

**Midterm Exam, Total = 100 Points**

Please write neatly and show as much of your work as possible for partial credit. Scan through all problems first, and attack the easiest problems first. Use the last page or the back if you need more space. Good luck!

**1. (15 pts) Short Answer.** Provide brief (1-3 sentence) answers to the following:

a) What is the major difference between a program that runs under a virtual machine vs. one that does not?

b) Given a textbox control on your form named `txtInfo`, what line of code would make the textbox display the following?



c) What happens when a program is compiled?

d) What is the difference in the binary representation between the String "5" and the number 5 represented as an Integer? (You can be general, i.e. you don't have to specifically say exactly what bits differ)

e) What does "Option strict on" force the programmer to do?

## 2. (6 pts) Arithmetic Operations

Show the output of the following code fragment:

```
Console.WriteLine(CInt(5 / 6))
Console.WriteLine(1 + 2 * 3 + 4)
Console.WriteLine(10 Mod 3)
```

## 3. (9 pts) Bug Hunt

All of the following code snippets have a bug. **Identify each one and fix the bug.** Assume the necessary code is in place to make a working program (e.g. the necessary TextBoxes exist, the code is within some event, etc.).

a) The following code should print “Big” or “Bigger”

```
Dim i As Integer
i = CInt(TextBox("Enter an integer."))
If (0 < i < 10) Then
    Console.WriteLine("Big")
ElseIf (10 <= i) Then
    Console.WriteLine("Bigger")
End If
```

b) The following should set n to the greater of two numbers entered in textboxes:

```
Dim n As Integer
If (TextBox1.Text < TextBox2.Text) Then
    n = TextBox2.Text
Else
    n = TextBox1.Text
End If
```

c) The following should prompt the user to enter “1” or “2” and if the user enters anything else then re-display the prompt to enter “1” or “2”:

```
Dim i As Integer
Do
    i = CInt(TextBox("Enter 1 or 2"))
Loop Until ((i = 1) And (i = 2))
```

#### 4. (15 pts) Burning Calories

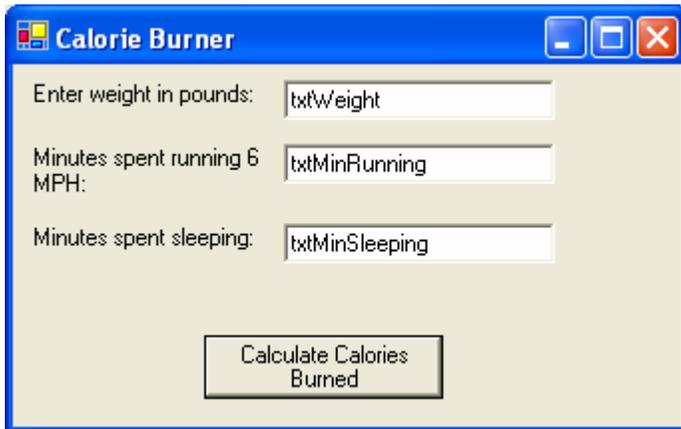
One way to measure the amount of energy that is expended during exercise is to use metabolic equivalents (MET). Here are some METs for various activities:

Running 6 MPH: 10 METs  
Sleeping: 1 MET

The number of calories burned per minute may be estimated using the formula:

$$\text{Calories/Minute} = 0.00795 \times \text{METs} \times \text{Weight\_In\_Pounds}$$

Write code that goes into a button click that calculates the total calories burned given inputs of weight, minutes spent running 6 MPH, and minutes spent sleeping. Output the answer in a MessageBox. Here is the form, where the names of the textboxes are indicated by the text within them:



Here is the event handler where you can fill in your code:

```
Private Sub btnCalculate_Click(...) Handles btnCalculate.Click  
    ' Write your code here
```

```
End Sub
```

