Programming is the process of designing a set of instructions (computer programs) which can be used to perform a particular task or solve a specific problem.

STAGES INVOLVED IN THE PROGRAM DEVELOPMENT CYCLE.

The process of program development can be broken down into the following stages:

1. Problem recognition (Identification of the problem).
2. Problem definition.
3. Program design.
4. Program coding.
5. Program testing & debugging.
6. Program Implementation and maintenance.
7. Program documentation.

- A **pseudocode** is a method of documenting a program logic in which English-like statements are used to describe the processing steps.
- These are structured English-like phrases that indicate the program steps to be followed to solve a given problem.
- The term "**Code**" usually refers to a computer program.
- A **Flowchart** is a diagrammatic or pictorial representation of a program's algorithm.
- It is a chart that demonstrates the logical sequence of events that must be performed to solve a problem.

REASONS WHY A FLOWCHART WOULD BE USED INSTEAD OF A PSEUDOCODE TO SOLVE A PROBLEM

- A flowchart is easy to interpret and understand
- A flowchart provides a better/easier understanding of the problem processing logic Flowcharts provide more detail yet readable structure of analyzing a problem.
- Are more capable of showing the overflow of instructions or data from one process to another.
- One can easily conceptualize the whole program at just a glance from a flowchart.
- A flowchart provides an easier way of error identification and rectification. They offer/give more efficient program maintenance as they give the programmer which part of the program logic to put emphasis on and can be edited to suite new changes.
- With flowcharts information needs or problems are analyzed in a more effective way that reduces costs and time wastage
- Makes results look attractive and organized

USING A FLOWCHART TO PLAN A PROCEDURE

Page2

SYMBOLS USED IN PROGRAM FLOWCHARTS.

Below is a standard set of symbols used to draw program flowcharts as created by American National Standard Institute (ANSI)

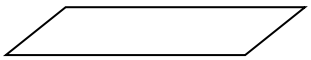
1. <u>Terminal symbol</u>.

 *Ellipse* (Oval in shape)

It is used to indicate the point at which a flowchart, a process or an algorithm begins & ends.

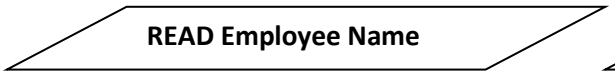
- √ All Flowcharts must have a START & STOP symbol. The START/BEGIN symbol is the first symbol of a flowchart, & identifies the point at which the analysis of the flowchart should begin. The STOP/END symbol is the last symbol of a flowchart, & indicates the end of the flowchart.
- √ The words **Begin** & **End** (or **Start** & **Stop**) should be inserted in the Terminal symbol.

2. <u>Input or Output symbol</u>.

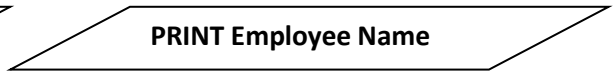
 (*Parallelogram*)

- It is used to identify/specify an input operation or output operation.

For example;



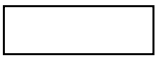
Input operation



Output operation

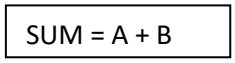
Note. The words mostly associated with I/O operations are **READ** & **PRINT**. READ describes the entry of computer data, while PRINT relates to the printed output of information.

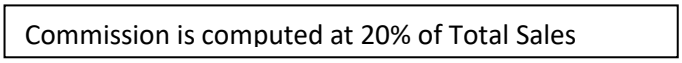
3. <u>Process symbol</u>.

 (*Rectangle*)

- **Process symbol** is used to indicate that a processing or data transformation is taking place.

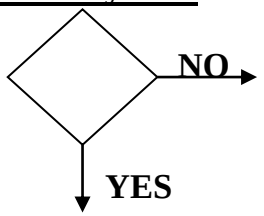
The information placed within the process symbol may be an algebraic formula or a sentence to describe processing.





Processing defined as a Formula ***Processing defined as a Sentence***

4. Decision symbol.



(*Rhombus*)

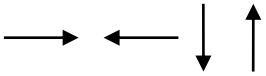
- It is used to indicate/ specify a condition or to show the decision to be made.
There are 2 main components of a Decision symbol:

(i). A question asked within the Decision symbol, that indicates the comparison / logical operation.

(ii). The results of the comparison (which are given in terms of **YES** or **NO**).

The arrows labeled YES or NO lead to the required action corresponding to the answer to the question.

5. Flow lines.

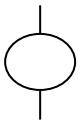


Flow lines with arrowheads are used to indicate the direction of processing of the program logic, i.e., they show the order in which the instructions are to be executed.

The normal flow of a flowchart is from *Top* to *Bottom*, and *Left* to *Right*.

Note. Flow lines should never cross each other.

6. Connector symbol.



Sometimes, a flowchart becomes too long to fit in a single page, such that the flow lines start crisscrossing at many places causing confusion & also making the flowchart difficult to understand.

The **Connector symbol** is used as a connecting point for arrows coming from different directions.

A Connector symbol is represented by a Circle, and a letter or digit is placed within the circle to indicate the link.

Variables: computer memory locations used to temporarily store data while an application is running; each variable must be assigned a data type, which determines the memory location's data type. E.g. double, decimal, single, char, string, integer, Boolean, date, object etc

Declaring a Variable in Code: **Declaration statement**: used to declare, or create, a variable; Declaration statement includes: Scope keyword: Dim, Private, or Static e.g. Const

Keyword: A word that is reserved by the program because it has a special meaning/purpose.

- Name of the variable and data type

Page4

Example 1:

(a) Design an algorithm for a program that can output a phrase "I Love My School"
(b) Using a Flowchart, design a program that can output a phrase "I Love My School"
(c) Using a programming Language of your Choice write a program code that can output a phrase "I Love My School"

Solution (a) Algorithm

START

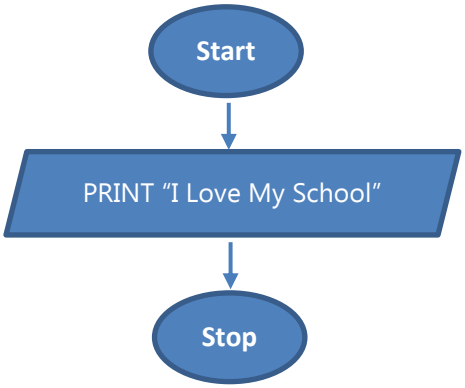
PRINT "I Love My School"

STOP

Solution (c) Code With Visual Basic

```
Private sub commandButton1_Click()
    MsgBox ("I Love My School")
End Sub
```

Solution (b) Flowchart



Example 2:

Write a pseudocode for a program that can be used to classify people according to age. If a person is more than 20 years; output "Adult" else output "Young person".

