Microsoft Foundation Classes (MFC)

入門

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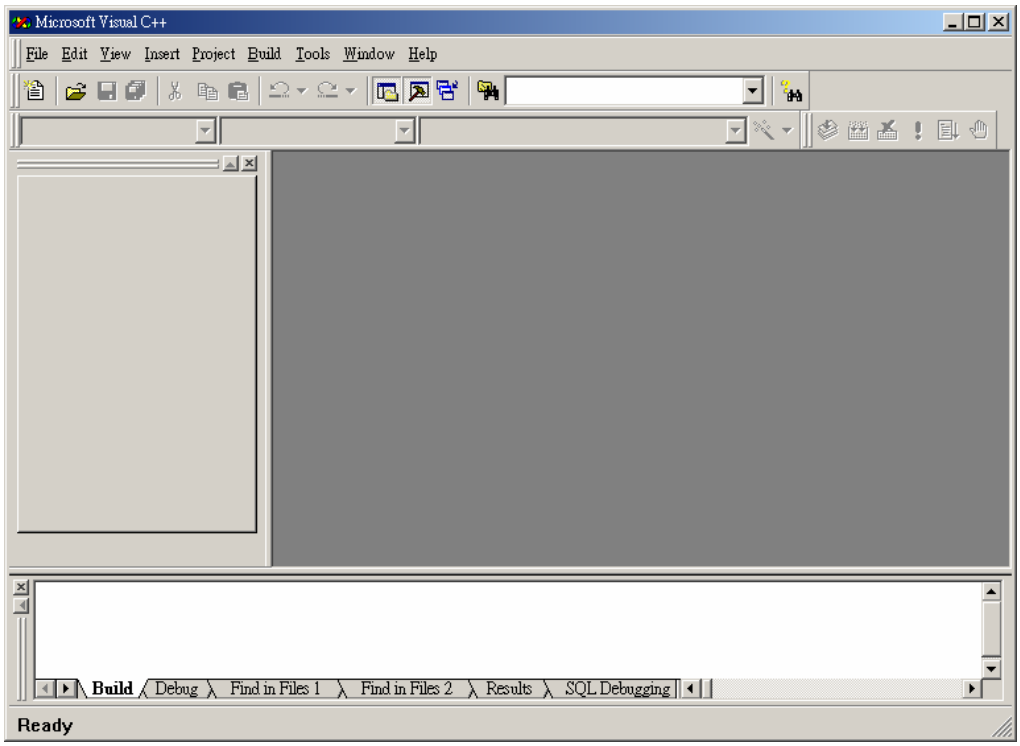
目錄

一、C＋＋的開發環境

1.1 關於這門課程

這門課程主要探討視窗程式使用 Microsoft Visual C++ 60 搭配 MSDN。同學在家中必須要有 VC＋＋與 MSDN，這樣子在學習的過程中會比較順利。

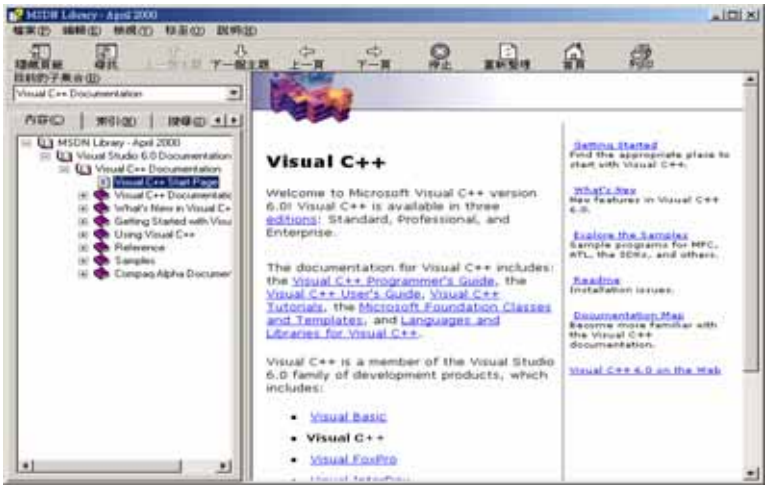
1.2 整合開發介面



微軟提供了一組強大的開發軟體，就如講義上所看到的是微軟的 VC＋＋開發環境的畫面，這種整合開發介面（IDE）最早是由 BORLAND 公司所提出的，後來幾乎所有的程式開發都走向 IDE 的介面。這樣子可以大幅提昇程式的寫作以及除錯並且執行程式。

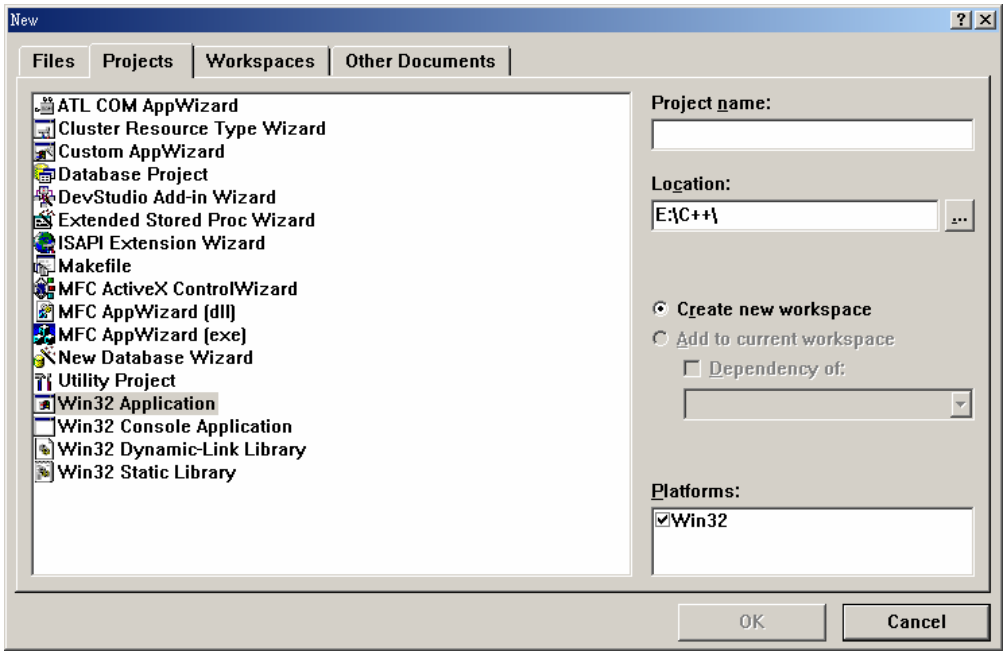
1.3 線上的 Visual C++ 說明文件

透過使用 MSDN 查詢相關函數的參數與使用範例，MSDN 多達 13GB 以上的說明文件可供參考。其中 C＋＋多達五百多 MB。MSDN 將來絕對成為你不可或缺的好幫手，不信你等著吧。

