Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

ADVANCED SUBSIDIARY GCE

F452

COMPUTING

Programming Techniques and Logical Methods

MONDAY 24 MAY 2010: Morning
DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

DC (NF/SW) MEP60274 29285

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).**

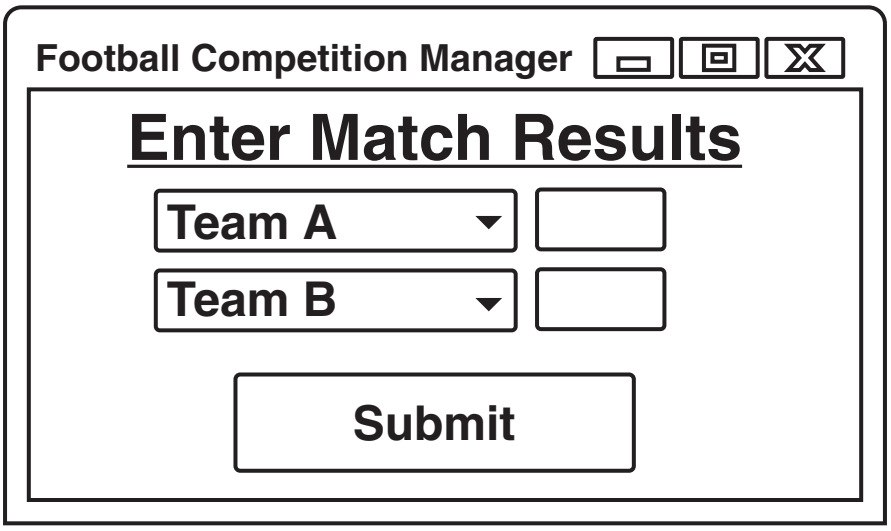
INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 100.**

BLANK PAGE

1 **A computer program is designed to store the results of matches in a football competition and calculate the ranking of the teams.**

To enter the results of each match, an interface will allow the user to select the name of two teams from drop down lists, and enter the number of goals scored in corresponding text boxes.



(a) Explain the advantages of using a drop down list to enter the name of a team.

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_____ **[4]**

(b) When the results are entered, the number of points of each team are updated as follows:

- **If both teams have the same number of goals (draw) then each team gets 1 point.**
- **If one team has more goals than the other (i.e. there is a winner) then the winning team gets 3 points, and the losing team gets 0 points.**

The algorithm for updating points in the case of a draw is given below.

```
IF goals_of_first_team = goals_of_
second_team THEN
    points_of(first_team) = points_
    of(first_team) + 1
    points_of(second_team) =
    points_of(second_team) + 1
END IF
```

Using the same format, write the algorithm for updating the points if there is a winner.

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_____ **[4]**

(c) The program is to be tested using black box testing.

(i) Describe what is meant by black box testing.

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_____ **[2]**

(ii) One possible test case is shown in the table opposite.

Complete the table opposite with <u>FOUR</u> different test cases. You may use "Team A" and "Team B" as team names in your test cases.

REASON FOR TEST	TEST DATA	EXPECTED OUTCOME
Normal score where the first team is the winning team	Team A 2 Team B 0	Team A has 3 more points, Team B's points unchanged

[12]

(d) Each day, the computer program outputs a report which shows an ordered list of the teams, the number of points they have, and their position in the competition. (No other data about the teams is shown on this report.)

In the space below, design a format for this report. You should annotate your design to explain how the data required will be displayed.

[6]

2 Tacompil Ltd is a company which owns vending machines where customers can purchase audio CDs containing songs of their choice.

The software for the vending machine is designed in modules, using stepwise refinement.

(a) (i) Explain what is meant by stepwise refinement.

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_____ **[3]**

(ii) Describe TWO advantages of using a modular design to produce the software.

Advantage 1 _____

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Advantage 2 _____

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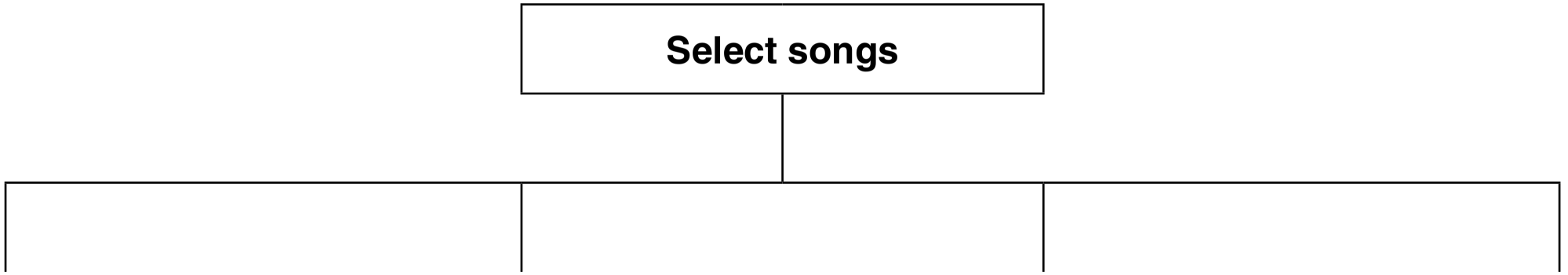
_____ **[4]**

(b) A section of the software allows the user to search for songs from a database and produce a list of selected songs. This section contains the following modules.