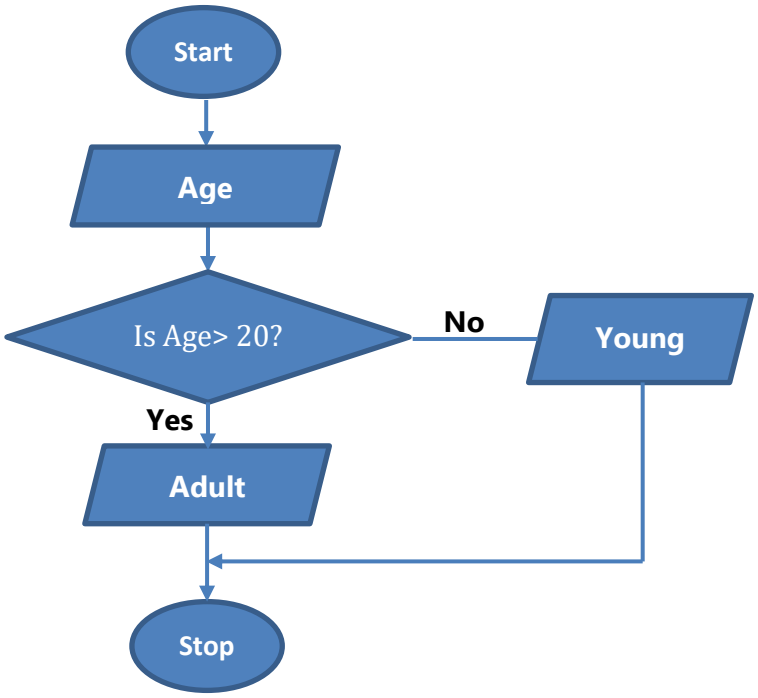
Solution Pseudocode

START
PRINT "Enter the Age"
INPUT Age
IF Age > 20 THEN
PRINT "Adult"
ELSE
PRINT "Young person"
STOP

Code

```
Private sub commandButton1_Click()
Dim Age As Integer
Age = Val(InputBox("Enter the Age"))
If Age > 20 Then
MsgBox("Adult")
Else
MsgBox("Child")
End If
End Sub
```

FLOW CHART



a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Page5

Example 3: (UCE 2015)

Write a pseudocode that can be used to prompt the user to enter two numbers, calculate the sum and average of the two numbers and then display the output on the screen.

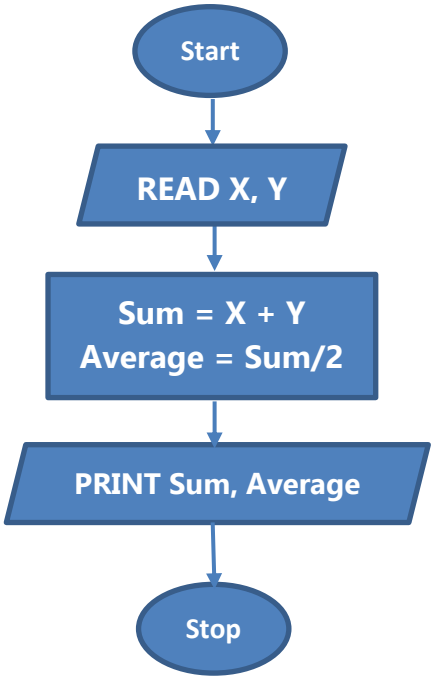
Solution Pseudocode

START
PRINT "Enter two numbers"
INPUT X, Y
Sum = X + Y
Average = Sum/2
PRINT Sum
PRINT Average
STOP

Code

```
Private sub commandButton1_Click()
Dim X, Y, Sum, Average As Integer
X = Val(InputBox("Enter value for X"))
Y = Val(InputBox("Enter value for Y"))
Sum = X + Y
Average = Sum / 2
MsgBox("Sum is:" & Sum & " Average is: " & Average)
End Sub
```

FLOW CHART



Example 4:

Write a structured algorithm that would prompt the user to enter the Length and Width of a rectangle, calculate the Area and Perimeter, then display the result.

Solution Pseudocode

START
PRINT "Enter Length and Width"
Area = Length * Width
Perimeter = 2 (Length + Width)
PRINT Area
PRINT Perimeter
STOP

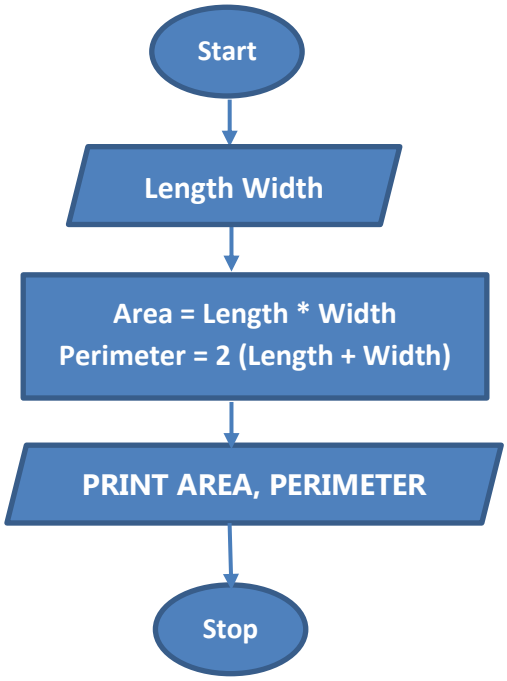
Code

```
Private sub commandButton1_Click()

Dim Length, Width, Area, Perimeter As Integer
Length = Val(InputBox("Enter Length"))
Width = Val(InputBox("Enter Width"))
Area = Length * Width
Perimeter = 2 * (Length + 2 * (Width))
MsgBox("Area is:" & Area & " Perimeter is:" & Perimeter)

End Sub
```

