Workbook O Level & IGCSE Computer Science

Solution of Pre-release Material

Paper 22 Summer 2018

Inqilab Ruknuddin Patel

Topical Past Paper Questions

Lecture Notes

Practice Questions

Revision Guide

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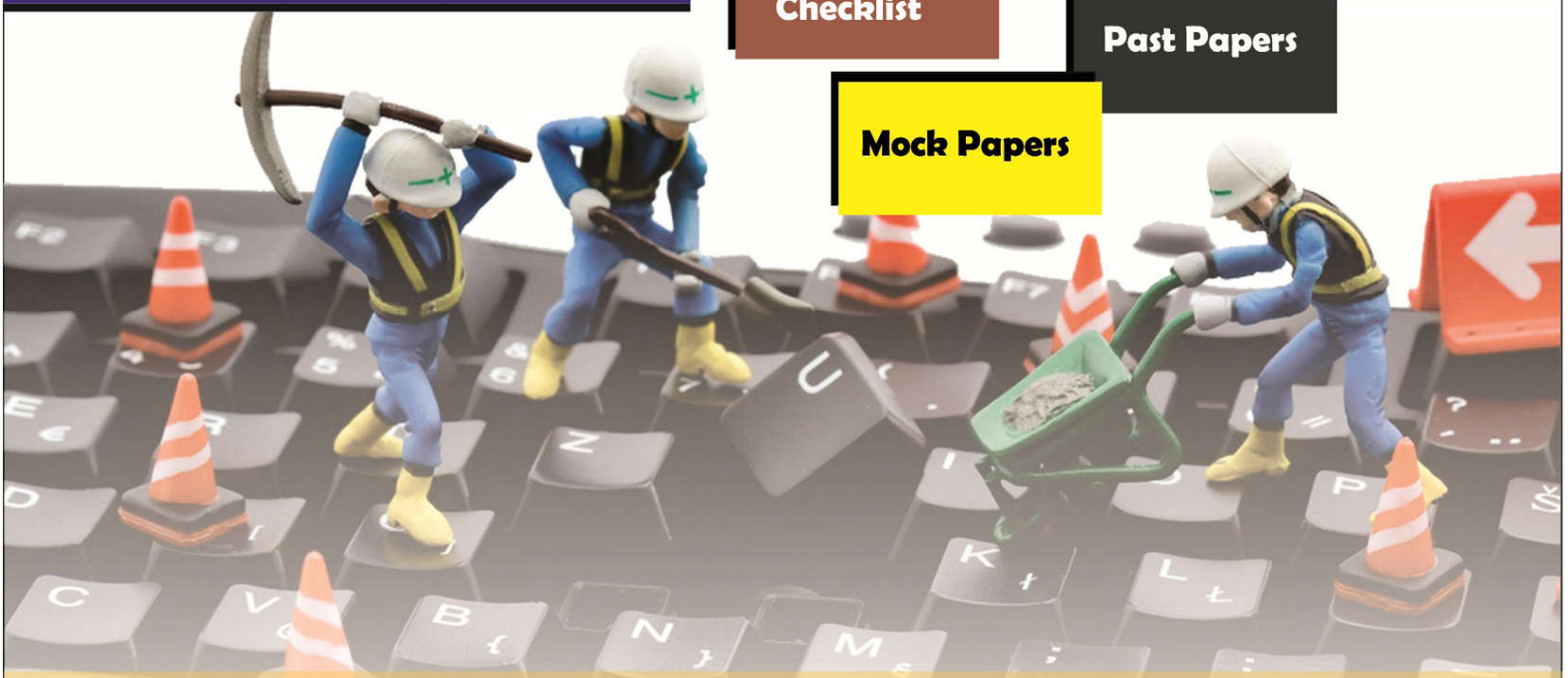
Mock Papers



Computer Science With Inqilab Patel

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Morning Affiliations:
The City School PAF Chapter
Hexis A Levels
Nakhlah

Evening Affiliations:
Uzair Academy (Khalid bin Waleed Rd)
BODMAS (kashmir Road)
Tayrr (Gulshan)

Here is a copy of pre-release material

A farmer records the milk production of a herd of cows. Every cow has a unique 3-digit identity code. Each cow can be milked twice a day, seven days a week. The volume of milk from each cow is recorded in litres correct to one decimal place (yield) every time the cow is milked. The size of the herd is fixed. At the end of the week the total and the average yield for each cow for that week is calculated. The farmer identifies the cow that has produced the most milk that week. The farmer also identifies any cows that have produced less than 12 litres of milk on four or more days that week.