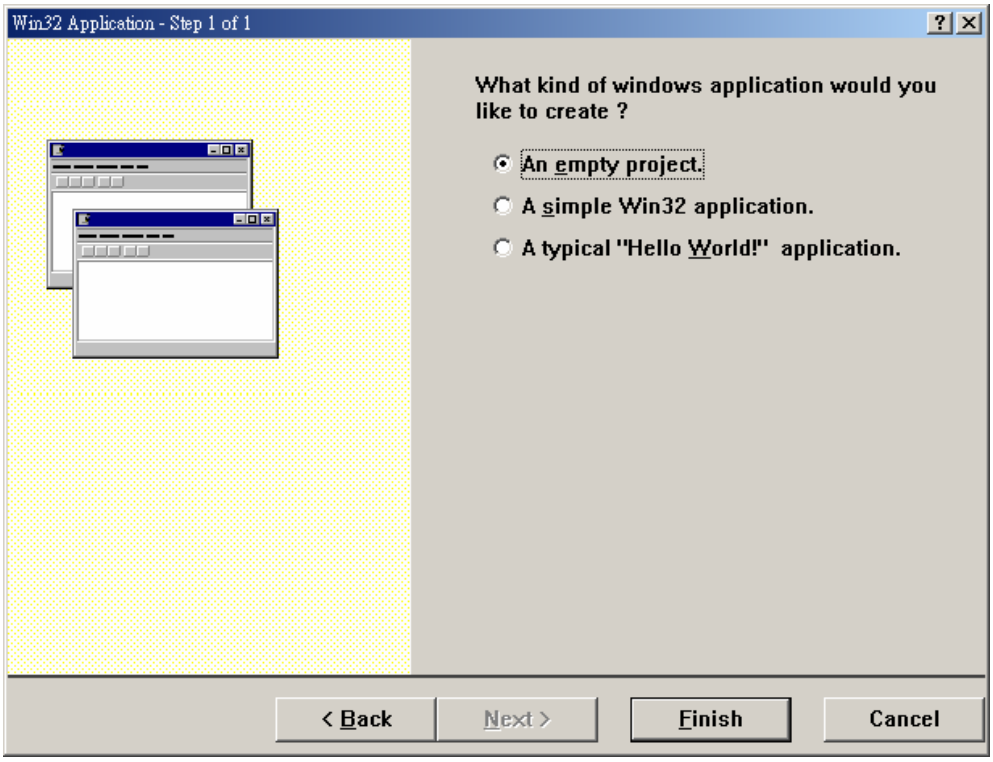


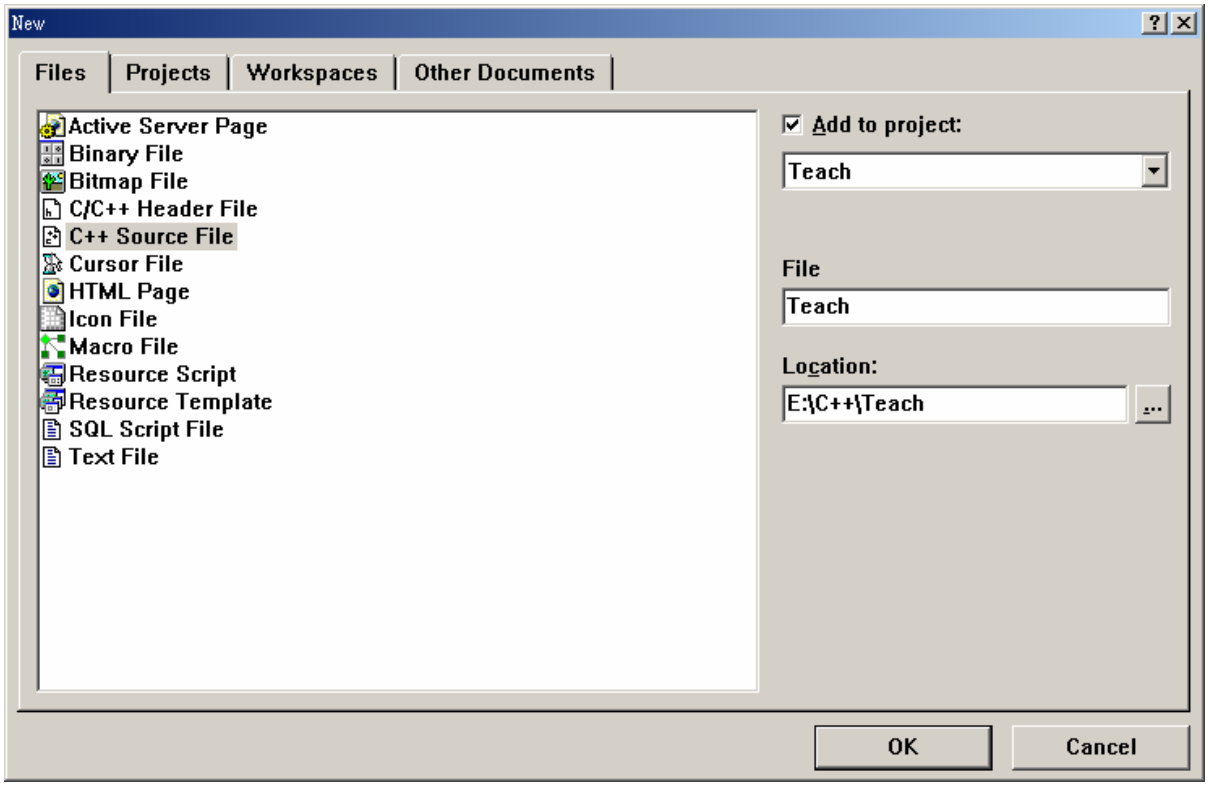
1.4 建立並執行一個 C++應用程式

執行並進入 Microsoft Visual ++ ，並開啟新檔，選擇新專案（Win32

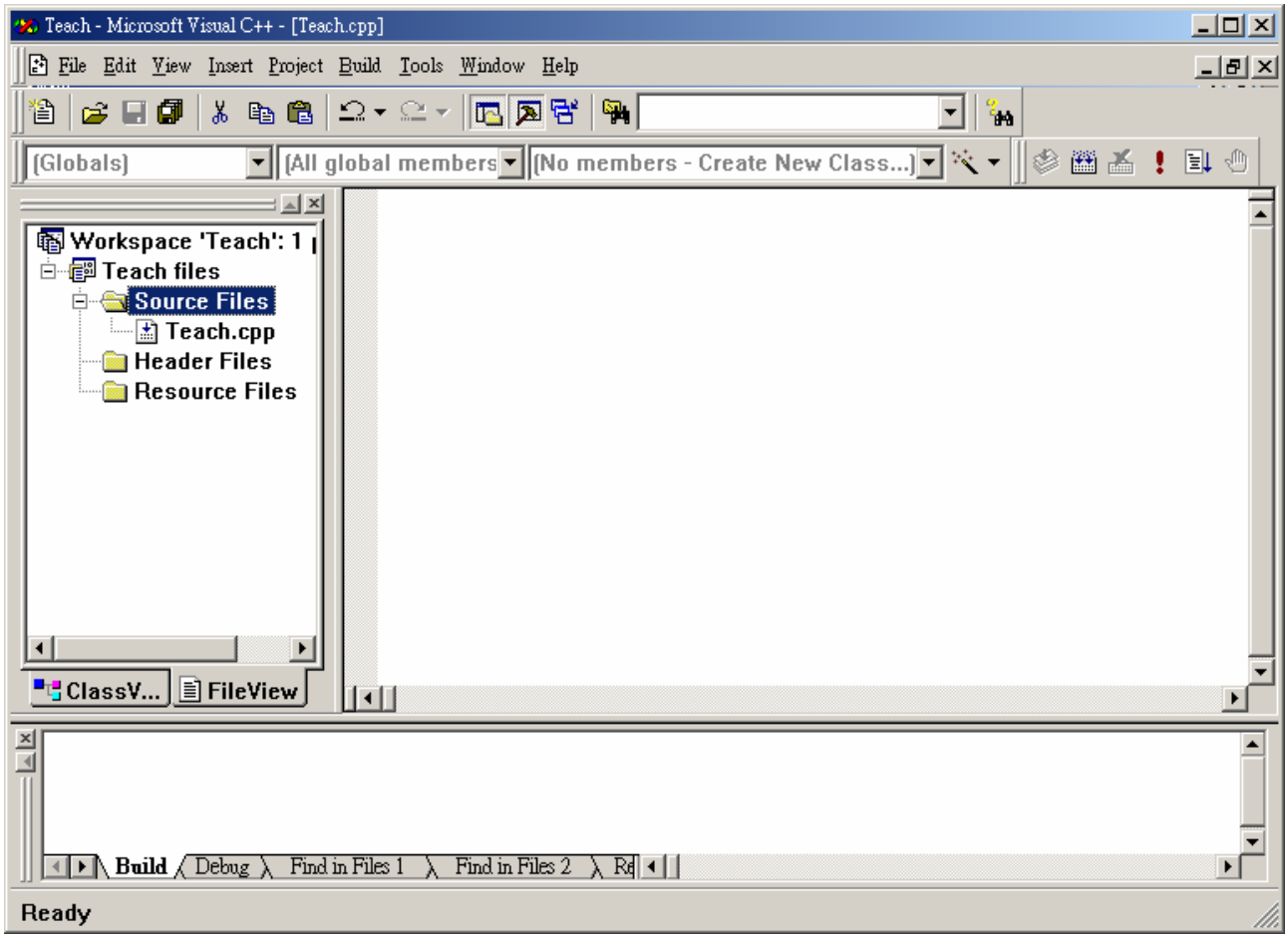


Application）並選擇空白專案選項，一直按 ENTER 到底就好了。再來請自行開啟新的 C++ source file 與 C++ header file。



