

Laboratory Exercise 13 (Intro to MFC)

Topics: Microsoft Foundation Classes

Goals: Upon successful completion of this lab you should be able to:

1. Write a simple windows program using the MFC Frame Window Class

Related text sections:

Chapters 1 - 5 (Introduction to MFC)

Laboratory Exercise 13 Instructions

1. Create a new Visual C++ application project called Lab13.
2. Add a new header file called CLab13Win.h to your project. Enter the following class description:

```
#include <afxwin.h>

class CLab13Win : public CFrameWnd
{
public:
    CLab13Win ();
    afx_msg void OnPaint ();
private:
    int m_nMessageX;
    int m_nMessageY;
    DECLARE_MESSAGE_MAP ()
};
```

3. Add a new header file called CLab13App.h to your project. Enter the following class description:

```
#include <afxwin.h>
#include "CLab13Win.h"

class CLab13App : public CWinApp
{
public:
    BOOL InitInstance ();
};
```

4. Add a new implementation file called CLab13Win.cpp to your project. Enter the following class method implementation and message map:

```
#include <afxwin.h>
#include "CLab13Win.h"

CLab13Win::CLab13Win ()
{
    Create (NULL, "Lab13");
    m_nMessageX = 100;
    m_nMessageY = 100;
}

afx_msg void CLab13Win::OnPaint ()
{
    CPaintDC dc (this);
    dc.DrawText("Hello World", CRect (m_nMessageX, m_nMessageY,
                                     m_nMessageX+80, m_nMessageY+16), DT_LEFT);
}

BEGIN_MESSAGE_MAP (CLab13Win, CFrameWnd)
    ON_WM_PAINT ()
END_MESSAGE_MAP ()
```

5. Add a new implementation file called CLab13App.cpp to your project. Enter the following class method implementation and application variable declaration

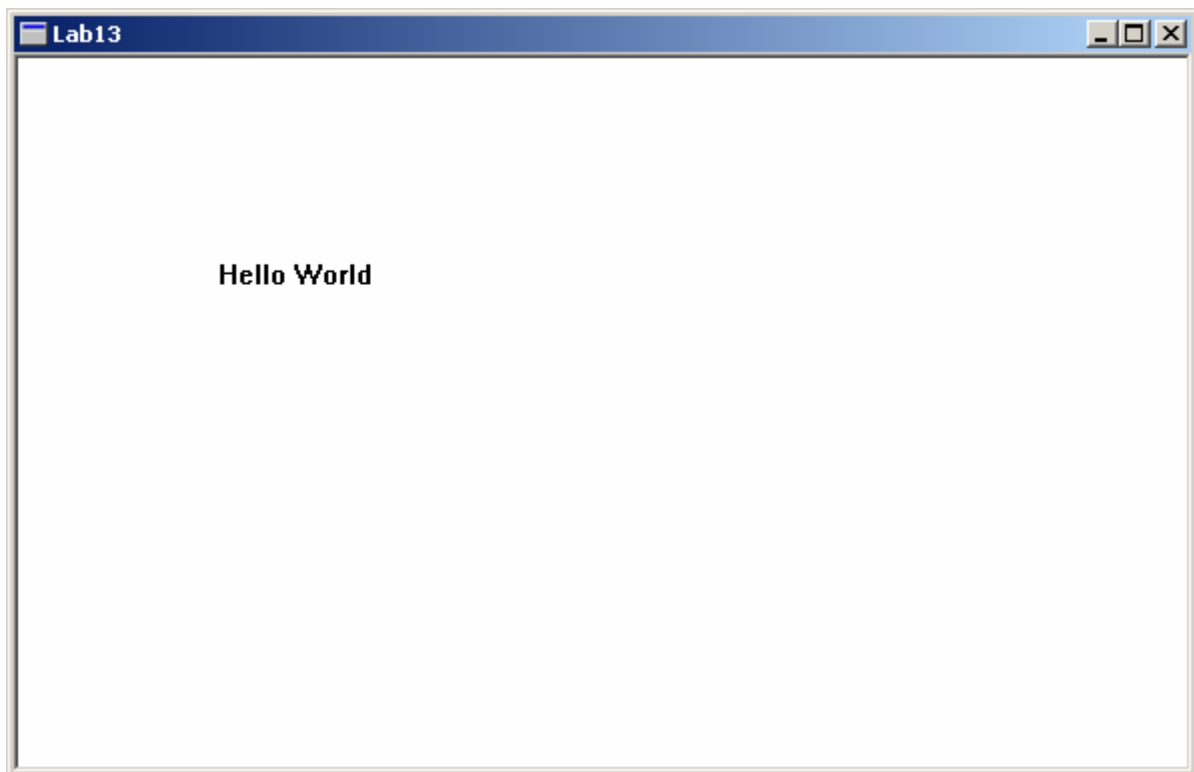
```
#include <afxwin.h>
#include "CLab13App.h"

BOOL CLab13App::InitInstance ()
{
    m_pMainWnd = new CLab13Win();
    m_pMainWnd->ShowWindow (m_nCmdShow);
    m_pMainWnd->UpdateWindow ();

    return TRUE;
}

CLab13App Lab13App;
```