A program is required to record the yield for each cow every time it is milked, calculate the total weekly volume of milk for the herd and the average yield per cow in a week. The program must also identify the cow with the best yield that week and identify any cows with a yield of less than 12 litres of milk for four or more days that week.

Write and test a program or programs for the farmer.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 - Record the yield

Write a program for TASK 1 to record the milk yields for a week. The program records and stores the identity code number and the yield every time a cow is milked.

TASK 2 - Calculate the statistics

Using your recorded data from TASK 1. calculate and display the total weekly volume of milk for the herd to the nearest whole litre. Calculate and display the average yield per cow in a week to the nearest whole litre.

TASK 3 - Identify the most productive cow and cows that are producing a low volume of milk

Extend TASK 2 to identify and display and identity code number and weekly yield of the cow that has produced the most milk. Also identify and display the identity code numbers of any cows with a yield of less than 12 litres of milk for four days or more in the week.

Pre-Release Materials

Summer 2018 Paper22

Working for the solution

Task 1

Data used in task 2 → Task 2

Data used in task 3 → Task 3

Cow No	CowID	Day No	Day Yield1	Rounded to 1 decimal	Day Yield2	Rounded to 1 decimal	Day Total	Cow Total	Herd Total	Nearest Whole Number	Weekly Average of Each Cow	Nearest Whole Number	Count Low Volume Day	Low Volume Cow ID	Best Yield	Best Cow ID
				ROUND(DayYield1,1)						ROUND(HerdTotal)						
									0						0	
1	121							0					0			
		1	7.895	7.9	8.7656	8.8	16.7	16.7								
		2	5.673	5.7	5.123	5.1	10.8	27.5					1			
		3	8.625	8.6	9.1	9.1	17.7	45.2								
		4	9	9.0	8.3	8.3	17.3	62.5								
		5	8	8.0	7.675	7.7	15.7	78.2								
		6	5	5.0	6.123	6.1	11.1	89.3					2			
		7	7.8	7.8	8.21	8.2	16.0	105.3	105.3	105	15.0	15			105	121
2	122							0					0			
		1	5.23	5.2	6.1	6.1	11.3	11.3					1			
		2	5.728	5.7	7.3	7.3	13.0	24.4								
		3	6.12	6.1	5.123	5.1	11.2	35.6					2			
		4	6.132	6.1	5.234	5.2	11.4	47.0					3			
		5	6.1	6.1	5.32	5.3	11.4	58.4					4			
		6	5.3	5.3	6.123	6.1	11.4	69.8					5			
		7	7.124	7.1	7.953	8.0	15.1	84.9	190.2	190	12.1	12		122		
3	123							0					0			
		1	8.763	8.8	7.893	7.9	16.7	16.7								
		2	7.123	7.1	7.3	7.3	14.4	31.1								
		3	9.234	9.2	9.11	9.1	18.3	49.4								
		4	8.823	8.8	10.123	10.1	18.9	68.4								
		5	9.345	9.3	10	10.0	19.3	87.7								
		6	5.234	5.2	6.123	6.1	11.4	99.1					1			
		7	6.89	6.9	8.21	8.2	15.1	114.2	304.3	304	16.3	16			114.2	123
4	1234			Error: Cow ID must be in 3 digits												
	12															
	122			Error: Cow ID must be unique												
	124							0					0			
		1	7.354	7.4	8.213	8.2	15.6	15.6								
		2	6.736	6.7	6.783	6.8	13.5	29.1								

TASK 1 - Record the yield

Write a program for TASK 1 to record the milk yields for a week. The program records and stores the identity code number and the yield every time a cow is milked.

Data structure:

A **data structure** is a specialized format for organizing and storing **data**. General **data structure** types include the array, list, variables, the file, the record, the table, and so on.
Variables: A variable is a memory location. It has a name (an identifier) that is associated with that location. The value associated with a variable name may change during program execution.
Constant: A constant is a memory location. It has a name (an identifier) that is associated with that location. The value associated with a constant remains unchanged during program execution.
Array: A variable that can store multiple data items.
List: a set of data items grouped together.

Data structure:

Data structure name	Data Type	Purpose
CowID[HerdSize]	Integer	To input and store 3 digit cow identityin one dimension array, The size of the array is dependent on herdsize.

Constants:

Constant name	Data Type	Purpose
HerdSize	Integer	To store fixed number of herd size, which remain same throught out execution of code and never change i.e. HerdSize=100 or HerdSize=50 etc. whatever decided at the beginning.