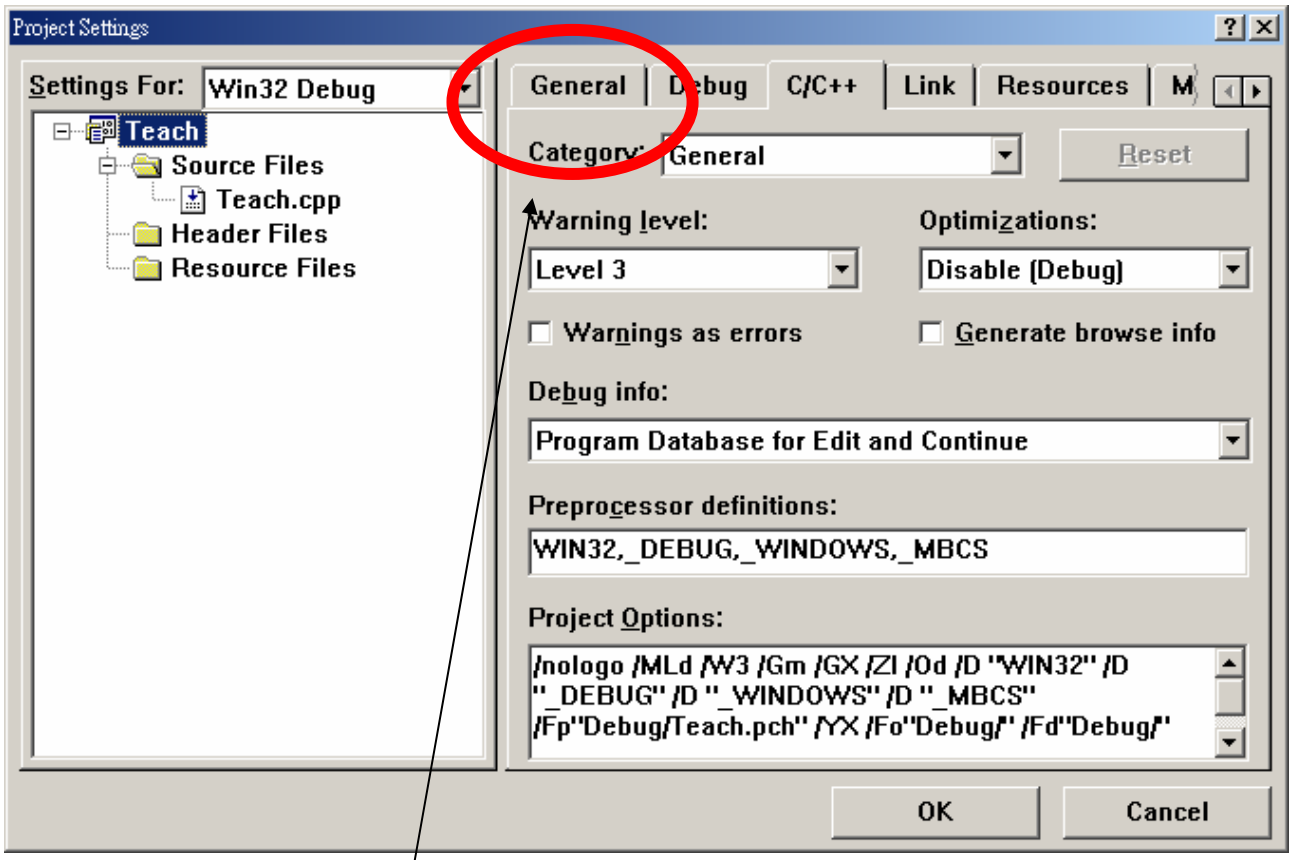


完成之後應該有下面的視窗才對。

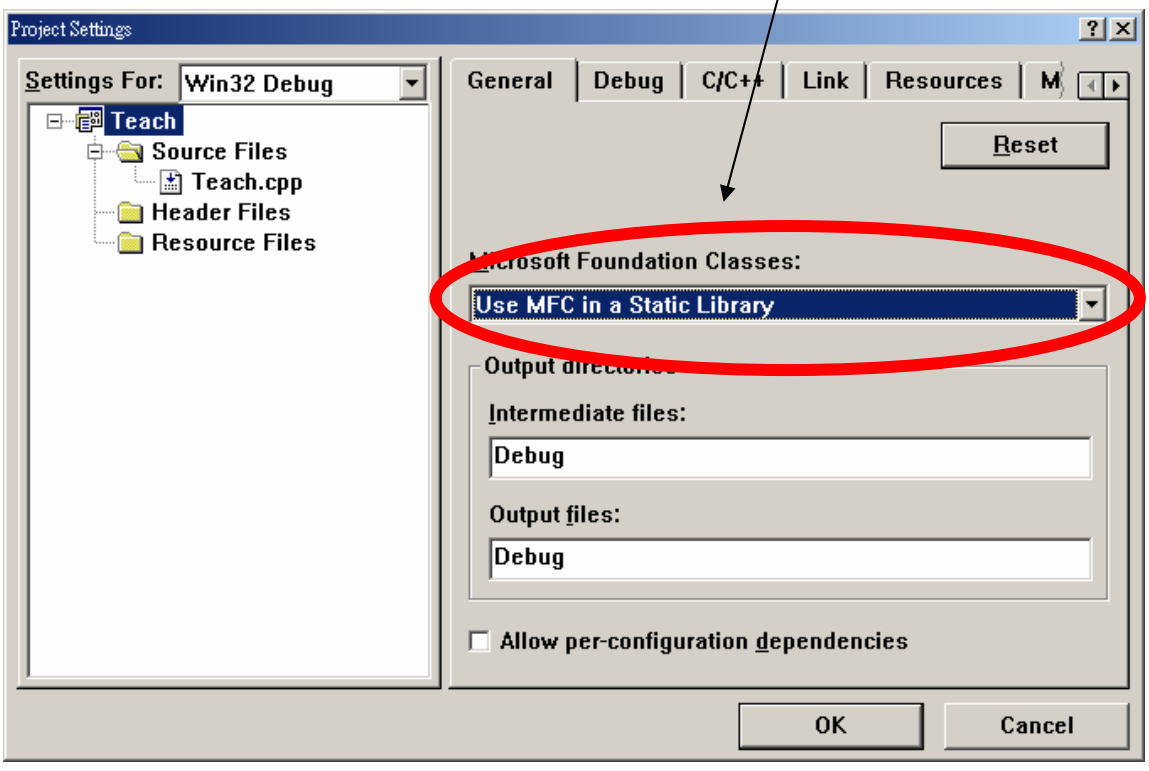


1.5 設定專案使用 MFC

當專案與 SOURCE FILE 都好了之後請按下 Alt + F7 設定專案。或選擇專案功能表中的 setting 就會出現下列畫面。



請選擇 general 標籤頁。並設定專案使用 Using MFC in Static Library



二、MFC 程式設計概念

2.1 關於 MFC 程式設計

2.1.1 早期的程式設計(DOS)

2.1.2 視窗的程式設計(GUI)

2.1.3 Microsoft Foundation of Classes(MFC)

2.2 MFC Classes 類別

CObject*	所有物件的基底類別
CGdiObject*	Graphic device interface class.
CPen	Class used for drawing pattern / color
CBrush	Class that represents fill patterns
CFont	Font class.
CBitmap	Bitmap class
CDC*	裝置容器基底類別
CClientDC	Client area device context class.
CPaintDC	Painting area device context class/
CMenu	Menu class
CCmdTarget*	事件訊息目標基底類別
CWnd*	視窗基底類別
CDialog	Dialog box window class
CStatic	Static control class.
CButton	Button control class.
CListBox	List box control class
CComboBox	Combo box control class
CEdit	Edit box control class
CFrameWnd	Frame Window class.
CWinThread*	工作排程基底類別
CWinApp	視窗應用類別

2.3 訊息

2.3.1 What is the Message.

當 GUI 事件發生時候，Windows OS 自動送出訊息給應用程式，程式也進行相關的回應動作，這種程式設計我們稱為事件導向的程式設計。

2.3.2 How the Message Operate?

1. Window 中每個訊息都被定義了一個獨一無二的符號，我稱稱為[message identifier]。
2. 而訊息將由程式交由訊息處利器處理[message handler]。
3. 這中間是透過一種叫做[message map]的構造完成的。

2.3.3 Declaring a Message Map

1. DECLARE_MESSAGE_MAP 巨集
2. 宣告方式

   BEGIN_MESSAGE_MAP(owner-class-name, base -class-name)

   ……..

