Cambridge International AS & A Level

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COMPUTER SCIENCE **9608/21**

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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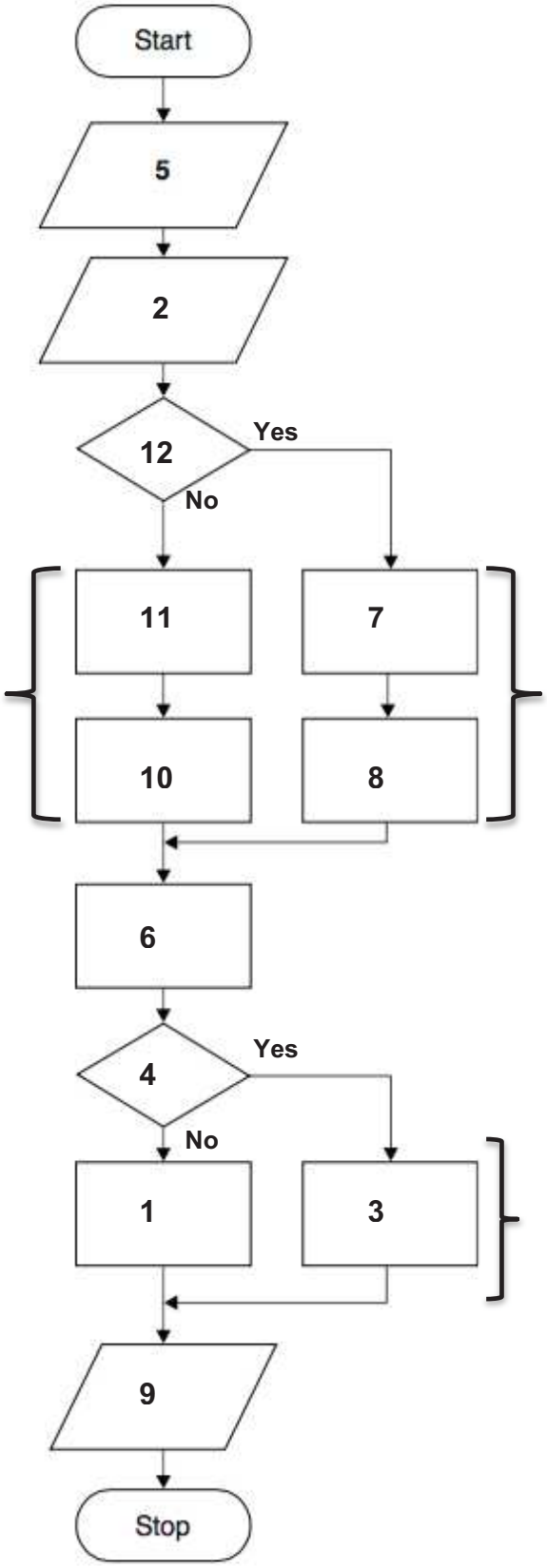
1 (a)



Note: Order of 11, 10 and 7,8 may be reversed.

One mark for each of the following symbols / symbol combinations:

- 2
- 7 and 8 from YES
- 10 and 11
- 6
- 1 and 3 (1 from NO, 3 from YES)
- 9
- 12 and 4

Max [6]

(b) Rows 2 to 7 are examples only

TicketType	BaggageWeight	Explanation	Expected output
E	15	Under the allowance	0
E	> 16	Under the allowance	*Charge*
S	<= 20	Under the allowance	0
S	> 20	Under the allowance	*Charge*
E	16	Boundary weight for a type E ticket	0
S	20	Boundary weight for a type S ticket	0
E or S	negative or non-numeric	Invalid weight	Error message

Ticket type	Baggage allowance (kg)	Charge rate per additional kg ($)
'E'	16	3.50
'S'	20	5.75