Variabels:

Variable name	Data Type	Purpose
CowNo	Integer	To count number of cows
TempCowNo	Integer	To be used in checking uniqueness of CowID
DayNo	Integer	To count number of days to record daily yield
DayYield1	Real	To record daily yield at first milking
DayYield2	Real	To record daily yield at second milking

In task 1 for task 2

Variabels:

Identifier	Data Type	Purpose
DayTotal	Real	To calculate and store daily yield
CowTotal[HerdSize]	Real	To calculate and store cow total for the week for each cow in one dimension array. The size of the array is dependent on herdsize.

In task 1 for task 3

Variabels:

Identifier	Data Type	Purpose
CountLowVolumeDay(HerdSize)	Real	To count and store number of days when milking was lesser than 12 in 1D array. The size of the array is dependent on herdsize.

Validation:

1) To accept only 3 digit CowId and to reject all others:

```
CowID(CowNo) = Console.ReadLine
'Validation of Cow ID using range check
While CowID(CowNo) < 100 Or CowID(CowNo) > 999
        Console.Write("Error: Enter Cow ID in 3 digits : ")
        CowID(CowNo) = Console.ReadLine
End While
```

2) To check uniqueness of Cow ID

```
For TempCowNo = 1 To (CowNo - 1)
     While CowID(CowNo) = CowID(TempCowNo)
          Console.Write("ID already used. Enter a unique ID : ")
          CowID(CowNo) = Console.ReadLine
     End While
Next
```

Function:

To correct to one decimal place (yield) every time the cow is milked.

```
DayYield1 = Math.Round(DayYield1, 1)
DayYield1 = Math.Round(DayYield1, 1)
```

Test Data:

To check corectness of pseudo code

Test Data Set	Purpose
121, 122, 123	To check input of Normal Data
90, 1212	To check rejection of Abnormal Data
100, 999	To check acceptance of extreme data

Pseudocode

```
//Declaration of Identifiers for task 1
CONSTANT HerdSize ← 100
DECLARE CowID(HerdSize), CowNo, TempCowNo, DayNo : Integer
DECLARE DayYield1, DayYield2 : Single

//Declaration of Identifiers for Task 2
DECLARE CowTotal(HerdSize), DayTotal : Single

//Declaration of Identifiers for Task 3
DECLARE CountLowDays(HerdSize) : Single

//Task 1: Record the Cow ID
FOR CowNo ← 1 TO HerdSize
    PRINT "Cow No. : " , CowNo
    PRINT "Enter 3 digit cow ID : "
    INPUT CowID(CowNo)

    //Validation of Cow ID using range check
    WHILE CowID(CowNo) < 100 Or CowID(CowNo) > 999 DO
        PRINT "Error: Enter Cow ID in 3 digits : "
        INPUT CowID(CowNo)
    END WHILE

    //To check uniqueness of Cow ID
    For TempCowNo = 1 To (CowNo - 1)
        While CowID(CowNo) = CowID(TempCowNo)
            PRINT "ID already used. Enter a unique ID : "
            INPUT CowID(CowNo)
       End While
    Next TempCowNo
  Next CowNo
//Task 1: Record the Yield
  FOR CowNo ← 1 TO HerdSize
    PRINT "Enter yield for cow ID " , CowID(CowNo)
    CowTotal(CowNo) = 0
    CountLowDays(CowNo) = 0
    //Data entry of cow yield
    FOR DayNo ← 1 TO 7
        PRINT "Day No. : " , DayNo
        PRINT "Enter yield of 1st milking in litres : "
        INPUT DayYield1
        DayYield1 ← Math.Round(DayYield1, 1)
        PRINT "Enter yield of 2nd milking in litres : "
        INPUT DayYield2
        DayYield2 ← Math.Round(DayYield2, 1)

        //For Task 2: calculating day total and cow total
        DayTotal ← DayYield1 + DayYield2
        CowTotal(CowNo) ← CowTotal(CowNo) + DayTotal

        //For Task 3: Recording days for the cow producing low volume
        IF DayTotal < 12 THEN
            CountLowDays(CowNo) ← CountLowDays(CowNo) + 1
        END IF

    NEXT DayNo
  NEXT CowNo
```