   END_MESSAGE_MAP()

2.3.4 Naming Convention

1. 我們經常在訊息前面加上 WM_
2. ex. WM_PAINT
3. WM is Window Message

2.3.5 Receive Window Message

1. In message map we will declare a handler .
2. ex. ON_WM_PAINT()
3. 處理訊息必須要在前面加上 ON。
4. ON_WM_PAINT() is MFC-defined marco .

2.3.6 Handling message by ON_COMMAND

1. When you defined a identifier you have to suit it into right message handler.
2. To archive such task you should using

   ON_COMMAND(identifier , function)

2.4 匈牙利命名法

ar	Array	m_	class member varible
b	BOOL (int) or bool	n or i	Integer
c	char	p	Pointer
C	class	s	String
d	double	sz	String with NULL termination
l	long	s_	static class member variable
lp	long pointer		

2.5 建立一個簡單的C＋＋程式使用 MFC

```
//一個最簡單的MFC應用程式: welcome.h
//Author: Curtis Chou

class CWelcomeWnd : public CFrameWnd {
public:
     CWelcomeWnd();
     ~CWelcomeWnd();
private:
     CStatic *m_pHello;
};

//一個最簡單的MFC應用程式: welcome.cpp
//Author: Curtis Chou

#include <afxwin.h>
#include "welcome.h"

CWelcomeWnd::CWelcomeWnd(){
     Create( NULL,
               "歡迎",
               WS_OVERLAPPEDWINDOW,
               CRect( 200, 200, 460, 400)   );
     m_pHello = new CStatic;
     m_pHello->Create(
               "歡迎來到MS Visual C++的世界！" ,
               WS_CHILD | WS_VISIBLE | WS_BORDER | SS_CENTER ,
               CRect( 40, 50 , 200, 120) ,
               this );
}

CWelcomeWnd::~CWelcomeWnd(){
     delete m_pHello;
}

//宣告應用程式類別
class CWelcomeApp : public CWinApp {
public:
     BOOL InitInstance(){
          m_pMainWnd = new CWelcomeWnd ;
          m_pMainWnd -> ShowWindow( m_nCmdShow );
          m_pMainWnd -> UpdateWindow();
          return TRUE;
     }
};

CWelcomeApp hi;
```

2.5.1 MFC Frame Window Programming

1. MFC 應用程式架構（主架構視窗）
3. Deitail of class CFrameWnd , CWinApp

2.5.2 CFrameWnd::Create()

BOOL Create(LPCTSTR *lpszClassName*, LPCTSTR *lpszWindowName*, DWORD *dwStyle* = WS_OVERLAPPEDWINDOW, const RECT& *rect* = rectDefault, CWnd* *pParentWnd* = NULL, LPCTSTR *lpszMenuName* = NULL, DWORD *dwExStyle* = 0, CCreateContext* *pContext* = NULL);
Return Value

2.5.3 CStatic::Create()

BOOL Create(LPCTSTR *lpszText*, **DWORD** *dwStyle*, **const RECT&** *rect*, **CWnd*** *pParentWnd*, **UINT** *nID* **= 0xffff);**

Return Value

Nonzero if successful; otherwise 0.

Parameters

lpszText Specifies the text to place in the control. If **NULL**, no text will be visible.

dwStyle

Specifies the static control's window style. Apply any combination of static control styles to the control.

rect

Specifies the position and size of the static control. It can be either a **RECT** structure or a **CRect** object.

pParentWnd

Specifies the **CStatic** parent window, usually a **CDialog** object. It must not be **NULL**.

nID

Specifies the static control's control ID.

2.5.4 Window Style

- **WS_BORDER** Creates a window that has a border.
- **WS_CAPTION** Creates a window that has a title bar (implies the **WS_BORDER** style). Cannot be used with the **WS_DLGFRAME** style.
- **WS_CHILD** Creates a child window. Cannot be used with the **WS_POPUP** style.
- **WS_CLIPCHILDREN** Excludes the area occupied by child windows when you draw within the parent window. Used when you create the parent window.
- **WS_CLIPSIBLINGS** Clips child windows relative to each other; that is, when a particular child window receives a paint message, the **WS_CLIPSIBLINGS** style clips all other overlapped child windows out of the region of the child window to be updated. (If **WS_CLIPSIBLINGS** is not given and child windows overlap, when you draw within the client area of a child window, it is possible to draw within the client area of a neighboring child window.) For use with the **WS_CHILD** style only.
- **WS_DISABLED** Creates a window that is initially disabled.

- **WS_DLGFRAME** Creates a window with a double border but no title.
- **WS_GROUP** Specifies the first control of a group of controls in which the user can move from one control to the next with the arrow keys. All controls defined with the **WS_GROUP** style **FALSE** after the first control belong to the same group. The next control with the **WS_GROUP** style starts the next group (that is, one group ends where the next begins).
- **WS_HSCROLL** Creates a window that has a horizontal scroll bar.
- **WS_MAXIMIZE** Creates a window of maximum size.
- **WS_MAXIMIZEBOX** Creates a window that has a Maximize button.
- **WS_MINIMIZE** Creates a window that is initially minimized. For use with the **WS_OVERLAPPED** style only.
- **WS_MINIMIZEBOX** Creates a window that has a Minimize button.
- **WS_OVERLAPPED** Creates an overlapped window. An overlapped window usually has a caption and a border.
- **WS_OVERLAPPEDWINDOW** Creates an overlapped window with the **WS_OVERLAPPED**, **WS_CAPTION**, **WS_SYSMENU**, **WS_THICKFRAME**, **WS_MINIMIZEBOX**, and **WS_MAXIMIZEBOX** styles.
- **WS_POPUP** Creates a pop-up window. Cannot be used with the **WS_CHILD** style.
- **WS_POPUPWINDOW** Creates a pop-up window with the **WS_BORDER**, **WS_POPUP**, and **WS_SYSMENU** styles. The **WS_CAPTION** style must be combined with the **WS_POPUPWINDOW** style to make the Control menu visible.
- **WS_SYSMENU** Creates a window that has a Control-menu box in its title bar. Used only for windows with title bars.
- **WS_TABSTOP** Specifies one of any number of controls through which the user can move by using the TAB key. The TAB key moves the user to the next control specified by the **WS_TABSTOP** style.
- **WS_THICKFRAME** Creates a window with a thick frame that can be used to size the window.
- **WS_VISIBLE** Creates a window that is initially visible.
- **WS_VSCROLL** Creates a window that has a vertical scroll bar.

2.5.5 Static Style

- **SS_BLACKFRAME** Specifies a box with a frame drawn with the same color as window frames. The default is black.
- **SS_BLACKRECT** Specifies a rectangle filled with the color used to draw window frames. The default is black.
- **SS_CENTER** Designates a simple rectangle and displays the given text centered

in the rectangle. The text is formatted before it is displayed. Words that would extend past the end of a line are automatically wrapped to the beginning of the next centered line.

- **SS_GRAYFRAME** Specifies a box with a frame drawn with the same color as the screen background (desktop). The default is gray.

- **SS_GRAYRECT** Specifies a rectangle filled with the color used to fill the screen background. The default is gray.

- **SS_ICON** Designates an icon displayed in the dialog box. The given text is the name of an icon (not a filename) defined elsewhere in the resource file. The *nWidth* and *nHeight* parameters are ignored; the icon automatically sizes itself.

- **SS_LEFT** Designates a simple rectangle and displays the given text flush-left in the rectangle. The text is formatted before it is displayed. Words that would extend past the end of a line are automatically wrapped to the beginning of the next flush-left line.

