Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE	**9608/22**
Paper 2 Written Paper	**October/November 2016**
MARK SCHEME	
Maximum Mark: 75	

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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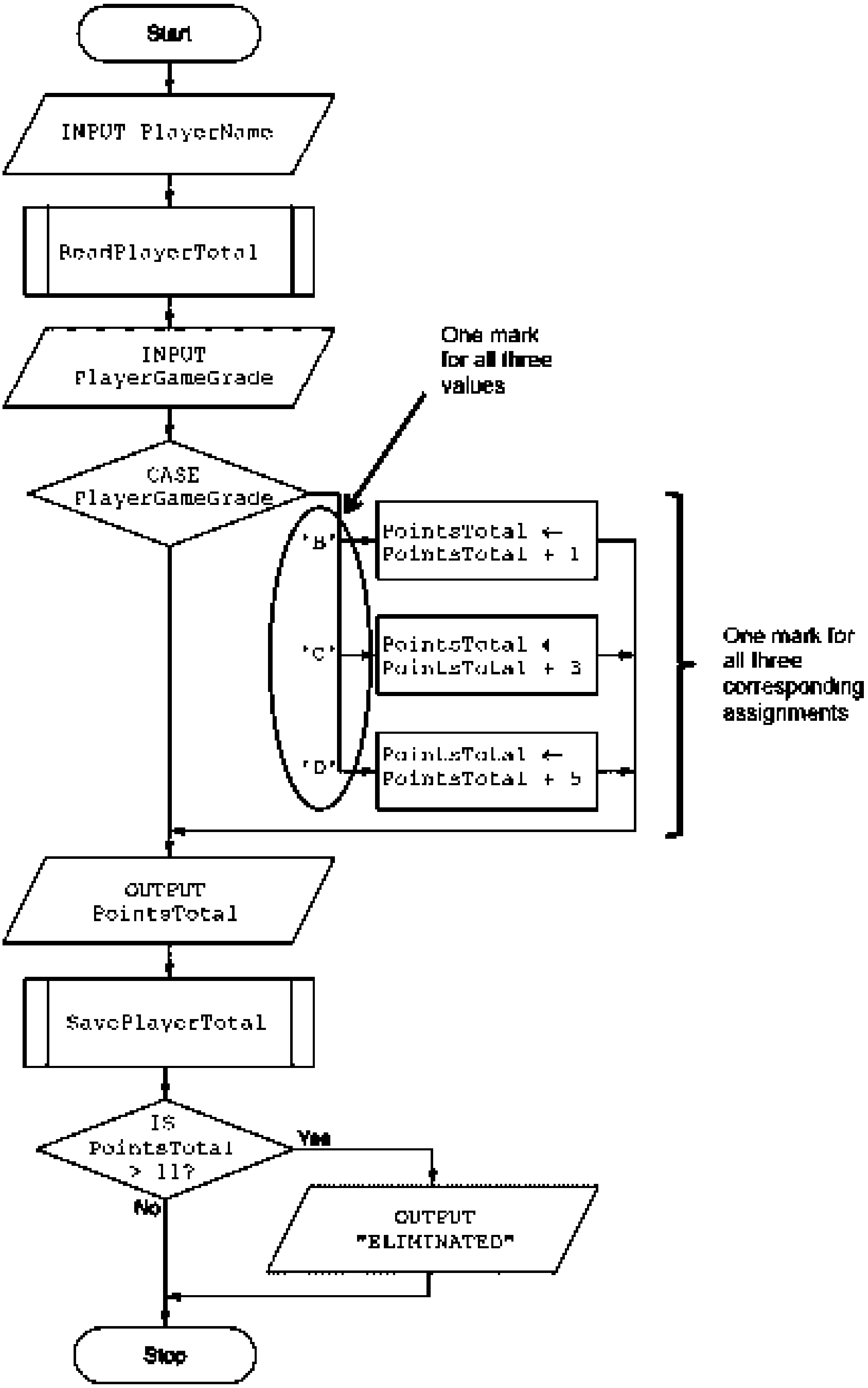
1 (a)


Start
INPUT PlayerName
ReadPlayerTotal
INPUT PlayerGameGrade
CASE PlayerGameGrade
'B'
'C'
'D'
PointsTotal ← PointsTotal + 1
PointsTotal ← PointsTotal + 3
PointsTotal ← PointsTotal + 5
One mark for all three values
One mark for all three corresponding assignments
OUTPUT PointsTotal
SavePlayerTotal
IS PointsTotal > 11?
Yes
No
OUTPUT "ELIMINATED"
Stop