Visual Basic Code

```
Module Module1
    Sub Main()
  'Declaration of Identifiers for task 1
        Const HerdSize = 3
        Dim CowID(HerdSize), CowNo, TempCowNo, DayNo As Integer
        Dim DayYield1, DayYield2 As Single

        'Declaration of Identifiers for Task 2
        Dim CowTotal(HerdSize), DayTotal As Single

        'Declaration of Identifiers for Task 3
        Dim CountLowDays(HerdSize) As Single

        'Task 1: Record the Cow ID and Yield
        For CowNo = 1 To HerdSize
            Console.WriteLine("Cow No. : " & CowNo)
            Console.Write("Enter 3 digit cow ID : ")
            CowID(CowNo) = Console.ReadLine
            'Validation of Cow ID using range check
            While CowID(CowNo) < 100 Or CowID(CowNo) > 999
                Console.Write("Error: Enter Cow ID in 3 digits : ")
                CowID(CowNo) = Console.ReadLine
            End While
            'To check uniqueness of Cow ID
            For TempCowNo = 1 To (CowNo - 1)
                While CowID(CowNo) = CowID(TempCowNo)
                    Console.Write("ID already used. Enter a unique ID : ")
                    CowID(CowNo) = Console.ReadLine
                End While
            Next
        Next
        'Task 1: Record the Yield
        For CowNo = 1 To HerdSize
            Console.WriteLine("Enter yield for cow ID " & CowID(CowNo))
            CowTotal(CowNo) = 0
            CountLowDays(CowNo) = 0
            'Data entry of cow yield
            For DayNo = 1 To 7
                Console.WriteLine("Day No. : " & DayNo)
                Console.Write("Enter yield of 1st milking in litres : ")
                DayYield1 = Console.ReadLine
                DayYield1 = Math.Round(DayYield1, 1)
                Console.Write("Enter yield of 2nd milking in litres : ")
                DayYield2 = Console.ReadLine
                DayYield2 = Math.Round(DayYield2, 1)

                'For Task 2: calculating day total and cow total
                DayTotal = DayYield1 + DayYield2
                CowTotal(CowNo) = CowTotal(CowNo) + DayTotal

                'For Task 3: Recording days for the cow producing low volume
                If DayTotal < 12 Then
                    CountLowDays(CowNo) = CountLowDays(CowNo) + 1
                End If
            Next
        Next
        Console.ReadKey()

    End Sub
End Module
```

TASK 2 - Calculate the statistics

Using your recorded data from TASK 1 calculate and display the total weekly volume of milk for the herd to the nearest whole litre. Calculate and display the average yield per cow in a week to the nearest whole litre.

Data structure:

Data structure name	Data Type	Purpose
CowTotal(HerdSize)	Real	To calculate and store cow total for the week for each cow in one dimension array. The size of the array is dependent on herdsize.
CowAverage(HerdSize)	Real	To calculate and store average for the week for each cow in one dimension array. The size of the array is dependent on herdsize.

Variabels:

Variable name	Data Type	Purpose
DayTotal	Real	To calculate and store daily yield
HerdTotal	Real	To calculate and store the total weekly volume of milk for the herd.

Initialization:

For weekly total of each cow

```
CowTotal(CowNo) = 0
```

For total volume milk of the herd

```
HerdTotal = 0
```

Formulae:

To calulate total volume of milk for the day

```
DayTotal = DayYield1 + DayYield2
```

To calulate total volume of milk for the week

```
CowTotal(CowNo) = CowTotal(CowNo) + DayTotal
```

To calculate average yield for the week for each cow

```
CowAverage(CowNo) = CowTotal(CowNo) / 7
```

To calculate the total volume of milk obatined in the week

```
HerdTotal = HerdTotal + CowTotal(CowNo)
```

Function:

To convert into nearest whole numbers:

```
HerdTotal = Math.Round(HerdTotal)
CowAverage(CowNo) = Math.Round(CowAverage(CowNo))
```

Pseudocode for Task 2

```
//Coding in task 1 For Task 2: calculating day total and cow total
      DayTotal ← DayYield1 + DayYield2
      CowTotal(CowNo) ← CowTotal(CowNo) + DayTotal
```

```
//Task 2 : calculating total weekly volume and average yield per cow in week
DECLARE HerdTotal, CowAverage[HerdSize]: Single
HerdTotal ← 0
For CowNo ← 1 To HerdSize
      CowAverage[CowNo] ← CowTotal[CowNo] / 7
      CowAverage(CowNo) = Math.Round(CowAverage(CowNo))
      HerdTotal = HerdTotal + CowTotal(CowNo)
Next

HerdTotal = Math.Round(HerdTotal)
Console.WriteLine("Total weekly volume of herd in litres : " & HerdTotal)

//Display average yield per cow in the week
PRINT "Display output:"
For CowNo = 1 To HerdSize
      PRINT "Cow ID : " , CowID[CowNo]
      PRINT "Average yield : " , CowAverage[CowNo]
Next
```