- **SS_LEFTNOWORDWRAP** Designates a simple rectangle and displays the given text flush-left in the rectangle. Tabs are expanded, but words are not wrapped. Text that extends past the end of a line is clipped.

- **SS_NOPREFIX** Unless this style is specified, Windows will interpret any ampersand (&) characters in the control's text to be accelerator prefix characters. In this case, the ampersand (&) is removed and the next character in the string is underlined. If a static control is to contain text where this feature is not wanted, **SS_NOPREFIX** may be added. This static-control style may be included with any of the defined static controls. You can combine **SS_NOPREFIX** with other styles by using the bitwise OR operator. This is most often used when filenames or other strings that may contain an ampersand (&) need to be displayed in a static control in a dialog box.

- **SS_RIGHT** Designates a simple rectangle and displays the given text flush-right in the rectangle. The text is formatted before it is displayed. Words that would extend past the end of a line are automatically wrapped to the beginning of the next flush-right line.

- **SS_SIMPLE** Designates a simple rectangle and displays a single line of text flush-left in the rectangle. The line of text cannot be shortened or altered in any way. (The control's parent window or dialog box must not process the **WM_CTLCOLOR** message.)

- **SS_USERITEM** Specifies a user-defined item.

- **SS_WHITEFRAME** Specifies a box with a frame drawn with the same color as the window background. The default is white.

- **SS_WHITERECT** Specifies a rectangle filled with the color used to fill the window background. The default is white.

2.5.6 Control Flow for the program

2.8 功能表

```
// Fig. 2.11: CMenusWin.h
// create menus with MFC
const int TEXT_SIZE = 16;

class CMenusWin : public CFrameWnd {
public:
   CMenusWin();
   void tally( int &nCount, double dAmount );
   afx_msg void OnExit();
   afx_msg void OnDoFood(UINT nFood);
   afx_msg void OnShowTotal();
   afx_msg void OnClearTotal();

private:
   int m_nChicken, m_nFish;     // count items ordered
   int m_nGingerale, m_nRootbeer;
   double m_dTotal;             // tally cost of the order

   char m_szText[ TEXT_SIZE ];  // output string
   ostrstream m_str;            // output string stream

   DECLARE_MESSAGE_MAP()
};
```

功能表（1 之 6）

```
// Fig. 2.11: menus.cpp
// create menus with MFC
#include <afxwin.h>        // MFC application framework
#include <strstrea.h>      // string stream
#include <iomanip.h>       // I/O manipulators
#include "menus_ids.h"     // application message ID symbols
#include "CMenusWin.h"

CMenusWin::CMenusWin()               // construct window
   : m_str( m_szText, TEXT_SIZE )    // initialize ostrstream
{
   Create( NULL, "Menus Example", WS_OVERLAPPEDWINDOW,
      CRect( 0, 0, 200, 200 ), NULL, "Food" );

   m_nChicken = m_nFish = 0;
   m_nGingerale = m_nRootbeer = 0;
   m_dTotal = 0.0;
}

// count each type of item ordered, compute total bill
void CMenusWin::tally( int &nCount, double dAmount )
{
   nCount++;
   m_dTotal += dAmount;
}

// afx_msg precedes each message handler function
afx_msg void CMenusWin::OnExit()
{
   SendMessage( WM_CLOSE );
}

afx_msg void CMenusWin::OnDoFood(UINT nFood)
{
   switch (nFood)
   {
   case IDM_CHICKEN:
      tally( m_nChicken, 2.25 );
      break;
   case IDM_FISH:
      tally( m_nFish, 1.80 );
      break;
   case IDM_GINGERALE:
      tally( m_nGingerale, .80 );
      break;
   case IDM_ROOTBEER:
      tally( m_nRootbeer, .80 );
      break;
   }
}

afx_msg void CMenusWin::OnShowTotal()
```

功能表（2 之 6）

```
{
   m_str.seekp( 0 );              // reset output string
   m_str << setprecision( 2 )
       << setiosflags( ios::fixed | ios::showpoint )
       << "        $" << m_dTotal << ends;  // stopper

   // display new dialog box with output string
   MessageBox( m_szText, "Your total is:" );
   m_dTotal = 0.0;
}

afx_msg void CMenusWin::OnClearTotal()
{
   m_dTotal = 0.0;
   MessageBox( "          $0.00", "Cleared Order" );
}

BEGIN_MESSAGE_MAP( CMenusWin, CFrameWnd )

   ON_COMMAND( IDM_EXIT, OnExit )

   ON_COMMAND_RANGE(IDM_CHICKEN, IDM_ROOTBEER, OnDoFood)

   ON_COMMAND( IDM_SHOW_TOTAL, OnShowTotal )
   ON_COMMAND( IDM_CLEAR_TOTAL, OnClearTotal )

END_MESSAGE_MAP()


class CMenusApp : public CWinApp {
public:
   BOOL InitInstance()        // called by CWinApp::CWinApp
   {
      m_pMainWnd = new CMenusWin;           // create window
      m_pMainWnd->ShowWindow( m_nCmdShow ); // make it visible
      m_pMainWnd->UpdateWindow();           // force refresh
      return TRUE;                          // report success
   }

} menusApp;                   // calls CWinApp::CWinApp
```

功能表（3 之 6）

```
// Fig. 2.11:  menus_ids.h
// define messages used by menus.cpp and menus.rc
#define  IDM_EXIT        2000

#define  IDM_CHICKEN     2021
#define  IDM_FISH        2022

#define  IDM_GINGERALE   2041
#define  IDM_ROOTBEER    2042

#define  IDM_SHOW_TOTAL  2051
#define  IDM_CLEAR_TOTAL 2052
```

功能表（4 之 6）

```
// Fig. 2.11   menus.rc
// resource script for menus example
#include <afxres.h>
#include "menus_ids.h"

Food MENU
{
   POPUP "File"
   {
      MENUITEM "Exit", IDM_EXIT
   }

   POPUP "Entree"
   {
      MENUITEM "Chicken", IDM_CHICKEN
      MENUITEM "Fish", IDM_FISH
   }

   POPUP "Beverage"
   {
      MENUITEM "Ginger Ale", IDM_GINGERALE
      MENUITEM "Root Beer", IDM_ROOTBEER
   }

   POPUP "Order"
   {
      MENUITEM "Show Total", IDM_SHOW_TOTAL
      MENUITEM "Clear Total", IDM_CLEAR_TOTAL
   }
}
```

功能表（5 之 6）

功能表（6 之 6） 執行結果

2.9 對話方塊 DIALOG

```
// Fig. 2.12: CAdditionDialog.h
// Addition program with MFC dialog box

class CAdditionDialog : public CDialog {
public:
   CAdditionDialog()
      : CDialog( "Addition" ), m_nTotal( 0 ) {}

   afx_msg void OnAdd();          // clicked the "Add" button
   afx_msg void OnClear();        // clicked the "Clear" button

private:
   int m_nTotal;                  // sum of numbers

   DECLARE_MESSAGE_MAP()
};
```

對話方塊（1 of 6）

```
// Fig. 2.12: addition.cpp
// Addition program with MFC dialog box
#include <afxwin.h>
#include "addition_ids.h"
#include "CAdditionDialog.h"

// clicked the "Add" button
afx_msg void CAdditionDialog::OnAdd()
{
    const TEXT_SIZE = 16;
    char szText[ TEXT_SIZE + 1 ]; // buffer for conversions

    // get addresses of Edit Box Controls

    CEdit *pTotal = ( CEdit * ) ( GetDlgItem( IDC_TOTAL ) );
    CEdit *pNum   = ( CEdit * ) ( GetDlgItem( IDC_NUMBER ) );

    pNum->GetWindowText( szText, TEXT_SIZE ); // get Number
```