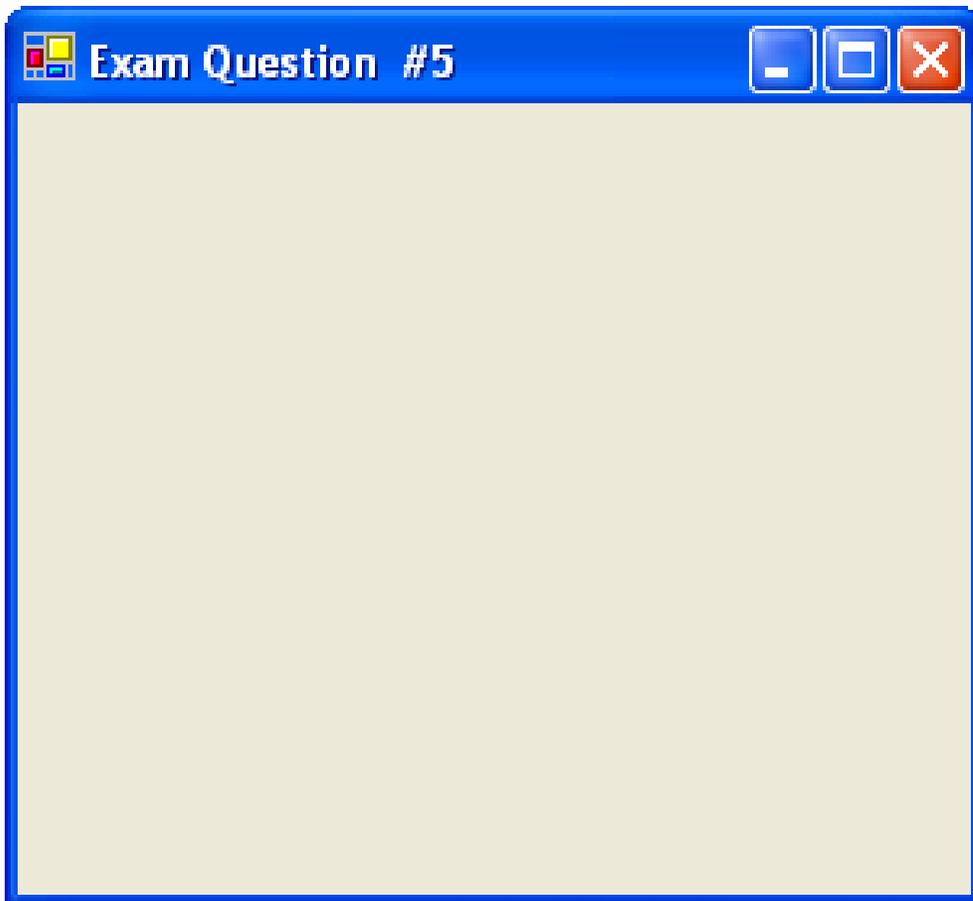
## 5. (20 pts) Loops and Drawing

Your form has a PictureBox named PictureBox1 that occupies the entire form. Here is the code that is in the Paint event for the PictureBox:

```
Private Sub PictureBox1_Paint(. . .) Handles PictureBox1.Paint
    Dim i As Integer
    Dim g As Graphics

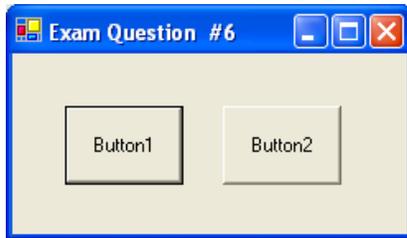
    g = e.Graphics
    i = 0
    While (i < 150)
        g.DrawRectangle(Pens.Black, i, i, 100, 50)
        i = i + 50
    End While
End Sub
```

In the screen shot below, sketch out what will be drawn in the PictureBox when the program is executed.



## 6. (15 pts) Scoping

Here is a program with two buttons:



Here is the code:

```
Public Class Form1
    Inherits System.Windows.Forms.Form

    Dim var1 As Integer = 10

    Private Sub Button1_Click(. . .) Handles Button1.Click
        Dim var2 As Integer

        Console.WriteLine("Var 1 = " & var1)
        Console.WriteLine("Var 2 = " & var2)
        var2 = var2 + 1
        var1 = var1 + 10
    End Sub

    Private Sub Button2_Click(. . .) Handles Button2.Click
        Dim var1 As Integer

        var1 = 5
        Console.WriteLine("Var 1 = " & var1)
        var1 = var1 + 25
    End Sub
End Class
```

Show what is output to the Console when the program is executed and the user clicks on Button1 twice and then Button2 twice:

1) Button1 clicked:                      Output:

2) Button1 clicked again:                Output:

3) Button 2 clicked:                      Output:

4) Button 2 clicked again:               Output:

## 7. (10 points) Algorithm Design – Maximize Candy Intake

Suppose we can buy a chocolate bar from the vending machine for \$1 each. Inside every chocolate bar is a golden coupon. The machine allows us to redeem 6 coupons for one chocolate bar.