Visual Basic Code for Task 2

```
//Coding in task 1 For Task 2: calculating day total and cow total
            DayTotal = DayYield1 + DayYield2
            CowTotal(CowNo) = CowTotal(CowNo) + DayTotal
```

```
Module Module1

    Sub Main()
        'Task 2 : calculating total weekly volume and average yield per cow in week
        Dim HerdTotal, CowAverage(HerdSize) As Single
        HerdTotal = 0
        For CowNo = 1 To HerdSize
            CowAverage(CowNo) = CowTotal(CowNo) / 7
            CowAverage(CowNo) = Math.Round(CowAverage(CowNo))
            HerdTotal = HerdTotal + CowTotal(CowNo)
        Next

        HerdTotal = Math.Round(HerdTotal)
        Console.WriteLine("Total weekly volume of herd in litres : " & HerdTotal)

        'Display average yield per cow in the week
        Console.WriteLine("Display output:")
        For CowNo = 1 To HerdSize
            Console.WriteLine("Cow ID : " & CowID(CowNo))
            Console.WriteLine("Average yield : " & CowAverage(CowNo))
        Next

        Console.ReadKey()

    End Sub

End Module
```

TASK 3 - Identify the most productive cow and cows that are producing a low volume of milk

Extend TASK 2 to identify and display and identity code number and weekly yield of the cow that has produced the most milk. Also identify and display the identity code numbers of any cows with a yield of less than 12 litres of milk for four days or more in the week.

Data structure:

Data structure name	Data Type	Purpose
CountLowDays(HerdSize)	Real	To count the number of days for each cow when daily yield is lesser than 12 litres in one dimension array. The size of the array is dependent on herdsize.

Variabels:

Variable name	Data Type	Purpose
BestCowID	Integer	To store ID of the most productive cow
BestCowYield	Real	To store weekly yield of the most productive cow

Initialization:

For counting low volume producing cow

CountLowDays(CowNo) = 0

For finding the most productive cow

BestCowYield = 0

Formulae:

To find most productive cow:

```
BestCowYield = 0
For CowNo = 1 To HerdSize
  If CowTotal(CowNo) > BestCowYield Then
      BestCowYield = CowTotal(CowNo)
      BestCowID = CowID(CowNo)
  End If
Next
```

To count low volume days

```
CountLowDays(CowNo) = 0
IF DayTotal < 12 THEN
        CountLowDays(CowNo) ← CountLowDays(CowNo) + 1
END IF
```

Pseudocode for task 3

```
//Coding in task 1: Recording days for the cow producing low volume
      IF DayTotal < 12 THEN
                  CountLowDays(CowNo) ← CountLowDays(CowNo) + 1
      ENDIF
```

```
'Identify the most productive cow
DECLARE BestCowID : Integer
DECLARE BestCowYield : Single
BestCowYield ← 0
For CowNo ← 1 To HerdSize
    If CowTotal(CowNo) > BestCowYield Then
        BestCowYield ← CowTotal(CowNo)
        BestCowID ← CowID(CowNo)
    End If
Next
PRINT "ID of the most productive cow :           " , BestCowID
PRINT "Weekly Yield of the most productive cow : " , BestCowYield)

'Identify the cows producing low volume of milk
PRINT "List of cows producing low volume of milk : "
For CowNo ← 1 To HerdSize
    If CountLowDays(CowNo) >= 4 Then
        PRINT "Low Volume Cow ID : " , CowID(CowNo)
    End If
Next CowNo
```

Visual Basic Code

```
//Coding in task 1: Recording days for the cow producing low volume
      IF DayTotal < 12 THEN
            CountLowDays(CowNo) = CountLowDays(CowNo) + 1
      ENDIF
```

```
Module Module1
    Sub Main()
        'Identify the most productive cow
        Dim BestCowID As Integer
        Dim BestCowYield As Single
        BestCowYield = 0
        For CowNo = 1 To HerdSize
            If CowTotal(CowNo) > BestCowYield Then
                BestCowYield = CowTotal(CowNo)
                BestCowID = CowID(CowNo)
            End If
        Next
        Console.WriteLine("ID of the most productive cow :           " & BestCowID)
        Console.WriteLine("Weekly Yield of the most productive cow : " & BestCowYield)

        'Identify the cows producing low volume of milk
        Console.WriteLine("List of cows producing low volume of milk : ")
        For CowNo = 1 To HerdSize
            If CountLowDays(CowNo) >= 4 Then
                Console.WriteLine("Low Volume Cow ID : " & CowID(CowNo))
            End If
        Next
        Console.ReadKey()
    End Sub
End Module
```