FLOW CHART



a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Example 5 a:

Kato was assigned a task by the computer teacher to develop a program that computes the radius of a circle whose area is to be entered by the user using either C or VB language. Assist Kato to write a working program according to the task assigned to him by the teacher

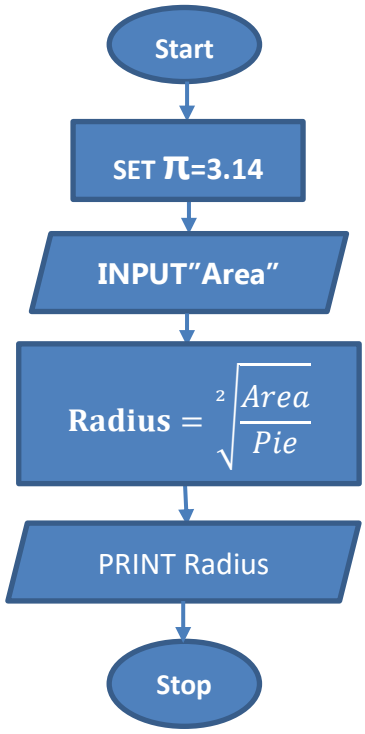
Solution Pseudocode

START
Set π to 3.14
Prompt the user for the Area
Store the Area
Set Radius to Sqrt(Area) / * Sqrt (π)
PRINT Radius
STOP

VB Code

Private sub commandButton1_Click()

```
Dim Area, Pie, Radius As Integer
Pie = 3.14
Area = Val(InputBox("Enter Area"))
Radius = Math.Sqrt(Area) /
Math.Sqrt(Pie)
MsgBox("Radius is:" & Radius)
End Sub
```



Example 5b:

Write a simple program that gives you the perimeter or area of a rectangle using programming language of your choice.

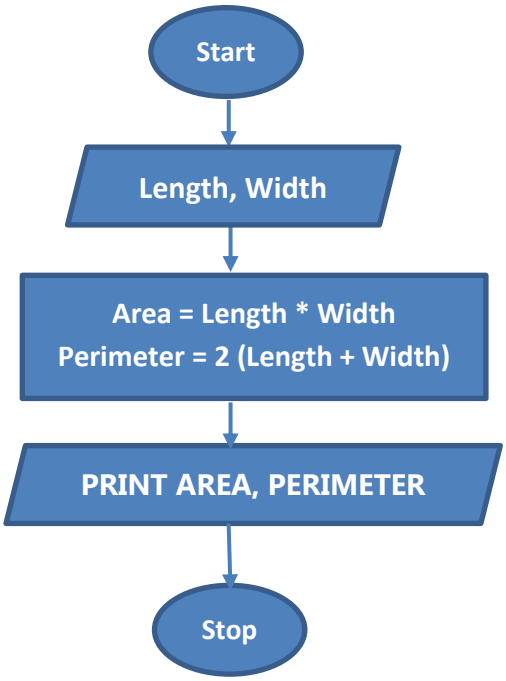
START
PRINT "Enter Length and Width"
Area = Length * Width
Perimeter = 2 (Length + Width)
PRINT Area
PRINT Perimeter
STOP

Code

Private sub commandButton1_Click()

```
Dim Length, Width, Area, Perimeter As
Integer
Length = Val(InputBox("Enter Length"))
Width = Val(InputBox("Enter Width"))
Area = Length * Width
Perimeter = 2 * (Length + 2 * (Width))
MsgBox("Area is:" & Area & " Perimeter
is:" & Perimeter)

End Sub
```



a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Example 6:

Write a pseudocode for a program that would be used to solve equation: **X = MC²**.

Solution Algorithm

START

Enter values from M to C

X = M * C * C

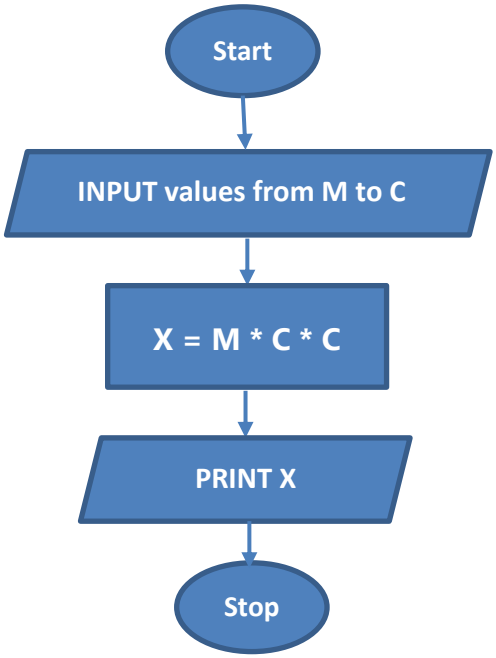
Display X

STOP

Code With Visual Basic

```
Private sub commandButton1_Click()
Dim X, M, C As Integer
M = Val(InputBox("Enter Value M"))
C = Val(InputBox("Enter Value C"))
X = M * C * C
MsgBox("The Answer For X Is: " & X)
End Sub
```

FLOW CHART



Example 7:

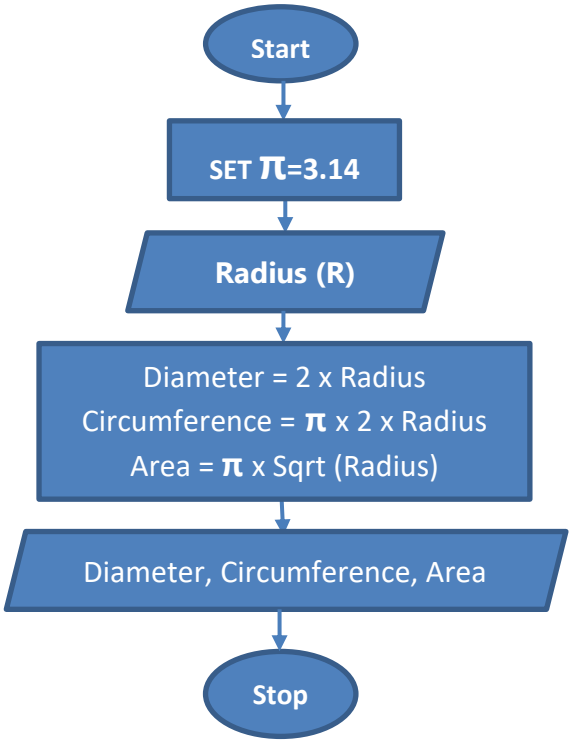
Write a pseudocode that can be used to calculate the Diameter, Circumference and Area of a circle and then display the output on the screen.