6. Compile and execute the program – you should see:



You have now written an MFC “Hello World” program!

7. This program will be more interesting if the “Hello World” text string is movable. One way to move items is to drag them with the mouse. Modify CLab13Win.h and CLab13Win.cpp as indicated:

CLab13Win.h:

```
#include <afxwin.h>

class CLab13Win : public CFrameWnd
{
public:
    CLab13Win ();
    afx_msg void OnPaint ();
    afx_msg void OnMouseMove( UINT nFlags, CPoint point );
private:
    int m_nMessageX;
    int m_nMessageY;
    DECLARE_MESSAGE_MAP ()
};
```

CLab13Win.cpp:

```
#include <afxwin.h>
#include "CLab13Win.h"

CLab13Win::CLab13Win ()
{
    Create (NULL, "Lab13");
    m_nMessageX = 100;
    m_nMessageY = 100;
}

afx_msg void CLab13Win::OnPaint ()
{
    CPaintDC dc (this);
    dc.DrawText("Hello World", CRect (m_nMessageX, m_nMessageY,
        m_nMessageX+80, m_nMessageY+16), DT_LEFT);
}

afx_msg void CLab13Win::OnMouseMove( UINT nFlags, CPoint point )
{
    if (nFlags == MK_LBUTTON)
    {
        m_nMessageX = point.x;
        m_nMessageY = point.y;
        Invalidate (TRUE);
    }
}

BEGIN_MESSAGE_MAP (CLab13Win, CFrameWnd)
    ON_WM_PAINT ()
    ON_WM_MOUSEMOVE( )
END_MESSAGE_MAP ()
```

8. Compile and execute the modified program.
9. The next set of modifications will create a patterned background for the window. Modify CLab13Win.h and CLab13Win.cpp as indicated:

CLab13Win.h:

```
#include <afxwin.h>

class CLab13Win : public CFrameWnd
{
public:
    CLab13Win ();
    afx_msg void OnPaint ();
    afx_msg void OnMouseMove( UINT nFlags, CPoint point );
private:
    int m_nMessageX;
    int m_nMessageY;
    int m_nNumRects;
    int m_nNumAreas;
    int m_nRedMin;
    int m_nRedMax;
    int m_nGreenMin;
    int m_nGreenMax;
    int m_nBlueMin;
    int m_nBlueMax;
    DECLARE_MESSAGE_MAP ()
};
```