Mark as follows:

- One mark per shape, correctly labelled (except for three assignments as noted above)
- One mark for three selection values ('B', 'C' and 'D') [9]

(b)

PointsTotal	PlayerGameGrade	Updated	Output
n	A	n	n
n	B	n + 1	n + 1
n	C	n + 3	n + 3
n	D	n + 5	n + 5
e.g. 10	e.g. C	13	13 ELIMINATED

One mark per complete row testing **different** routes through the algorithm. [5]

(c)

```
INPUT PlayerGameGrade
WHILE NOT(PlayerGameGrade = 'A' OR
          PlayerGameGrade = 'B' OR
          PlayerGameGrade = 'C' OR
          PlayerGameGrade = 'D')
  OUTPUT "Invalid – Re-enter"
  INPUT PlayerGameGrade
ENDWHILE
```

One mark for each of:

- `WHILE ... ENDWHILE`
- Correct condition in a loop
- `INPUT` within loop plus one before loop // alternative arrangement leading to correct exit from loop [3]

2 (a) (i) 'e' [1]

(ii) "Cat-food" [1]

(iii) 213 [1]

(b) (i) 03 // 3 [1]

(ii) 29 [1]

(iii) 14 // 16 [1]

(iv) 18 // 24 // 25 [1]

(c) `NextChar <> '*'` [1]

(d) (i)

						Numbers	
i	j	NextChar	NextNumberString		1	2	3
1	1	'2'					
			""				
			"2"				
	2	'3'	"23"				
	3	'*'			23		
2	4	'7'	""				
			"7"				
	5	'3'	"73"				
	6	'1'					
	7	'*'	"731"			731	
3	8	'5'	""				
	9	'*'	"5"				5
4	10	'#'					

One mark for each of columns 1 to 4
One mark for numbers 2 & 3 as shown in box [5]

(ii) One mark for each of:

- Isolates / separates / splits up each numeric string / the numbers / data string separated by '*'
- Converts each numeric string / each number into an integer and
- Stores each integer in array (`Numbers`) [Max. 2]

3 **(a)** **(i)** Declaration of a variable // identifier [1]

(ii) `$TimesTable, // $UpTo //  $Posn // $Product` [1]

(iii) 15 // 16 // 18 // 21 // 23 [1]

(iv) Statements inside the loop are enclosed by curly brackets {} // or by example, such as `{<statements>}` [1]

(b) **(i)**

- a learned / existing skill…
- … which can be applied to / used in a new situation / role [2]

(ii) The ability to recognise:

- Similar syntax
  - Assignment / variables / data types
  - Common operators / symbols for functions (+, –, /, *, OR, AND, >, <…)

- Control Structures
  - Iteration
  - Selection
  - Sequence
  - Layout / format (e.g. indentation)

- Modular features
  - Objects
  - Procedures / Functions

Any two of the above. [Max. 2]

4 **(a)** `INT(RND() * 150 ) + 1`

One mark for each part as follows:

- `RND() * 150`
- `+ 1`
- `INT()` [3]

(b) 'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.

Expected Loop-based solution:

```
DECLARE i , NextNumber : INTEGER
FOR i ← 1 TO 4
   NextNumber ← 1 + INT(Rnd() * 150)
   OUTPUT NextNumber
ENDFOR
```

Mark as follows:

- Declaration of all variables used including data types
- Loop
- Assignment / calculation of (four) different random numbers (0 to 150) in a loop
- Output of four values

ALTERNATIVE Non-Loop version

```
DECLARE Num1, Num2, Num3, Num4 : INTEGER

  Num1 ← INT(RND() * 150)) + 1
  Num2 ← INT(RND() * 150)) + 1
  Num3 ← INT(RND() * 150)) + 1
  Num4 ← INT(RND() * 150)) + 1

OUTPUT Num1, Num2, Num3, Num4
```

Mark as follows:

- Declaration of all variables used including data types
- Assignment of four different random numbers (0 to 150)
- Assignment to four separate variables
- Output of four values [4]

(c) Visual Basic

```
Function GenerateNumber(ByVal AnyName AS INTEGER) AS INTEGER
```