START
Set π to 3.14
Prompt the user for the Radius (R)
Store the radius in a variable (R)
Set Diameter to 2 * Radius
Set Circumference to π * 2 * Radius
Set Area to π * Sqrt (Radius)
PRINT Diameter
PRINT Circumference
PRINT Area
STOP

```
Private Sub Command1_Click()
Dim Area, Diameter, Circumference As Double
Dim Radius, Pie As Integer
Pie = 3.14
Radius = Val(InputBox("Enetr Radius"))
Diameter = 2 * Radius
Circumference = Pie * 2 * Radius
Area = Pie * Math.Sqrt(Radius)
MsgBox("Diameter is:" & Diameter)
MsgBox("Circumference is:" & Circumference)
MsgBox("Area is:" & Area)

End Sub
```

FLOW CHART



a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Page8

Example 8:

In an Olympics track event, medals are awarded only to the first three athletes as follows:

a). Position 1: Gold medal
b). Position 2: Silver medal
c). Position 3: Bronze medal

The pseudocode and flowchart below can be used to show the structure of the Nested IF selection.

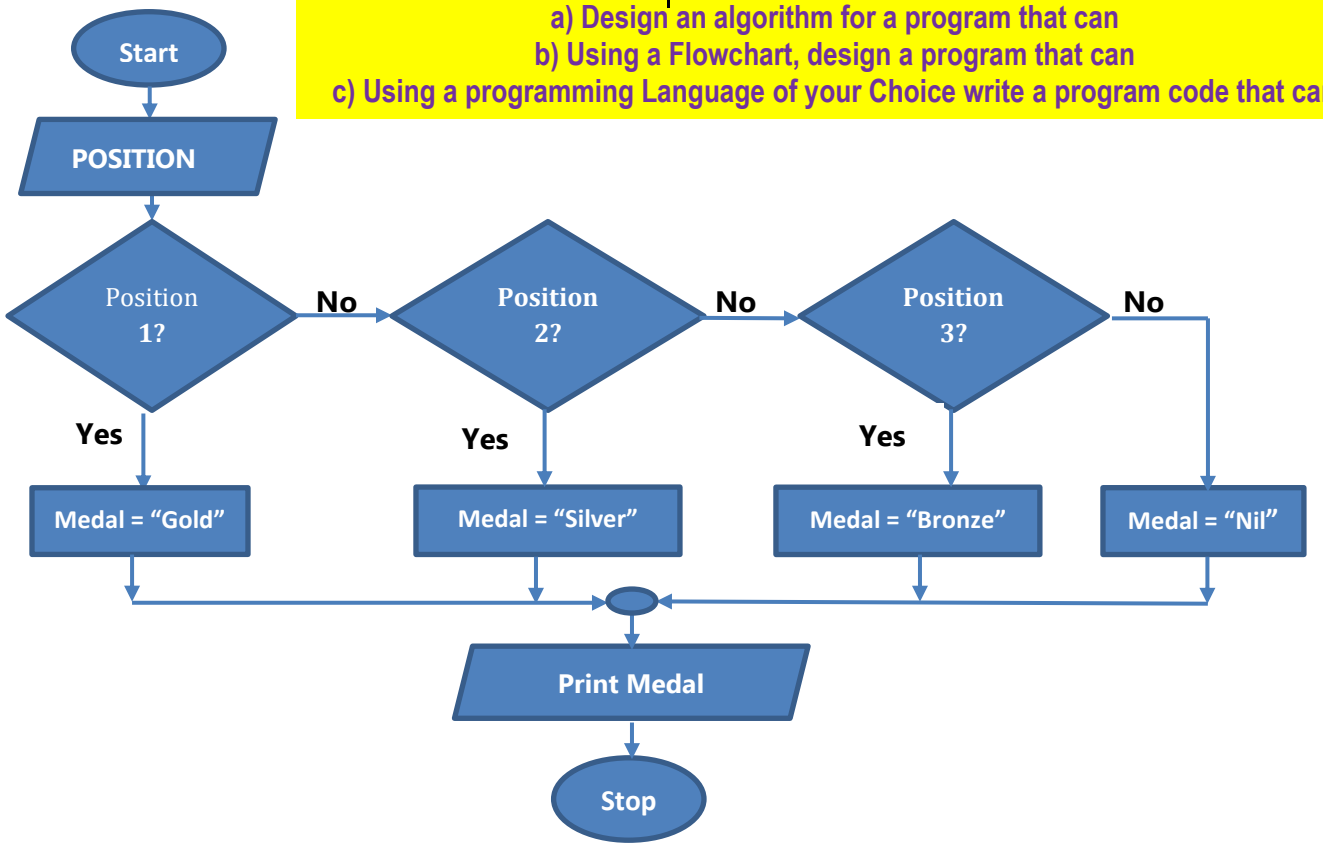
Pseudocode

IF Position = 1 **THEN**
Medal = "Gold"
ELSE
IF Position = 2 **THEN**
Medal = "Silver"
ELSE
IF Position = 3 **THEN**
Medal = "Bronze"
ELSE
Medal = "Nil"
ENDIF
ENDIF
ENDIF

VB Code

```
Private Sub CommandButton1_Click()
Dim Position As Integer
Position = Val(InputBox("Enter Position"))
If Position = 1 Then
MsgBox("Gold")
Else
If Position = 2 Then
MsgBox("Silver")
Else
If Position = 3 Then
MsgBox("Bronze")
Else
MsgBox("Nil")
End If
End If
End If
End Sub
End Class
```

a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can



Example 9: (UCE 2018)