對話方塊（2 of 6）

```
    m_nTotal += atoi( szText );          // add binary value

    itoa( m_nTotal, szText, 10 );       // convert total to text

    pTotal->SetWindowText( szText ); // display total
    pNum->SetWindowText( "" );           // clear input
    pNum->SetFocus();                    // next input to Number
}

// clicked the "Clear" button
afx_msg void CAdditionDialog::OnClear()
{
    CEdit *pTotal = ( CEdit * ) ( GetDlgItem( IDC_TOTAL ) );
    CEdit *pNum     = ( CEdit * ) ( GetDlgItem( IDC_NUMBER ) );

    m_nTotal = 0;                        // clear the total
    pTotal->SetWindowText( "" ); // clear the edit box
    pNum->SetFocus();                    // next input to Number
}

BEGIN_MESSAGE_MAP( CAdditionDialog, CDialog )
    ON_COMMAND( IDC_ADD, OnAdd )
    ON_COMMAND( IDC_CLEAR, OnClear )
END_MESSAGE_MAP()

// dialog-based application
class CAdditionApp : public CWinApp {
public:
    BOOL InitInstance()
    {
        CAdditionDialog additionDialog;
        additionDialog.DoModal();    // run dialog
        return FALSE;                // finished
    }

} addition;
```

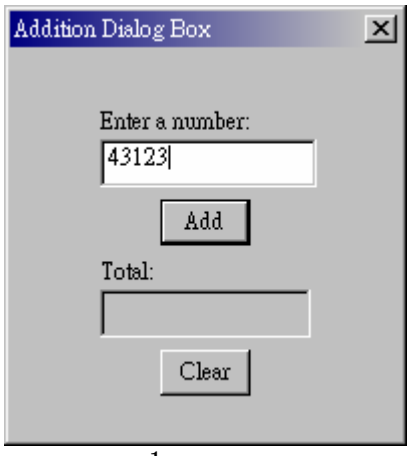
對話方塊（3 of 6）

```
/* Fig 2.12: addition_ids.h
// Define Message Numbers

#define IDC_NUMBER 2000
#define IDC_ADD    2001
#define IDC_TOTAL  2002
#define IDC_CLEAR  2003
```

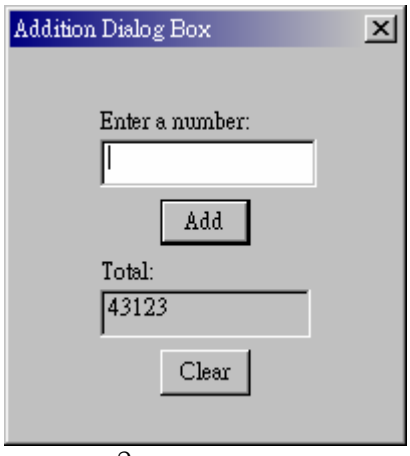
對話方塊（4 of 6）

```
// Fig. 2.12: Addition.rc
// resource script for addition example
#include "afxres.h"
#include "addition_ids.h"

Addition DIALOG  50, 50, 130, 130
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU

CAPTION "Addition Dialog Box"
{
    LTEXT          "Enter a number:", IDC_STATIC, 30, 20, 50, 8
    EDITTEXT       IDC_NUMBER, 30, 30, 72, 16, ES_NUMBER

    DEFPUSHBUTTON "Add", IDC_ADD, 50, 50, 30, 15

    LTEXT          "Total:", IDC_STATIC, 30, 70, 20, 8
    EDITTEXT       IDC_TOTAL, 30, 80, 70, 16,
                   ES_READONLY | NOT WS_TABSTOP

    PUSHBUTTON     "Clear", IDC_CLEAR, 50, 100, 30, 15,
                   NOT WS_TABSTOP
}
```

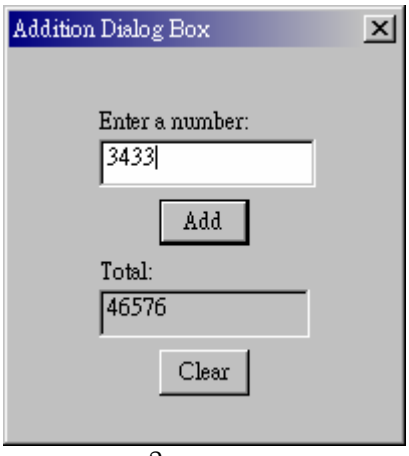
對話方塊（5 of 6）



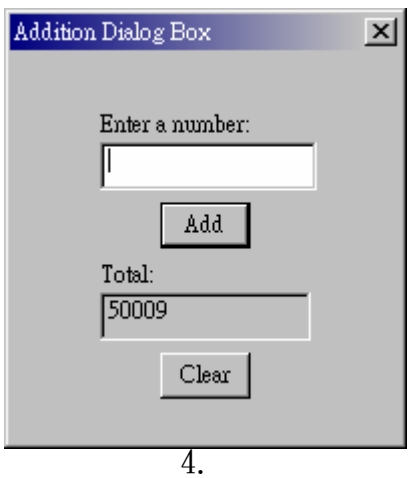
1.



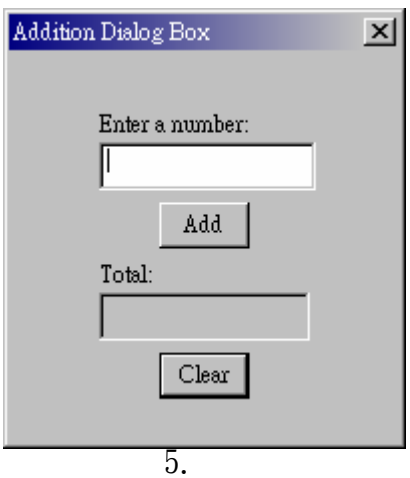
2.



3.



4.



5.

三、MFC 程式設計

3.1 用 MFC 設計一個擁有對話方塊的視窗

```
// Fig. 3.1: CLogInDialog.h
// login dialog

class CLoginDialog : public CDialog {
public:
   CLoginDialog( char *lpszName );
   afx_msg void OnLogin();     // message handler for Log in
private:
   char m_szUserid[ 17 ];
   char m_szPassword[ 13 ];

   DECLARE_MESSAGE_MAP()
};


class CMainWin : public CFrameWnd {
public:
   CMainWin();
   void login();
};
```

對話方塊視窗（1 之 5）

```
// Fig. 3.1: login.cpp
// login dialog
#include <afxwin.h>
#include "login_ids.h"
#include "CLoginDialog.h"

CLoginDialog::CLoginDialog( char *lpszName )
   : CDialog( lpszName )
{
   m_szUserid[ 0 ] = m_szPassword[ 0 ] = '\0';
}

// clicked the "Log in" button
afx_msg void CLoginDialog::OnLogin()
{
   CEdit *pUserid;
   CEdit *pPassword;

   // get user ID value
   pUserid = ( CEdit * ) GetDlgItem( IDC_USERID );
   pUserid->GetWindowText( m_szUserid, 16 );

   // get password value
   pPassword = ( CEdit * ) GetDlgItem( IDC_PASSWORD );
   pPassword->GetWindowText( m_szPassword, 12 );

   // validate password
   int j = strcmp( m_szPassword, "PassWord" );

   if ( *m_szUserid != '\0' && j == 0 ) {
      MessageBox( m_szUserid, "Access Granted",
                  MB_ICONINFORMATION );
      EndDialog( IDOK );        // Report login success
   }
   else {
      MessageBox( "Invalid userid or password",
                  "Login error",
                  MB_ICONEXCLAMATION );

      pPassword->SetWindowText( "" );  // clear password
      pUserid->SetFocus();             // cursor in userid
   }
}

BEGIN_MESSAGE_MAP( CLoginDialog, CDialog )
   ON_COMMAND( IDC_LOGIN, OnLogin )    // Log in handler
END_MESSAGE_MAP()
```

對話方塊視窗（2 之 5）

```
// after validating user, main application continues
CMainWin::CMainWin()
{
   Create( NULL, "Application Window",
           WS_OVERLAPPEDWINDOW,
           rectDefault );
}

// launch login dialog
void CMainWin::login()
{
   CLoginDialog loginDialog( "Login" );

   if ( loginDialog.DoModal() != IDOK )
      SendMessage( WM_CLOSE );   // login failed
}


// application creates main window, requests login dialog
class CLoginApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      CMainWin *pMainWnd = new CMainWin;  // create window
      m_pMainWnd = pMainWnd;              // set main window
      pMainWnd->ShowWindow( m_nCmdShow ); // make visible
      pMainWnd->UpdateWindow();           // force refresh

      pMainWnd->login();                  // login dialog
      return TRUE;                        // report success
   }

} loginApp;
```