Modify the constructor and OnPaint methods of CLab13Win.cpp:

```
CLab13Win::CLab13Win ()
{
    Create (NULL, "Lab13");
    m_nMessageX = 100;
    m_nMessageY = 100;
    m_nNumRects = 5;
    m_nNumAreas = 3;
    m_nRedMin = 0;
    m_nRedMax = 255;
    m_nGreenMin = 0;
    m_nGreenMax = 0;
    m_nBlueMin = 255;
    m_nBlueMax = 0;
}

afx_msg void CLab13Win::OnPaint ()
{
    CPaintDC dc (this);
    dc.SetBkMode(TRANSPARENT);
    dc.SetTextColor(RGB (255,255,255));
    CRect rect;
    GetClientRect (&rect);
    int height = rect.Height () / m_nNumAreas;
    int width = rect.Width () / m_nNumAreas;
    int deltaX = width / 2 / m_nNumRects;
    int deltaY = height / 2 / m_nNumRects;
    int deltaR = (m_nRedMax - m_nRedMin) / (m_nNumRects - 1);
    int deltaG = (m_nGreenMax - m_nGreenMin) / (m_nNumRects - 1);
    int deltaB = (m_nBlueMax - m_nBlueMin) / (m_nNumRects - 1);
```

```

for (int aX = 0; aX < m_nNumAreas; aX++)
    for (int aY = 0; aY < m_nNumAreas; aY++)
    {
        int ulX = aX * width;
        int ulY = aY * height;
        int lrX = (aX+1) * width;
        int lrY = (aY+1) * height;
        for (int r = 0; r < m_nNumRects; r++)
        {
            int red = m_nRedMin + r * deltaR;
            int green = m_nGreenMin + r * deltaG;
            int blue = m_nBlueMin + r * deltaB;
            CBrush paintBrush;
            paintBrush.CreateSolidBrush (RGB(red, green,
                blue));
            CBrush * pBrushSv = dc.SelectObject
                (&paintBrush);
            dc.Rectangle (ulX + r*deltaX, ulY + r*deltaY,
                lrX - r*deltaX, lrY - r*deltaY);
            dc.SelectObject (pBrushSv);
        }
    }
dc.DrawText("Hello World", CRect (m_nMessageX, m_nMessageY,
    m_nMessageX+80, m_nMessageY+16), DT_LEFT);
}

```

10. Compile and execute the program – you should see:



11. Recompile and execute the program after changing the values of `m_nNumRects`, and `m_nNumAreas`. Try several values for each of these variables. Describe the purpose of each:

12. Recompile and execute the program after changing the values `m_nRedMin`, `m_nRedMax`, `m_nGreenMin`, `m_nGreenMax`, `m_nBlueMin`, and `m_nBlueMax = 0`. Try several values for each of these variables. Describe the purpose of each:

13. The next set of modifications will allow the user to employ the arrow keys to modify the patterned background for the window. Modify `CLab13Win.h` and `CLab13Win.cpp` as indicated:

Add the function `OnKeyDown` to `CLab13Win.cpp`:

```
afx_msg void CLab13Win::OnKeyDown( UINT nChar, UINT nRepCnt, UINT nFlags )
{
    switch (nChar)
    {
        case 37: // Left arrow key
            m_nNumRects--;
            Invalidate (TRUE);
            break;
        case 38: // Up arrow key
            m_nNumAreas++;
            Invalidate (TRUE);
            break;
        case 39: // Right arrow key
            m_nNumRects++;
            Invalidate (TRUE);
            break;
        case 40: // Down arrow key
            m_nNumAreas--;
            Invalidate (TRUE);
            break;
        default:
            MessageBox ("Key not recognized");
    }
}
```