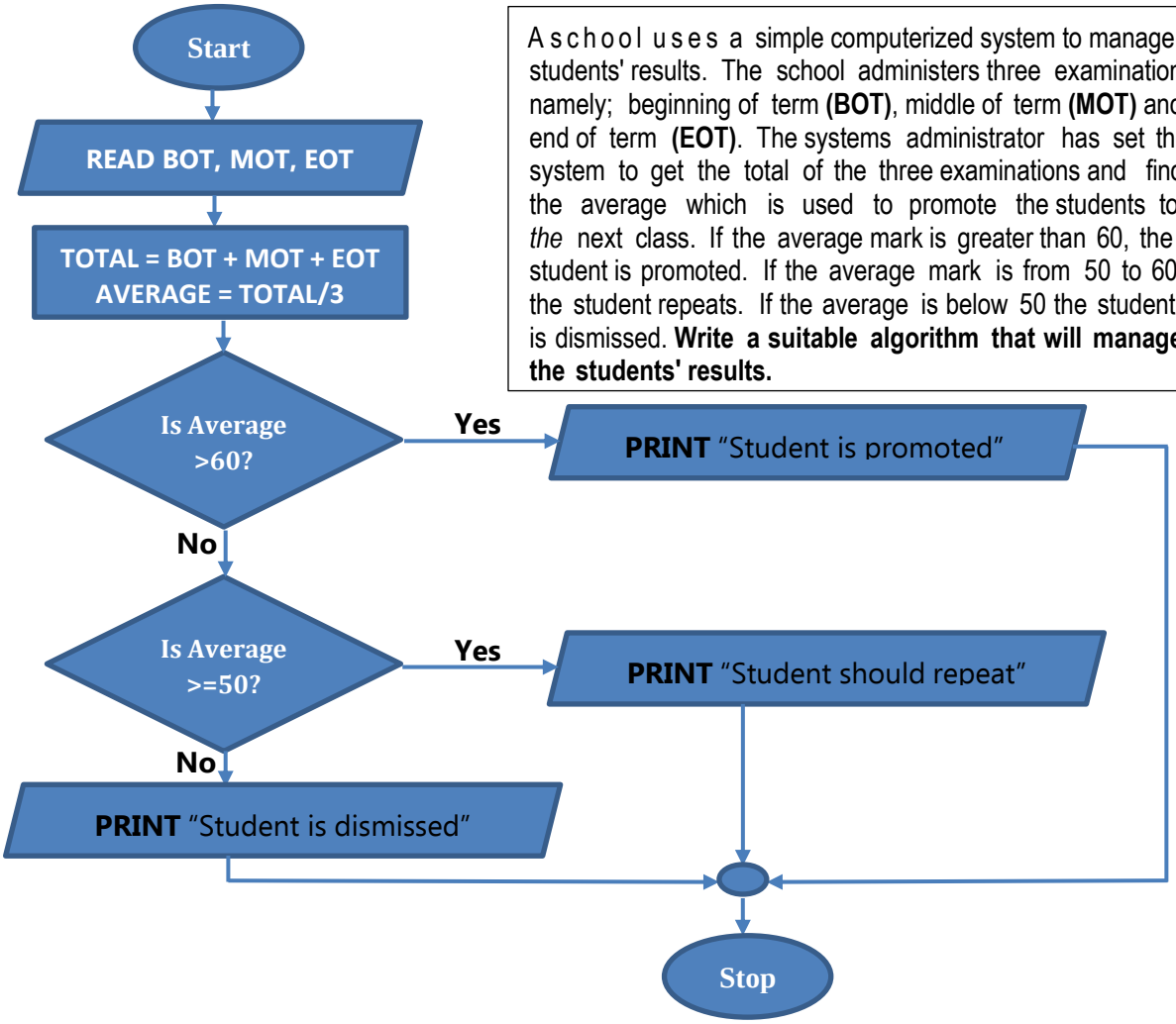
Write a suitable algorithm that will manage the students' results.

Pseudocode

```
START
PRINT "Enter BOT, MOT and EOT marks"
READ BOT, MOT, EOT
TOTAL = BOT + MOT + EOT
AVERAGE = TOTAL/3
IF AVERAGE > 60 THEN
PRINT "Student is promoted"
ELSE
IF AVERAGE >= 50 THEN
PRINT "Student should repeat"
ELSE
PRINT "Student Dismissed"
END IF
END IF
END
```

VB Code

```
Private Sub CommandButton1_Click()
Dim BOT, MOT, EOT, TOTAL, AVERAGE As Double
BOT = Val(InputBox("Enter BOT mark"))
MOT = Val(InputBox("Enter MOT mark"))
EOT = Val(InputBox("Enter EOT mark"))
TOTAL = BOT + MOT + EOT
AVERAGE = TOTAL / 3
MsgBox("The Average is " & AVERAGE)
If AVERAGE > 60 Then
MsgBox("Student is promoted.")
Else
If AVERAGE >= 50 Then
MsgBox("Student should repeat.")
Else
MsgBox("Student is dismissed.")
End If
End If
End Sub
```



A school uses a simple computerized system to manage students' results. The school administers three examinations namely; beginning of term **(BOT)**, middle of term **(MOT)** and end of term **(EOT)**. The systems administrator has set the system to get the total of the three examinations and find the average which is used to promote the students to *the* next class. If the average mark is greater than 60, the student is promoted. If the average mark is from 50 to 60, the student repeats. If the average is below 50 the student is dismissed. **Write a suitable algorithm that will manage the students' results.**

a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Example 10:

Given a quadratic equation in the form: , where a, b, and c are constant.
Use a flowchart to design a program algorithm for calculating of the roots of quadratic equation.
Write the Pseudo code for the algorithm in (a) above
Using C or Visual Basic, write source code for a program that can solve the quadratic equations.