- **A module to enter search criteria**
- **A module to search the database**
  - **by artist**
  - **by title**
  - **by type**
- **A module to display the results of the search**
- **A module to add a song from the search results to the list of songs to be included on the CD**

Part of the top-down design for this section is shown opposite.
Complete this top-down design to show the modules listed above.



11

[7]

The playing length of each song, which has been selected, is stored in an array called SongLength. When the user wants to write the songs selected onto a CD, the software must check that the total playing length does not exceed 80 minutes.

The software contains the following function to perform this check.

```
01  FUNCTION CheckTotalLength() :
    BOOLEAN
02    TotalLength = 0
03    FOR i = 1 TO NumberOfSongs
04      TotalLength = TotalLength +
        SongLength(i)
05    NEXT i
06    RETURN (TotalLength > 80)
07  END FUNCTION
```

(c) Describe what is meant by a function.

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_____ [3]

(d) The function CheckTotalLength() returns a value of data type Boolean.

State what is meant by a Boolean data type.

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_____ **[1]**

(e) State the value returned on line 06, if the value of TotalLength is

(i) 105

_____

(ii) 80

_____ **[2]**

(f) The algorithm for the function CheckTotalLength() contains a FOR loop in lines 03 to 05.

Rewrite this FOR loop as a WHILE loop.

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_____ **[5]**

3 A printing company uses a computer program to randomly generate and print bingo tickets.

Each bingo ticket has a grid with three rows and nine columns. Each row contains 5 numbers and 4 blank spaces.

4			32	45		68		82
9		26			51	62		88
		24		47	55	65	71	

(a) The computer program stores the numbers in a 2-dimensional array called Ticket.

(i) Explain what is meant by an array.

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_____ **[3]**

(ii) State <u>THREE</u> items which should be specified when declaring an array.

Item 1 _____

Item 2 _____

Item 3 _____ **[3]**

In the array Ticket, the first index represents the row and the second represents the column.
e.g. Ticket(1,4) = 32 means the number on row 1, column 4 is 32.

(b) To generate the tickets, the computer program first fills in the columns with random integers as specified in the table below.

Column	Highest Possible Random Integer	Lowest Possible Random Integer
1	10	1
2	20	11
3	30	21
4	40	31
5	50	41
6	60	51
7	70	61
8	80	71
9	90	81

The algorithm used to fill the array with random numbers is given below. Complete this algorithm by filling in the spaces.

```
01  For Column = 1 to

    _________________________

02    Highest = Column *

      _________________________

03    Lowest = _____________________ – 9

04    For Row = 1 to _____________________

05     Ticket(Row,Column) = Random
       integer between Highest and Lowest

06    Next Row

07  Next Column
```

[4]

After filling the array, the computer program ensures that no numbers have been repeated, and replaces four positions on each row with the number 0.

(c) The bingo ticket is then printed using the following method.

- **For every row in the array**
- **For every column in that row**
  - **If the value is 0 then output a space,**
  - **otherwise output the value**

Write an algorithm in pseudo-code to print the numbers in the array onto a ticket.

You should indent your pseudo-code correctly to make it easier to understand.

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_____ **[8]**

(d) To implement the algorithms for this program, it may be necessary to declare the array Ticket, as well as other variables and constants.

Explain and justify the best practice when declaring variables and constants in code, to ensure error-free and easily understandable code.

The quality of written communication will be assessed in your answer to this question.

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_____ **[8]**

4 Numerology is a method of fortune-telling where letters are converted into numbers.

A programmer is writing an application to carry out this conversion.

(a) The application contains the function PositionInAlphabet() which takes a single upper case letter as an argument and returns the position of that letter in the alphabet.

For example PositionInAlphabet('A') = 1 and PositionInAlphabet('J') = 10.

Here is the code for this function.

```
01  FUNCTION
    PositionInAlphabet(Letter :
    CHARACTER) : INTEGER
02    CharCode = ASCII(Letter)
03    PositionInAlphabet = CharCode –
      64
04  END FUNCTION
```

(i) In line 02, a built-in string manipulation function, ASCII, has been used.

Describe what the function ASCII does.

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_____ **[2]**

(ii) Explain why it is necessary to subtract 64 in line 03.

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_____ **[2]**

The application also contains the following function.

```
51  FUNCTION Mystery(n : Integer) :
    Integer
52    IF n < 10 THEN
53      RETURN n
54    ELSE
55      RETURN Mystery (n - 9)
56    END IF
57  END FUNCTION
```

(b) Using this example, explain what is meant by a recursive function.

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_____ **[3]**

(c) State the value which will be returned by Mystery(5) and justify your answer.

Value Returned _____

Justification _____

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_____ **[3]**

(d) Trace the execution of the call Mystery(15), showing every function call and the value returned.

(You may use a diagram.)

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_____ **[5]**

(e) The function Mystery() can be written using iteration instead of recursion, as shown below.

```
FUNCTION Mystery(n : INTEGER) :
INTEGER

      Temp = n

      WHILE Temp > _____________________

        Temp = Temp – 9

      END WHILE

      RETURN _____________________

END FUNCTION
```

Fill in the blank spaces in the algorithm above. [2]

(f) Explain ONE advantage and ONE disadvantage of using iteration instead of recursion when writing functions.

Advantage _____

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_____ **[2]**

Disadvantage _____

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_____ **[2]**