Pascal

```
FUNCTION GenerateNumber (AnyName : INTEGER) : INTEGER
```

Python

```
def GenerateNumber (AnyName):
```

- Mark as follows:
- Correct keyword + Function name
- Single input parameter of correct type
- Return parameter type [3]

(d) **(i)**
- Program code is modified
- following a change to the requirements [2]

(ii)
- Use an array / list / file to store each number generated // a flag value
- Check the array / list / file to see if the new random number has already been drawn
- If YES, generate another number
- If NO, output the number and update the array / list / file [Max. 3]

5 **(a)**
- 2D array
- of type integer
- with identifier `PlayerScore` [Max. 2]

(b) **(i)** Stepwise refinement // Top-Down Design [1]

(ii) 'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.

```
DECLARE ThisPlayerName : STRING
DECLARE PlayerName : ARRAY[1:8) OF STRING
DECLARE i : INTEGER

OPENFILE "NAMES.TXT" FOR READ
i ← 1

WHILE NOT EOF("NAMES.TXT")
  READFILE "NAMES.TXT", ThisPlayerName
  PlayerName[i] ← ThisPlayerName
  i ← i + 1
ENDWHILE

CLOSEFILE "NAMES.TXT"
```

One mark for each of:
- File open in read mode
- Loop until `EOF()` or count-controlled (8 iterations)
- Read a line from the file in a loop
- Assignment to `PlayerName[1 to 8]`from the file in a loop]

Close file [Max. 4]

(iii) 'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.

```
// search for player name ....
Found ← FALSE
i ← 1

REPEAT
  IF ThisPlayerName = PlayerName[i]
    THEN
      Found ← TRUE
      PlayerNumber ← i
    ELSE
      i ← i + 1
  ENDIF

UNTIL (Found = TRUE) OR (i = 9)
```

One mark for each of:

- Initialise `i` to 1 and Found to `FALSE`
- Loop through array `PlayerName` (including exit when found)
- Comparison: `ThisPlayerName = PlayerName[i]` in a loop
- `Found` set to `TRUE` if `ThisPlayerName` found [Max. 4]

(c) (i)

- a nested // an inner and an outer
- count controlled // incremented loop(s) [2]

(ii)

…	True
…	False

Both answers must be correct [1]

(iii) Error line number 5, 9 or 11 as follows:

Line 5:
The boundary value must be included //
`IF PlayerScore[GameIndex, PlayerIndex]` **`>= 100 // > 99`**

Line 9:
The boundary value must be included //
`IF PlayerScore[GameIndex, PlayerIndex]` **`>= 50 // > 49`**

Line 11:
One should be added to `Total50` (not `GameIndex`) //
`Total50 ← Total50 + 1`

One mark for line number + explanation [1]

6 **(i)** 10 / 10.0 [1]

(ii) 18.4 [1]

(iii) 41 [1]

(iv) TRUE [1]

(v) 12.4 [1]

Appendix – Program code example solutions

Q4 (b): Visual Basic

```
Randomize()
Dim i As Integer
Dim NextNumber As Integer
For i = 1 To 4
   NextNumber = 1 + Int(Rnd() * 150)
   Console.WriteLine(NextNumber)
Next
```

OR

```
Randomize()
Dim Num1, Num2, Num3, Num4 As Integer
Num1 = 1 + Int(Rnd() * 150)
Num2 = 1 + Int(Rnd() * 150)
Num3 = 1 + Int(Rnd() * 150)
Num4 = 1 + Int(Rnd() * 150)
Console.WriteLine(Num1, Num2, Num3, Num4)
```

Q4 (b): Pascal

```
Var i : Integer;
   NextNumber : Integer;
Begin
   Randomize;
   For i := 1 To 4 Do
   Begin
      NextNumber := 1 + Random(150);
      Writeln(NextNumber);
   End;
   Readln;
End.
```

OR

```
Var Num1, Num2, Num3, Num4 : Integer;
Begin
   Randomize;
   Num1 := 1 + Random(150);
   Num2 := 1 + Random(150);
   Num3 := 1 + Random(150);
   Num4 := 1 + Random(150);
   Writeln(Num1, Num2, Num3, Num4);
   Readln;
End.
```

Q4 (b): Python

```
import random
# i : Integer
# NextNumber : Integer

for i in range(1, 5) :
   NextNumber = 1 + int(150 * random.random())
   print(NextNumber)
```