START
PRINT "Enter the coefficients a, b and c of the quadratic equation"
READ a, b, c

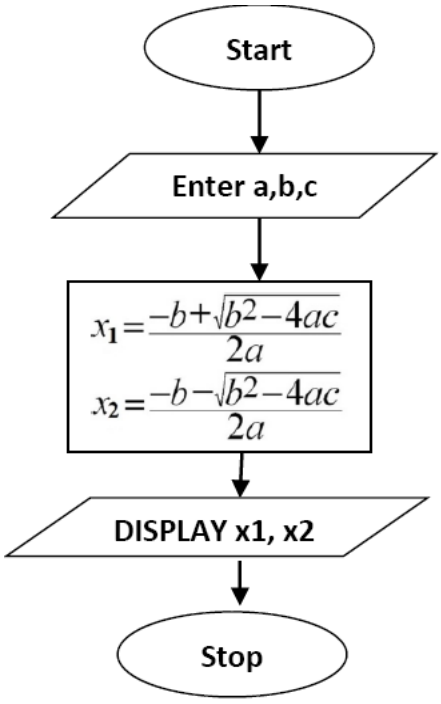
$X_1 = \frac{-b+\sqrt{b^2-4ac}}{2a}$

$X_1 = \frac{-b-\sqrt{b^2-4ac}}{2a}$

DISPLAY x1, x2
STOP

Simple Quadratic Equation Program using Visual Basic

```
Private Sub CommandButton1_Click()
Dim a, b, c As Integer
Dim x1, x2 As Double
a = Val(InputBox("Enter value for a"))
b = Val(InputBox("Enter value for b"))
c = Val(InputBox("Enter value for c"))
x1 = (b + Math.Sqr(b * b - (4 * a * c))) / (2 * a)
x2 = (-b + Math.Sqr(b * b - (4 * a * c))) / (2 * a)
MsgBox ("The roots are:" & x1 & " and " & x2 & ".")
End Sub
```



a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Example 11:

Page1

The class teacher of Form 3S in a secondary school requested a programmer to design for her a simple program that would help her do the following:

(a) Enter the names of students and marks obtained in 8 subjects – Mathematics, English, Kiswahili, Biology, Chemistry, Business studies, Computer studies, and History.

(b) After entering the mark for each subject, the program should calculate the total and average marks for each student.

(c) Depending on the Average mark obtained, the program should assign grade as follows:

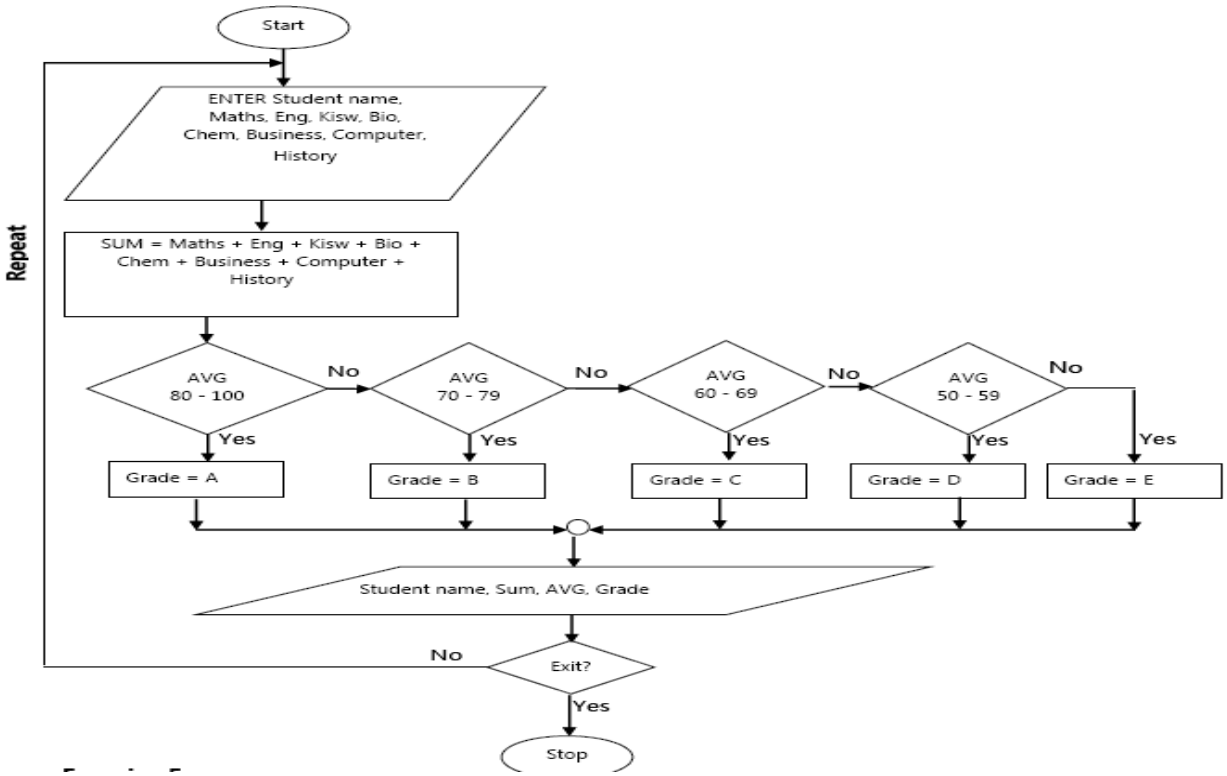
(i) Between 80 and 100 – A
(ii) Between 70 and 79 – B
(iii) Between 60 and 69 – C
(iv) Between 50 and 59 – D
(v) Below 50 – E

(d) The program should then display each student's Name, Total marks and the Average grade.

Using a pseudocode and a flowchart, write an algorithm that shows the design of the program.

