1. (25 points) Write a Visual Basic FUNCTION which, when passed 3 doubles (a, b, and c) representing the sides of a valid triangle, returns a float for the area calculated using Heron's formula. The area of any triangle can be calculated by Heron's formula, which defines the semiperimeter, s, as half the sum of the sides of the triangle. The area of the triangle then is given by the formula \[ \text{area} = \text{the square root of} \left( \frac{s(s - a)(s - b)(s - c)}{4} \right) \]
where a, b and c are the sides of the triangle and s is the semiperimeter. The function MUST first make sure the triangle is valid by testing the sides as in the hint below; if the sides do not represent a valid triangle, the function returns 0 as an error indicator.

Notes & Hints:
- For a triangle to be valid, the sum of any two sides must always be greater than the third side.
- You must use a function, \text{sqr}, to calculate the square root of a number. The Visual Basic library provides this function and its usage is as follows:
  - \text{sqr( Number as Double ) as Double}
  - \text{DO NOT WRITE THIS sqr FUNCTION, JUST USE IT!} (The Visual Basic library provides it).
- You are not prompting the user for input—the sides are passed to the function!

PLEASE USE NEXT PAGE FOR YOUR SOLUTION
-- THIS BLANK PAGE PROVIDED FOR YOUR SOLUTION TO QUESTION 1 --
2. (25 Points) Write a MODULE containing the code that sets up an application for using DirectDraw 7 in normal (windowed) mode.

You should declare the variables and have an Initialize procedure that readies the application for drawing on a form named `frmMain`.

You do not have to write any code in the form.

You should ensure that your module requires declaration of variable names.

You do not have to blt, just set up a primary surface and an offscreen surface.

Some of the objects and constants you may need are as follows. To minimize time writing, you may use the abbreviations where provided to represent the constants or objects (not to be used as variable names).

<table>
<thead>
<tr>
<th>Object/Constant</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DirectX7</td>
<td>DX</td>
</tr>
<tr>
<td>DirectDraw7</td>
<td>DD</td>
</tr>
<tr>
<td>DirectDrawSurface7</td>
<td>DDS</td>
</tr>
<tr>
<td>DDSCL_NORMAL</td>
<td>DDSCL_NORMAL</td>
</tr>
<tr>
<td>DDSURFACEDESC2</td>
<td>DDSD</td>
</tr>
<tr>
<td>DDSD_CAPS</td>
<td>DDSD_CAPS</td>
</tr>
<tr>
<td>DDSCAPS_PRIMARYSURFACE</td>
<td>DDSCAPS_P</td>
</tr>
<tr>
<td>DDSCAPS_OFFSCREENPLAIN</td>
<td>DDSCAPS_O</td>
</tr>
</tbody>
</table>

Some surface description statements you'll need are:

```plaintext
<your surface description>.lFlags = DDSD_CAPS
<your surface description>.ddsCaps.lCaps = [fill in the rest]
```

Extra Credit (3 points): Set up a clipper object, too.

PLEASE USE NEXT PAGE FOR YOUR SOLUTION
3. (20 points) What output does the following code fragment produce (i.e. what is the final value of sAnswer)?

```vbnet
Dim i As Integer
Dim j As Integer
Dim lResult As Long
Dim sAnswer As String

For i = 5 To 9 Step 3
    For j = 1 To 3 Step 1
        lResult = i * j + 1
        sAnswer = sAnswer & CStr(lResult)
    Next j
Next i

MsgBox sAnswer
```

**Answer:**

4. (15 points) There are at least 5 errors in the module code below. Comments, formatting, capitalization, or lack thereof, are not any of the errors. Identify the line numbers and the errors.

```vbnet
1 Option Explicit;
2 Dim m_iSpellListID As New Integer
3 Property Get SpellListID() As Integer
4     SpellListID = m_iSpellListID
5 End Sub
6
7 Public Sub Initialize()
8    Dim iRandomNumber as Int
9    'generate a random number
10   iRandomNumber = Randomize(100)
11   m_iSpellListID = iRandomNumber
12 End Function
```

**Line** | **Error**
---|---
1 | ___________________________________________
2 | ___________________________________________
3 | ___________________________________________
4 | ___________________________________________
5 | ___________________________________________

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5. (15 points)
   i. In DirectDraw, a page-flipping structure is a complex surface structure: 
      True____ False ____
   
   ii. What is the Hardware Emulation Layer and what does it do? (one sentence 
       answer only):
       ________________________________________________________________
   
   iii. Bounding boxes are typically used in what aspect of 2D game programming? 
        (one two-word answer only):
        ________________________________________________________________
   
   iv. The undesirable condition where part of a whole image on screen is shifted, 
        created when the system is simultaneously drawing to the same primary 
        display surface the video card is reading, is known as ________________.
   
   v. What is pixel overlap comparison used for? (one sentence answer only):
       ________________________________________________________________