Alternative:

```
import random
# i Integer
# NextNumber Integer
for i in range(1, 5) :
   NextNumber = random.randint(1, 150)
   print(NextNumber)
```

OR

```
import random
# i Integer
# Num1, Num2, Num3, Num4 Integer

Num1 = random.randint(1, 150)
Num2 = random.randint(1, 150)
Num3 = random.randint(1, 150)
Num4 = random.randint(1, 150)

print(Num1, Num2, Num3, Num4)
```

Q5 (b) (ii): Visual Basic

```
Dim PlayerName(8) As String
Dim i As Integer
FileOpen(1, "Names.txt", OpenMode.Input)
i = 1
Do
   PlayerName(i) = LineInput(1)
   i = i + 1
Loop Until EOF(1)
FileClose(1)
```

Alternative:

```
Dim PlayerName(8) As String
Dim i As Integer
FileOpen(1, "Names.txt", OpenMode.Input)
For i = 1 To 8
   PlayerName(i) = LineInput(1)
Next
FileClose(1)
```

Alternative:

```
Dim sr As StreamReader = New StreamReader("Names.txt")
Dim line As String
line = sr.ReadLine()
i = 1
Do While (line <> Nothing)
   PlayerName(i) = line
   i = i + 1
   line = sr.ReadLine()
Loop
sr.Close()
```

Q5 (b) (ii): Pascal

```
Var Names : TextFile;
   i : Integer;
   PlayerName : Array[1..8] Of String;
Begin
   AssignFile(Names, 'Names.txt');
   Reset(Names);
   i := 1;
   While Not Eof(Names) Do
   Begin
      Readln(Names, PlayerName[i]);
      Writeln(PlayerName[i]);
      i := i + 1;
   End;
   Close(Names);
   Readln;
End.
```

Alternative:

```
Var Names : TextFile;
   i : Integer;
   PlayerName : Array[1..8] Of String;
Begin
   AssignFile(Names, 'Names.txt');
   Reset(Names);
   For i := 1 To 8 Do
   Begin
      Readln(Names, PlayerName[i]);
      Writeln(PlayerName[i]);
   End;
   Close(Names);
   Readln;
End.
```

Q5 (b) (ii): Python

```
# PlayerName : List
# NextPlayer : String
# File : File handle
File = open("Names.txt", "r")
PlayerName = []
while (1) :
   NextPlayer = File.readline()
   if not NextPlayer :
      break
   else :
      PlayerName.append(NextPlayer)
File.close()
```

Alternative:

```
# PlayerName : List
# NextPlayer : String
# File : File handle
# i : Integer
File = open("Names.txt", "r")
PlayerName = []
for i in range(1, 9) :
   NextPlayer = File.readline()
   PlayerName.append(NextPlayer)
File.close()
```

Alternative:

```
# PlayerName : List
# NextPlayer : String
# File : File handle
# i : Integer
File = open("Names.txt", "r")
PlayerName = ["" for i in range(8)]
for i in range(1, 9) :
   PlayerName[i - 1] = File.readline()
File.close()
```

Q5 (b) (iii): Visual Basic

```
Found = False
i = 1

Do
   If ThisPlayerName = PlayerName(i) Then
      Found = True
      PlayerNumber = i
   Else
      i = i + 1
   End If
Loop Until Found = True Or i = 9
```

Q5 (b) (iii): Pascal

```
Begin
Found := False;
   i := 1;
   Repeat
      If (ThisPlayerName = PlayerName[i]) Then
      Begin
         Found := True;
         PlayerNumber := i;
      End
      Else
         i := i + 1;
   Until (Found) Or (i = 9);
End.
```

Q5 (b) (iii): Python

```
Found = FALSE
PlayerName = [j.strip() for j in PlayerName]
if ThisPlayerName in PlayerName :
   PlayerNumber = PlayerName.index(ThisPlayerName) + 1
   Found = TRUE
```

Alternative:

```
Found = False
i = 1
while not Found and i < 9 :
   if ThisPlayerName == PlayerName[i].strip() :
      Found = True
      PlayerNumber = i
   else :
      i = i + 1
```

Alternative:

```
Found = False
for i in range(1, 9) :
   if ThisPlayerName == PlayerName[i].strip() :
      Found = True
      PlayerNumber = i
```