Visual Basic Code for all 3 tasks

```
Module Module1

    Sub Main()
        'Declaration of Identifiers for task 1
        Const HerdSize = 3
        Dim CowID(HerdSize), CowNo, TempCowNo, DayNo As Integer
        Dim DayYield1, DayYield2 As Single

        'Declaration of Identifiers for Task 2
        Dim CowTotal(HerdSize), DayTotal As Single

        'Declaration of Identifiers for Task 3
        Dim CountLowDays(HerdSize) As Single

        'Task 1: Record the Cow ID and Yield
        For CowNo = 1 To HerdSize
            Console.WriteLine("Cow No. : " & CowNo)
            Console.Write("Enter 3 digit cow ID : ")
            CowID(CowNo) = Console.ReadLine
            'Validation of Cow ID using range check
            While CowID(CowNo) < 100 Or CowID(CowNo) > 999
                Console.Write("Error: Enter Cow ID in 3 digits : ")
                CowID(CowNo) = Console.ReadLine
            End While
            'To check uniqueness of Cow ID
            For TempCowNo = 1 To (CowNo - 1)
                While CowID(CowNo) = CowID(TempCowNo)
                    Console.Write("ID already used. Enter a unique ID : ")
                    CowID(CowNo) = Console.ReadLine
                End While
            Next
        Next
        'Task 1: Record the Yield
        For CowNo = 1 To HerdSize
            Console.WriteLine("Enter yield for cow ID " & CowID(CowNo))
            CowTotal(CowNo) = 0
            CountLowDays(CowNo) = 0
            'Data entry of cow yield
            For DayNo = 1 To 7
                Console.WriteLine("Day No. : " & DayNo)
                Console.Write("Enter yield of 1st milking in litres : ")
                DayYield1 = Console.ReadLine
                DayYield1 = Math.Round(DayYield1, 1)
                Console.Write("Enter yield of 2nd milking in litres : ")
                DayYield2 = Console.ReadLine
                DayYield2 = Math.Round(DayYield2, 1)

                'For Task 2: calculating day total and cow total
                DayTotal = DayYield1 + DayYield2
                CowTotal(CowNo) = CowTotal(CowNo) + DayTotal

                'For Task 3: Recording days for the cow producing low volume
                If DayTotal < 12 Then
                    CountLowDays(CowNo) = CountLowDays(CowNo) + 1
                End If
            Next
        Next

        'Task 2 : calculating total weekly volume and average yield per cow in week
        Dim HerdTotal, CowAverage(HerdSize) As Single
        HerdTotal = 0
```

```
        For CowNo = 1 To HerdSize
            CowAverage(CowNo) = CowTotal(CowNo) / 7
            CowAverage(CowNo) = Math.Round(CowAverage(CowNo))
            HerdTotal = HerdTotal + CowTotal(CowNo)
        Next

        HerdTotal = Math.Round(HerdTotal)
        Console.WriteLine("Total weekly volume of herd in litres : " & HerdTotal)

        'Display average yield per cow in the week
        Console.WriteLine("Display output:")
        For CowNo = 1 To HerdSize
            Console.WriteLine("Cow ID : " & CowID(CowNo))
            Console.WriteLine("Average yield : " & CowAverage(CowNo))
        Next

        'Task 3
        'Identify the most productive cow
        Dim BestCowID As Integer
        Dim BestCowYield As Single
        BestCowYield = 0
        For CowNo = 1 To HerdSize
            If CowTotal(CowNo) > BestCowYield Then
                BestCowYield = CowTotal(CowNo)
                BestCowID = CowID(CowNo)
            End If
        Next
        Console.WriteLine("ID of the most productive cow :            " & BestCowID)
        Console.WriteLine("Weekly Yield of the most productive cow : " & BestCowYield)

        'Identify the cows producing low volume of milk
        Console.WriteLine("List of cows producing low volume of milk : ")
        For CowNo = 1 To HerdSize
            If CountLowDays(CowNo) >= 4 Then
                Console.WriteLine("Low Volume Cow ID : " & CowID(CowNo))
            End If
        Next


        Console.ReadKey()


    End Sub

End Module
```