START
REPEAT
PRINT "Enter student Name and subject marks"
INPUT Student name, Maths, Eng, Kisw, Bio, Chem, Business, Computer, History
SUM = Maths + Eng + Kisw + Bio + Chem + Business + Computer + History
AVG = SUM/8
IF (AVG => 80) AND (AVG <= 100) **THEN**
Grade = "A"
ELSE
IF (AVG => 70) AND (AVG <= 79) **THEN**
Grade = "B"
ELSE
IF (AVG => 60) AND (AVG <= 69) **THEN**
Grade = "C"
ELSE
IF (AVG => 50) AND (AVG <= 59) **THEN**
Grade = "D"
ELSE
Grade = "E"
ENDIF
ENDIF
ENDIF
ENDIF
PRINT Student name, Sum, AVG, Grade
UNTIL Count = Number of students
STOP

a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can



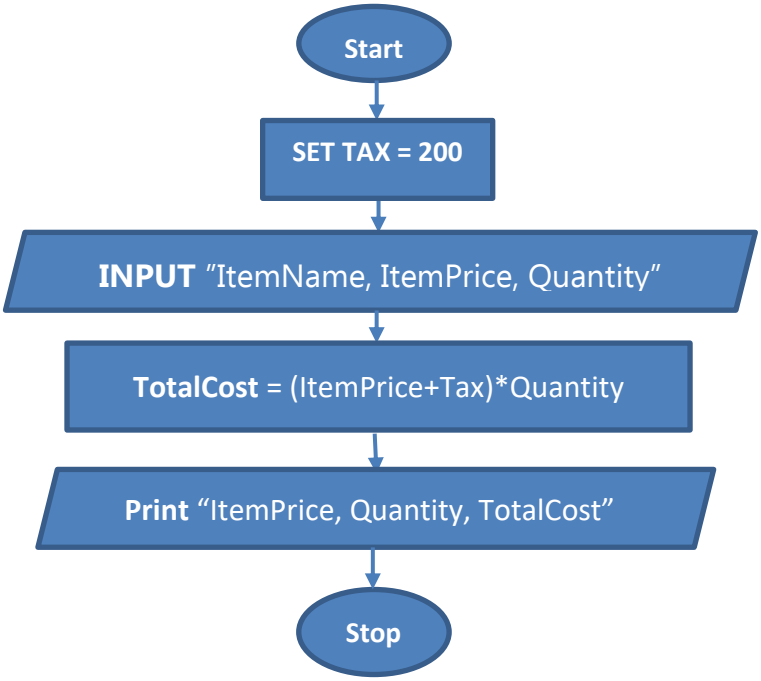

```
Dim Maths, Eng, Kisw, Bio, Chem, Business, Computer, History, Sum, Average As Integer
        Dim Name As Double
        Name = Val(InputBox("Enter Students' Name"))
        Maths = Val(InputBox("Enter Maths Marks"))
        Eng = Val(InputBox("Enter Eng Marks"))
        Kisw = Val(InputBox("Enter Kisw Marks"))
        Bio = Val(InputBox("Enter Bio Marks"))
        Chem = Val(InputBox("Enter Chem Marks"))
        Business = Val(InputBox("Enter Business Marks"))
        Computer = Val(InputBox("Enter Computer Marks"))
        History = Val(InputBox("Enter History Marks"))
        Sum = Maths + Eng + Kisw + Bio + Chem + Business + Computer + History
        Average = Sum / 8
        MsgBox("Sum is:" & Sum & " Average is: " & Average)
        If Average >= 80 And Average <= 100 Then
            MsgBox("A")
        Else
            If Average >= 70 And Average <= 79 Then
                MsgBox("B")
            Else
                If Average >= 60 And Average <= 69 Then
                    MsgBox("C")
                Else
                    If Average >= 50 And Average <= 59 Then
                        MsgBox("D")
                    Else
                        MsgBox("E")
                    End If
                End If
            End If
        End If
    End Sub
End Class
```

a) Design an algorithm for a program that can
b) Using a Flowchart, design a program that can
c) Using a programming Language of your Choice write a program code that can

Exercise

Mountain Biking wants an application that allows the store clerk to enter an item's price and the quantity purchased by a customer, but every item is charged a tax of **200**. The application should calculate the total amount the customer owes by multiplying the price by the quantity purchased plus the tax. It should then display the total amount owed.

Start
Set Tax to 200
Promt the User for 'ItemName, ItemPrice, Quantity'
Read "ItemName, ItemPrice, Quantity"
TotalCost = (ItemPrice + Tax)*Quantity
Print ItemPrice, Quantity, TotalCost
Stop



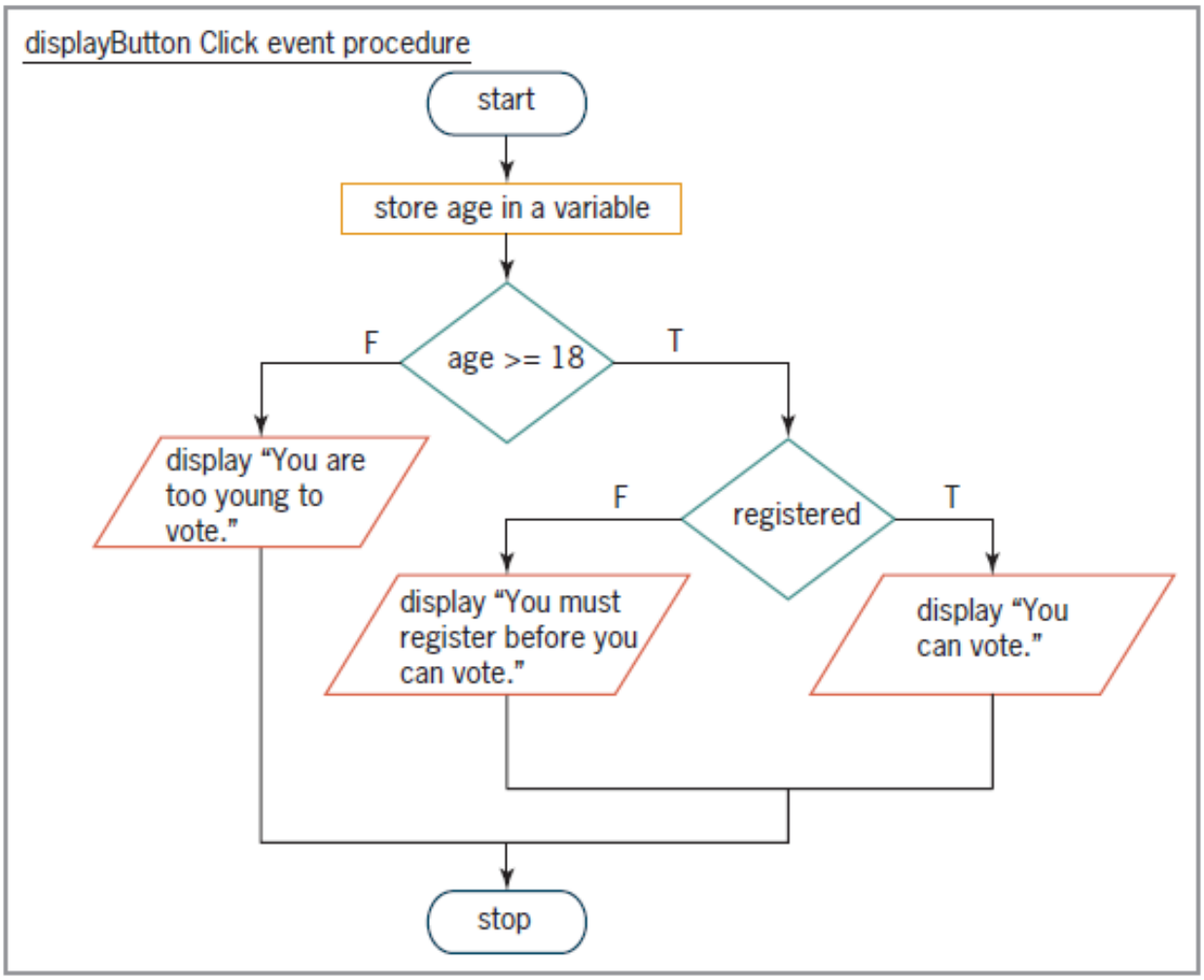

```
Private Sub Command1_Click()
Dim ItemPrice, Quantity, TotalCost As Integer
Dim ItemName As Double
Const Tax As Double = 200
ItemName = Val(InputBox("Enter ItemName"))
ItemPrice = Val(InputBox("Enter ItemPrice"))
Quantity = Val(InputBox("Enter Quantity"))
TotalCost = (ItemPrice + Tax) * Quantity
MsgBox ("ItemPrice is:" & ItemPrice & " Quantity Is :" & Quantity &
"TotalCost is:" & TotalCost)
End Sub
```