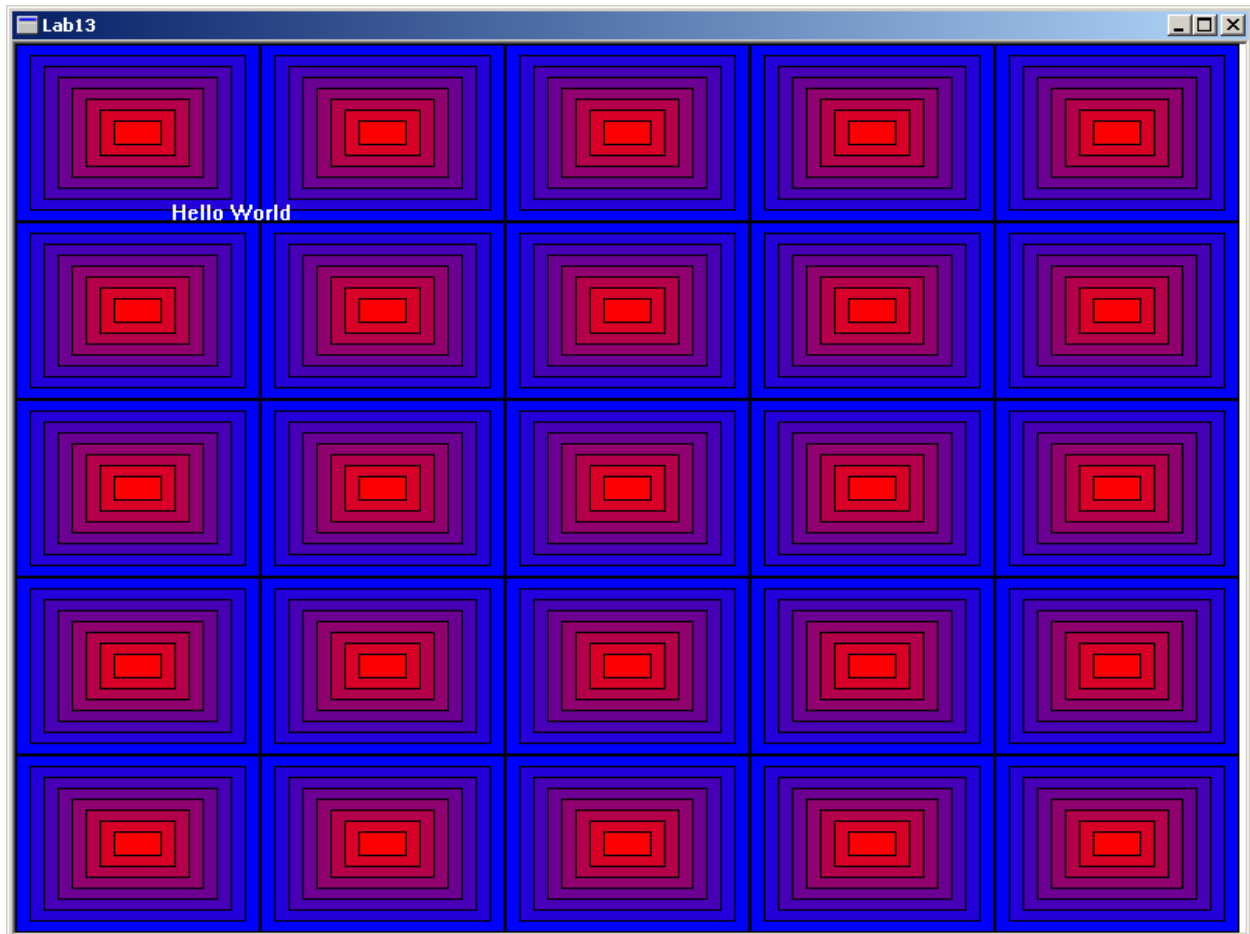
Add the Key down windows message to the message map:

```
BEGIN_MESSAGE_MAP (CLab13Win, CFrameWnd)
    ON_WM_PAINT ( )
    ON_WM_KEYDOWN( )
    ON_WM_MOUSEMOVE( )
END_MESSAGE_MAP ( )
```

Add the prototype for `OnKeyDown` to `CLab13Win.h`:

```
afx_msg void OnKeyDown( UINT nChar, UINT nRepCnt, UINT nFlags );
```

14. Compile and execute the program. After pressing the up arrow (↑) twice and the right arrow (→) three times you should see:



15. Experiment with the up, down, left, and right arrow keys until the program crashes. Modify the program to prevent crashes.
16. When you are convinced that your program is working correctly, tar and zip your folder into a file called as *yourlastnameL13.gz* and drop it into the course dropbox..