One mark for each different test (examples above) **Max [5]**

(c)
```
INPUT TicketType
WHILE NOT (TicketType = 'E') OR (TicketType = 'S')
   INPUT TicketType
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)

Status2	ReadingCount	ThisBit	BitCount	OUTPUT
			0	
1	1	1	1	
	2	0	1	
	3	1	2	
	4	1	3	
	5	1	4	
	6	0	4	
1				
	1	1	5	Error – Investigate
			0	
	2	1	1	
	3	0	1	
	4	0	1	
	5	1	2	
	6	1	3	
0				

1 must 'follow' 6 as shown by arrow. Can have only 1 or nothing above.

0 must 'follow' 6 as shown by arrow. Can have only 1 or nothing above.

One mark per area outlined **[7]**

(b) One mark for each of:
- Assignment: 01 // 02 // 06 // 09 // 14 // 18
- Selection: 07 // 11
- Iteration: 03 // 05 **[3]**

3 (a) (i) 7 **[1]**

(ii) 103 **[1]**

(iii) 'K' **[1]**

(iv) "come" **[1]**

(b) (i)
```
PROCEDURE CalculateCustomerID
    OUTPUT "Key in surname"
    INPUT Surname
    Length ← CHARACTERCOUNT(Surname)
    CustomerID ← 0
    FOR i ← 1 TO Length
        //NextChar is a single character from Surname
        Nextchar ← 1 SUBSTR(Surname, i, 1) // ONECHAR(Surname, i)
        NextCodeNumer ← ASC(NextChar)
        CustomerID ← CustomerID + NextCodeNumber
    ENDFOR
    OUTPUT "Customer ID is ", CustomerID
ENDPROCEDURE
```

One mark per phrase in **bold** **[3]**

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

```
PROCEDURE CalculateCustomerID
   DECLARE Surname : STRING
   DECLARE NextChar : CHAR
   DECLARE NextCodeNumber, i, CustomerID, SLength : INTEGER
   OUTPUT "Key in surname"
   INPUT Surname
   SLength ← LEN(Surname)
   CustomerID ← 0
   FOR i ← 1 TO SLength
      //NextChar is a single character from Surname
      Nextchar ← MID(Surname, i, 1)
      NextCodeNumber ← ASC(NextChar)
      CustomerID ← CustomerID + NextCodeNumber
   ENDFOR
   OUTPUT "Customer ID is ", CustomerID
ENDPROCEDURE
```

Mark as follows:
- Declaration of Surname as STRING and NextChar as CHAR and any three INTEGERs
- Prompt and Input
- Calculation of string length
- FOR Loop to process all characters in the string
- Assignment to NextChar in a loop
- Assignment to NextCodeNumber in a loop
- Totalling CustomerID in a loop
- Output following a loop **[6]**

(c) (i) Visual Basic

```
Function CalculateCustomerID(ByVal AnyName AS STRING) As Integer
```

Pascal

```
FUNCTION CalculateCustomerID(AnyName : STRING) : INTEGER
```

Python

```
def CalculateCustomerID(AnyName):
```

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

(ii) Visual Basic

```
Return customerID // CalculateCustomerID = CustomerID
```

Pascal

```
Result := CustomerID // CalculateCustomerID := CustomerID
```

Python

```
Return CustomerID
```

[1]

(iii) Visual Basic

```
ThisID = CalculateCustomerID ("Wilkes")
```

Pascal

```
ThisID := CalculateCustomerID ('Wilkes')
```

Python

```
ThisID = CalculateCustomerID ("Wilkes")
```

One mark per underlined element **[3]**

(d) (i)
- Built-in functions are made available by the programming language / already in the system
- Built-in functions are ready made and tested
- User-defined functions can be modified // built-in cannot be modified
- User defined functions can be designed to meet the user's requirements
- User-defined functions can only be used in that program / module **[Max 2]**

(ii)
- They have an identifier name
- They return a value
- They have none, one or more arguments
- Both perform a specific task
- Both represent re-usable code
- Both are 'called' **[Max 2]**

4 (a)
- Create / modify the source code using the text editor
- Compiler translates the source code
- Compiler produces the object code **[Max 3]**

(b) (i)
- Errors in keywords are highlighted // before the compilation process
- Provides line-by-line syntax checking as code is typed in
- Provides line number of the error
- Display of known identifier names
- Auto-complete
- Colour-coding
- Auto-indent
- type checking
- Subroutine parameter checking **[Max 1]**

(ii)
- Set break-points
- Single step / step into/over subroutine
- Window to watch the changing value of variables **[Max 1]**

(c) (i)