The Harrisburg city manager wants an application that determines voter eligibility and displays one of three messages. The messages and criteria for displaying each message are as follows:

Message	Criteria
You are too young to vote.	person is younger than 18 years old
You can vote.	person is at least 18 years old and is registered to vote
You must register before you can vote.	person is at least 18 years old but is not registered to vote

The manager has assigned you to develop a working application for this company, in your preparations develop a **pseudocode**, a **flow chart** and finally choose from VB or C languages to write a **code** that will be used for this application.

START
Print "Enter Age"
Input Age
If Age >=18 Then
If Registered = True
Print "You Can Vote"
Else
Print "You Must Registered Before You Can Vote"
Else
End If
Print "You Are Too Young To Vote"
End If
STOP




```
Dim Age As Integer
        Age = Val(InputBox("Enter Age"))
        If Age >= 18 Then
            If CheckBox1.Checked = True Then
                MsgBox("You Can Vote")
            Else
                MsgBox("You Must Register Before Can Vote")
            End If
        Else
            MsgBox("You Are Too Young To Vote")
        End If
    End Sub
```

Example 11:
With aid of a pseudocode and a flowchart, design an algorithm that:

a). Prompt the user to enter two numbers X and Y.

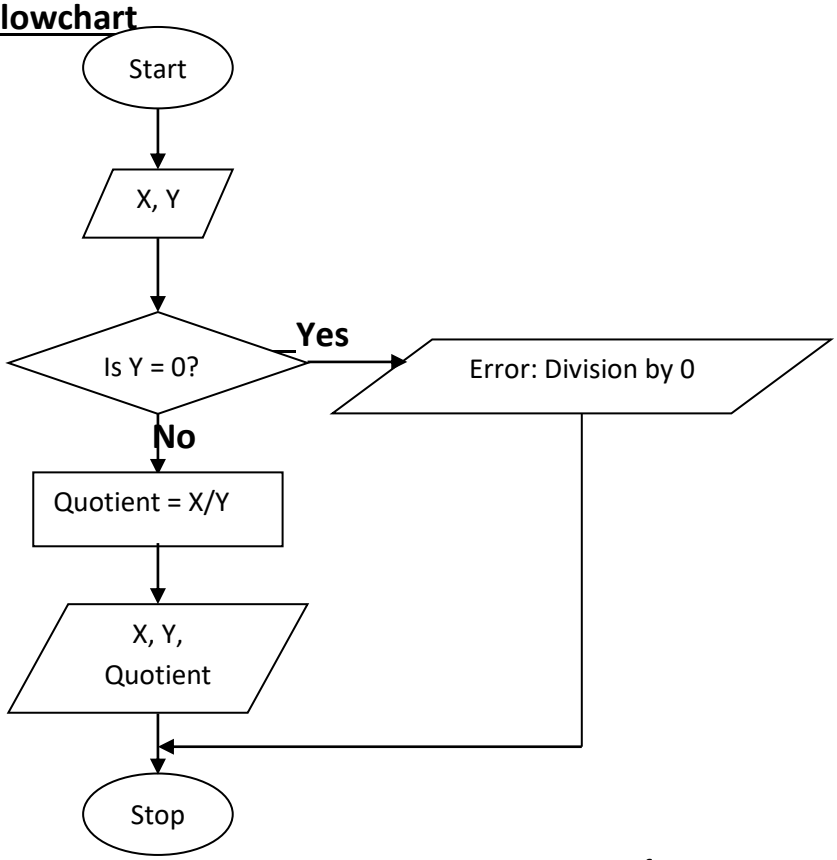
b). Divide X by Y. However, if the value of Y is 0, the program should display an error message "Error: Division by zero".

c). Using C or VB language, write a code for the above.

Pseudocode

```
START
PRINT "Enter two numbers X and Y"
        INPUT X, Y
        IF Y = 0 THEN
                PRINT "Error: Division by zero"
        ELSE
Quotient = X/Y
PRINT X, Y, Quotient
ENDIF
STOP
```

Flowchart



Page1

```
Dim X, Y, Quotient As Double
    X = Val(InputBox("Enter Value For X"))
    Y = Val(InputBox("Enter Value For Y"))
    If Y = 0 Then
        MsgBox ("Division By Zero")
    Else
Quotient = X / Y
MsgBox ("X is:" & X & "Y is:" & Y & "Quotient is:" & Quotient)
End If
```