)(i): Pascal

```
EndTime := Addtime(BeginTime, 60)
```

Q6(c)(i): Python

```
EndTime = Addtime(BeginTime, 60)
```