```
OPEN "PRODUCTS" FOR READ
i ← 1
WHILE NOT EOF("PRODUCTS")

   READFILE ("PRODUCTS", PCode[i])
   READFILE ("PRODUCTS", PDescription[i])
   READFILE ("PRODUCTS", Temp // PRetailPrice[i])

   PRetailPrice[i] ← TONUM(Temp)

   i ← i + 1
ENDWHILE

CLOSE "PRODUCTS"
OUTPUT "Product file contents written to arrays"
```

One mark per bold phrase (three READFILE() counts as a single mark) **[5]**

(ii) Benefit:

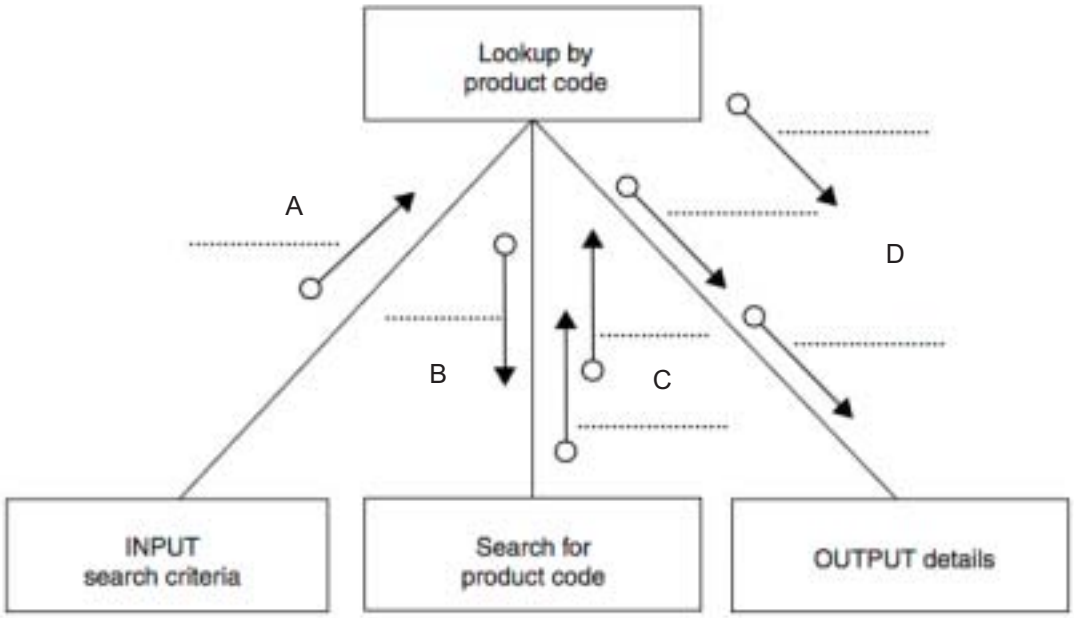
- The number of file read operations is reduced (by 2/3rds)
- It may use less storage / space in the file if strings are NOT fixed length
- All the data related to a single product is read at once / in one file operation / grouped together

Drawback:

- The program will need to use the string handling functions to isolate each of the three items of data
- Difficult to isolate data items if the format is not consistent
- More difficult to search

Max one benefit and one drawback **[2]**

(d)



One mark per group (one or more names) as follows:

A: SearchCode
B: SearchCode // ThisIndex
C: ThisRetailPrice, ThisDescription
D: SearchCode, ThisDescription, ThisRetailPrice **[4]**

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