We would like to know, if given  $n$  dollars, how many chocolate bars can be eaten? Also, how many coupons will we have leftover?

For example, for 6 dollars, we can buy six chocolate bars from the machine and get 6 coupons. We can then redeem the coupon for one more chocolate bar. This means we can get a total of 7 chocolate bars with 1 coupon leftover.

For 11 dollars, we could have consumed 13 chocolate bars and still have one coupon left.

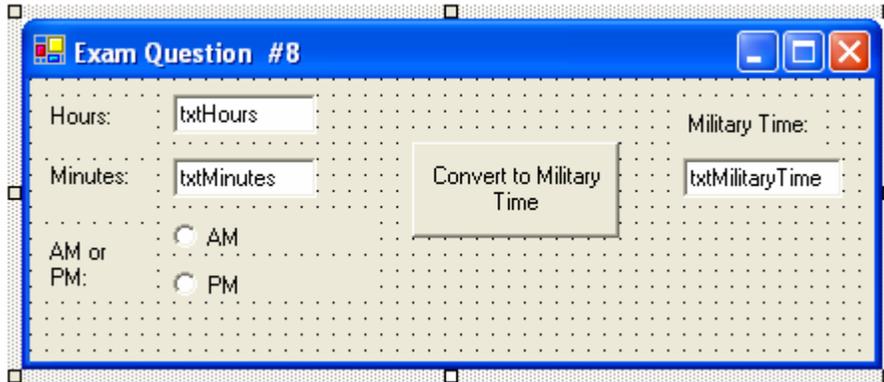
For 12 dollars, we could have consumed 14 chocolate bars and have two coupons left.

Describe an algorithm that computes the number of chocolate bars we can eat and the number of coupons leftover if you start with  $n$  dollars. **You do not have to write any actual code, just describe the algorithm in English or pseudocode.**

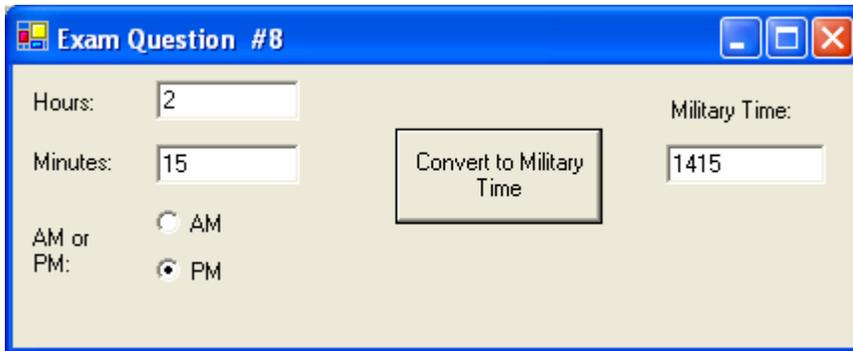
**For up to 5 extra credit points** (but max score on the exam < 100) write code that could go into a Button Click event that computes the number of candy bars we can eat and the number of leftover coupons.

## 8. (10 points) The Time Machine

Complete the program described below so that it inputs time in AM/PM format (given hours, minutes, and AM/PM) and converts it to 24 hour military time. The form is laid out as follows, where the text indicates the names of the controls:



Here is a sample run, where upon clicking the button, the program computes 1415:



Complete the code in the button click event to make this program functional. You will find the following function useful:

`Format(number, "00")`

This function returns a string containing *number* with a leading zero if possible. For example:

`Format(2, "00")` returns "02"  
`Format(15, "00")` returns "15"

Make sure your program correctly handles times between 12 AM and 1 AM!

Space for your solution is on the next page.

Fill in the code in the button click event for the time conversion program:

```
Private Sub btnConvert_Click(...) Handles btnConvert.Click  
    ' Write your code here
```

```
End Sub
```

(this page intentionally left blank if you need extra space for your answer)