對話方塊視窗（3 之 5）

```
// Fig 3.1: login_ids.h
// define message numbers

#define IDC_USERID   2000
#define IDC_PASSWORD 2001
#define IDC_LOGIN    2002
```

對話方塊視窗（4 之 5）

```
// Fig03.01: login.rc
// login resources
#include <afxres.h>
#include "login_ids.h"

Login DIALOG  50, 50, 130, 130
CAPTION "User Authorization"
{
    LTEXT          "Enter userid:",
                   IDC_STATIC,    30,  20, 50,  8
    EDITTEXT       IDC_USERID,    30,  30, 70, 16

    LTEXT          "Password:",
                   IDC_STATIC,    30,  50, 40,  8
    EDITTEXT       IDC_PASSWORD, 30,  60, 70, 16,
                   ES_PASSWORD

    DEFPUSHBUTTON  "Log in", IDC_LOGIN, 50, 100, 30, 15
}
```

對話方塊視窗（5 之 5）

3.3 滑鼠訊息處理

```
// Fig 3.3: CMouseWin.h
// Mouse coordinates display

class CMouseWin : public CFrameWnd {
public:
   CMouseWin();

   // display mouse coordinates and mouse button status
   void showPoint( UINT uFlags, CPoint point );

   // mouse button handlers
   afx_msg void OnLButtonDown( UINT uFlags, CPoint point );
   afx_msg void OnRButtonDown( UINT uFlags, CPoint point );
private:
   DECLARE_MESSAGE_MAP()
};
```

滑鼠訊息處理（1 之 3）

```
// Fig 3.3: mouse.cpp
// Mouse coordinates display
#include <afxwin.h>
#include <strstrea.h>
#include "CMouseWin.h"

CMouseWin::CMouseWin()
{
   Create( NULL, "Mouse Example", WS_OVERLAPPEDWINDOW );
}
```

滑鼠訊息處理（2 之 3）

```
// display mouse coordinates and mouse button status
void CMouseWin::showPoint( UINT uFlags, CPoint point )
{
   CClientDC dc( this );      // get display context

   static char sText[ 64 ];
   static ostrstream s( sText, sizeof( sText ) );

   s.seekp( 0 );    // reset to start of output string

   // format data to display in sText buffer
   s << "(" << point.x << ", " << point.y << ")";

   // at point (x, y) on screen, display (x, y) value
   dc.TextOut( point.x, point.y, sText, s.pcount() );

   s.seekp( 0 );    // reset to start of output string
   s << ( uFlags & MK_LBUTTON ? '*' : ' ' ) << " Left  "
     << ( uFlags & MK_RBUTTON ? '*' : ' ' ) << " Right ";

   // at 1,1 on screen, display mouse buttons' states
   dc.TextOut( 1, 1, sText, s.pcount() );
}

// left mouse button handler
afx_msg void CMouseWin::OnLButtonDown( UINT uFlags, CPoint point )
{
   showPoint( uFlags, point );
}

// right mouse button handler
afx_msg void CMouseWin::OnRButtonDown( UINT uFlags, CPoint point )
{
   showPoint( uFlags, point );
}

BEGIN_MESSAGE_MAP( CMouseWin, CFrameWnd )
   ON_WM_LBUTTONDOWN()   // left mouse button message handler
   ON_WM_RBUTTONDOWN()   // right mouse button message handler
END_MESSAGE_MAP()

// load main application window
class CMouseApp : public CWinApp {
public:
   BOOL InitInstance(){
      m_pMainWnd = new CMouseWin;      // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );
      m_pMainWnd->UpdateWindow();      // force refresh
      return TRUE;                     // report success
   }

} mouseApp;
```

滑鼠訊息處理（3 之 3）

3.4 鍵盤訊息處理

```
// Fig. 3.4: CKeyboardWin.h
// keyboard input example

const int LINES = 24;          // maximum number of lines
const int LINE_LENGTH = 64;    // maximum characters per line
const int LINE_HEIGHT = 16;    // pixels between lines

// application window
class CKeyboardWin : public CFrameWnd {
public:
   CKeyboardWin();

   // refresh window when requested to by the system
   afx_msg void OnPaint();

   // process each character typed on keyboard
   afx_msg void OnChar( UINT uChar, UINT uRepCnt, UINT uFlg );
private:
   char m_asText[ LINES ][ LINE_LENGTH ]; // text to paint
   int m_anLen[ LINES ];          // keep track of line lengths
   int m_nLine;                   // line receiving keystrokes
   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 3.4: keyboard.cpp
// keyboard input example
#include <afxwin.h>
#include "CKeyboardWin.h"

// initialize main window
CKeyboardWin::CKeyboardWin()
{
   m_nLine = 0;             // empty text array
   m_anLen[ m_nLine ] = 0;  // empty line of text

   Create( NULL, "Keyboard Example", WS_OVERLAPPEDWINDOW,
           CRect( 0, 0, 200, 200 ) );
}

// refresh window when requested to by the system
afx_msg void CKeyboardWin::OnPaint()
{
   CPaintDC dc( this );    // get device context

   int nPosition = m_anLen[ m_nLine ]++;

   m_asText[ m_nLine ][ nPosition ] = '_';  // make a cursor
```

```
   for ( int ln = 0; ln <= m_nLine; ln++ ) // paint lines
      dc.TextOut( 1, LINE_HEIGHT * ln,
                  m_asText[ ln ], m_anLen[ ln ] );

   m_anLen[ m_nLine ]--;                    // remove cursor
}

// process each character typed on keyboard
afx_msg void CKeyboardWin::OnChar( UINT uChar, UINT uRepCnt, UINT uFlg ){
   switch ( uChar ) {
      case '\r':                            // start new line
         m_nLine++;

         if ( m_nLine >= LINES )
            m_nLine = 0;                    // wrap around

         m_anLen[ m_nLine ] = 0;
         break;
      case '\b':        // backspace erases previous char
         if ( m_anLen[ m_nLine ] > 0 )
            m_anLen[ m_nLine ]--;
         break;
      default:
         int nPosition = m_anLen[ m_nLine ]++;

         m_asText[ m_nLine ][ nPosition ] = uChar;

         if ( m_anLen[ m_nLine ] >= LINE_LENGTH ) {

            if ( ++m_nLine >= LINES )
               m_nLine = 0;                 // wrap around

            m_anLen[ m_nLine ] = 0;
         }
   }
   InvalidateRect( NULL );      // send WM_PAINT message
}

BEGIN_MESSAGE_MAP( CKeyboardWin, CFrameWnd )
   ON_WM_CHAR()      // listen for any key press message
   ON_WM_PAINT()     // listen for paint message
END_MESSAGE_MAP()

// application class creates window
class CKeyboardApp : public CWinApp {
public:
   BOOL InitInstance(){
      m_pMainWnd = new CKeyboardWin;        // create window
      m_pMainWnd->ShowWindow( m_nCmdShow ); // make it visible
      m_pMainWnd->UpdateWindow();           // force refresh
      return TRUE;                          // report success
   }

} keyboardApp;
```