```
FUNCTION ProductCodeSearch(AnyName : String) RETURNS : Integer
   DECLARE FoundPos : Integer
   DECLARE i : Integer

   i ← 1
   FoundPos ← -1

   REPEAT
      IF AnyName = PCode[i]
         THEN
         FoundPos ← i
      ELSE
         i ← i + 1
      ENDIF
   UNTIL (i = 1001) OR (FoundPos <> -1)

   RETURN FoundPos

ENDFUNCTION
```

Mark as follows:

- Function header returns INTEGER
- Initialisation of index variable
- Loop through array PCode (including exit when found)
- Comparison of AnyName with PCode[i] in a loop
- Increment index variable in a loop
- Return index if AnyName found AND return -1 if AnyName not found **[Max 6]**

5 **(i)** 13 / 13.0 **[1]**

(ii) 18.6 **[1]**

(iii) TRUE **[1]**

(iv) 32 **[1]**

(v) 22 **[1]**

*** End of Mark Scheme – Example program code solutions follow ***

Appendix – Example program code solutions

3(b)(ii): Visual Basic

```
Dim Surname As String
Dim NextChar As Char
Dim NextCodeNumber As Integer
Dim i As Integer
Dim CustomerID As Integer
Dim SLength As Integer

Console.Write("Key in surname ")
Surname = Console.ReadLine
SLength = Len(Surname)
CustomerID = 0
   For i = 1 To SLength
      \\ NextChar is a single character from surname
      NextChar = Mid(Surname, i, 1)
      NextCodeNumber = Asc(NextChar)
      CustomerID = CustomerID + NextCodeNumber
   Next

   Console.WriteLine("Customer ID is " & CustomerID)
```

3(b)(ii): Pascal

```
Var Surname : string;
   SLength, i, CustomerID, NextCodeNumber : integer;
   NextChar : char;
begin
   Writeln ('Enter the surname: ');
   Readln (Surname);
   SLength := Length(Surname);
   CustomerID := 0;
   For i := 1 to SLength do
      begin
         NextChar := SurName[i];
         NextCodeNumber := Ord(NextChar);
         CustomerID := CustomerID +  NextCodeNumber;
      end;
   Writeln ('Customer ID is  ', CustomerID);
   Readln;
end.
```

3(b)(ii): Python

```
# Surname String
# NextChar Char
# NextCodeNumber, I, CustomerID, SLength Integer

Surname = input("Key in Surname ")
SLength = len(Surname)
CustomerID = 0

for i in range(SLength):
   # NextChar is a single character from surname
   NextChar = Surname[i]
   NextCodeNumber = ord(NextChar)
   CustomerID = CustomerID + NextCodeNumber

print("Customer ID is " + str(CustomerID))
```

4(e): Visual Basic

```
Function ProductCodeSearch(ByVal SearchCode As String) As Integer
   Dim FoundCode As Integer
   Dim i As Integer

   i = 1
   FoundCode = -1

   Do
      If SearchCode = PCode(i) Then
         FoundCode = i
      Else
         i = i + 1
      End If
   Loop Until i = 1001 Or FoundCode <> -1
   Return FoundCode
End Function
```

4(e): Pascal

```
Function ProductCodeSearch (SearchCode : String): integer;

   var FoundCode, ThisIndex : integer;
         Found : Boolean;

   Begin
      Found := false;
      ThisIndex := 1;
      Repeat
         If SearchCode = PCode[ThisIndex] then
            Begin
               FoundCode := ThisIndex;
               Found := true;
               Else
                  ThisIndex := ThisIndex + 1;
            end;
      Until (ThisIndex = 1001) OR (Found);
      If Found = false then
         FoundCode := -1
      ProductCodeSearch := FoundCode;
   end.
```

4(e): Python

```
def ProductCodeSearch(SearchCode):
   # list indexes start at zero
   i = 0
   Found = "no"
   while not(i == 1001 or Found == "yes"):
      if SearchCode == PCode[i]:
         Found = "yes"
         FoundIndex = i
      else:
         i = i + 1

   if Found == "no":
      FoundIndex = -1

   return FoundIndex
```