3.5 字串輸出

```
// Fig. 3.5: CTextWin.h
// Text display in the client area of a window

class CTextWin : public CFrameWnd {
public:
   CTextWin();

   // Refresh window when requested to by the system
   afx_msg void OnPaint();
private:
   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 3.5: text.cpp
// Text display in the client area of a window
#include <afxwin.h>
#include "CTextWin.h"

char *aszText[] =
{
   "Welcome to C++ and MFC!",
   "This is text in the client area.",
   " ",
   "<---Neatly Centered--->",
   NULL
};

// Create window for displaying text
CTextWin::CTextWin()
{
   Create( NULL, "Text Example", WS_OVERLAPPEDWINDOW,
           CRect( 100, 100, 400, 300 ) );
}

// Refresh window when requested to by the system
afx_msg void CTextWin::OnPaint()
{
   CPaintDC dc( this );    // get paint display context

   CRect rect;
   GetClientRect( &rect ); // get size of client area

   int nX = rect.right / 2;       // centered horizontally
   int nY = rect.bottom / 4;      // 1/4 for top margin

   // display lines of text centered in region of screen
   for ( int nLine = 0; aszText[ nLine ] != NULL; nLine++ )
   {
      int nLength = strlen( aszText[ nLine ] );
```

```
      CSize nCSizeText = dc.GetTextExtent( aszText[ nLine ],
                                           nLength );

      dc.SetTextColor( RGB( 255, 0, 0 ) );  // red text
      dc.TextOut( nX - nCSizeText.cx / 2,   // center text
                  nY,                 // vertical offset
                  aszText[ nLine ],   // text to display
                  nLength );          // char count

      nY += nCSizeText.cy;  // advance to next line
   }
}

BEGIN_MESSAGE_MAP( CTextWin, CFrameWnd )
   ON_WM_PAINT()     // OnPaint handles WM_PAINT message
END_MESSAGE_MAP()


// application creates main window
class CTextApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      m_pMainWnd = new CTextWin;             // create window
      m_pMainWnd->ShowWindow( m_nCmdShow ); // make it visible
      m_pMainWnd->UpdateWindow();            // force refresh
      return TRUE;                           // report success
   }

} textApp;
```

四、MFC 圖形化使用者介面（GUI）

4.1 使用多行編輯方塊

```
// Fig. 4.1: CEditTextDialog.h
// multiline edit text example

const int MAX_TEXT = 128;

class CEditTextDialog : public CDialog {
public:
   CEditTextDialog( char *lpszName );
   afx_msg void OnCount();     // clicked the "Count" button

private:
   char m_szText[ MAX_TEXT + 1 ];

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 4.1: edittext.cpp
// multiline edit text example
#include <afxwin.h>
#include <strstrea.h>
#include "edittext_ids.h"
#include "CEditTextDialog.h"

// Dialog constructor
CEditTextDialog::CEditTextDialog( char *lpszName )
   : CDialog( lpszName )   // base class constructor
{
   m_szText[ 0 ] = '\0';
}

// count the characters in the edit text control
afx_msg void CEditTextDialog::OnCount()
{
   // get address of edit control
   CEdit *pText = ( CEdit * ) GetDlgItem( IDC_TEXT );
   pText->GetWindowText( m_szText, MAX_TEXT );

   // display length of text read from edit text control
   static char szBuf[ 20 ];
   static ostrstream str( szBuf, 20);

   str.seekp( 0 );
   str << "Text length = " << strlen( m_szText ) << ends;
   pText->SetWindowText( szBuf );
}

BEGIN_MESSAGE_MAP( CEditTextDialog, CDialog )
```

```
   ON_COMMAND( IDC_COUNT, OnCount )
END_MESSAGE_MAP()

// start dialog-based application
class CEditApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      CEditTextDialog editTextDialog( "EditText" );
      editTextDialog.DoModal();     // run dialog
      return FALSE;                 // finished
   }

} editApp;
```

```
// Fig 4.1:  edittext_ids.h
// define edit text message identifiers

#define IDC_TEXT     2001
#define IDC_COUNT    2002
```

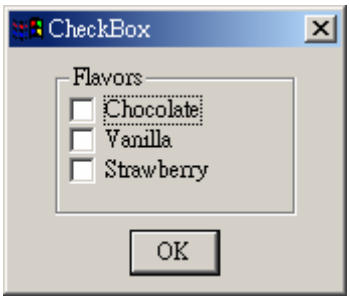
```
// Fig 4.1: edittext.rc
// multiline edit text resource file
#include <afxres.h>
#include "edittext_ids.h"

EditText DIALOG  50, 50, 130, 130
CAPTION "Edit"
{
   LTEXT          "Enter text:",
                  IDC_STATIC, 30,  20, 50, 8

   // Define edit text with identifier IDC_TEXT,
   // position (30, 30) and size 70 by 64
   // edit styles multiline and auto vertical scroll
   EDITTEXT       IDC_TEXT,   30,  30, 70, 64,
                  ES_MULTILINE | ES_WANTRETURN | WS_VSCROLL
```

4.2 使用核選方塊

```
// Fig. 4.2: CCheckBoxDialog.h
// check box example

class CCheckBoxDialog : public CDialog {
public:
   CCheckBoxDialog( char *lpszName );

   afx_msg void OnOK();     // clicked the "OK" button

private:
   // helper function combines two MFC calls in one
   int GetButtonStatus( int nId );

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 4.2: checkbox.cpp
// check box example
#include <afxwin.h>
#include <strstrea.h>
#include "checkbox_ids.h"
#include "CCheckBoxDialog.h"

CCheckBoxDialog::CCheckBoxDialog( char *lpszName )
     : CDialog( lpszName ) {}

// helper function combines two MFC calls in one
int CCheckBoxDialog::GetButtonStatus( int nId )
{
   CButton *pCButton = ( CButton * ) GetDlgItem( nId );
   return pCButton->GetCheck();
}

// overriding OnOK function
afx_msg void CCheckBoxDialog::OnOK() // clicked "OK" button
{
   static char sMessage[ 64 ];
   static ostrstream str( sMessage, 64 );
   str.seekp( 0 );

   int nChocolate  = GetButtonStatus( IDC_CHOCOLATE );
   int nVanilla    = GetButtonStatus( IDC_VANILLA );
   int nStrawberry = GetButtonStatus( IDC_STRAWBERRY );

   str << "Flavor(s) Selected:\n\n";

   if ( nChocolate )
```

```
      str << "   Chocolate\n";

   if ( nVanilla )
      str << "   Vanilla\n";

   if ( nStrawberry )
      str << "   Strawberry\n";

   if ( nChocolate + nVanilla + nStrawberry == 0 )
      str << "   None\n";

   str << ends;

   MessageBox( sMessage, "Ice Cream" );
}

BEGIN_MESSAGE_MAP( CCheckBoxDialog, CDialog )
   ON_COMMAND( IDOK, OnOK )
END_MESSAGE_MAP()


// start application, create dialog window
class CCheckBoxApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      CCheckBoxDialog checkBoxDialog( "CCheckBox" );
      checkBoxDialog.DoModal();        // run dialog window
      return FALSE;                    // exit
   }

} checkBoxApp;
```




```
// Fig. 4.2: checkbox_ids.h
// check box message identifiers

#define IDC_CHOCOLATE  2200
#define IDC_VANILLA    2201
#define IDC_STRAWBERRY 2202
```

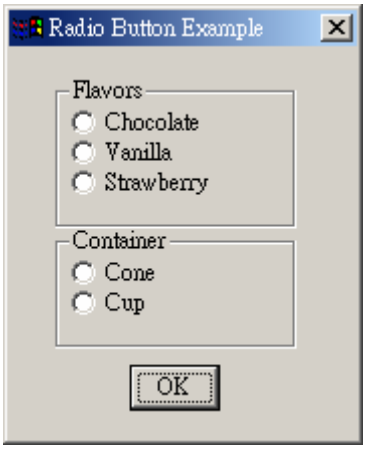
```
// Fig. 4.2: checkbox.rc
// check box resource file
#include <afxres.h>
#include "checkbox_ids.h"

CCheckBox DIALOG  50, 50, 110, 80
CAPTION "CheckBox"
{
   GROUPBOX     "Flavors",     IDC_STATIC,      15,  5, 80, 50

   AUTOCHECKBOX "Chocolate",   IDC_CHOCOLATE,   20, 15, 60, 10
   AUTOCHECKBOX "Vanilla",     IDC_VANILLA,     20, 25, 60, 10
   AUTOCHECKBOX "Strawberry", IDC_STRAWBERRY, 20, 35, 60, 10

   DEFPUSHBUTTON "OK",         IDOK,            40, 60, 30, 15
}
```

4.3 使用圓形按鈕(Radio Buttons)

```
// Fig. 4.3: CRadioButtonDialog.h
// radio button example

class CRadioButtonDialog : public CDialog
{
public:
   CRadioButtonDialog( char *lpszName )
      : CDialog( lpszName ), m_lpszFlavor( "" ),
        m_lpszContainer( "" ) {}

   afx_msg void OnOK();     // clicked the "OK" button

private:
   char *m_lpszFlavor;
   char *m_lpszContainer;
   char m_szOrder[ 64 ];

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 4.3: radiobutton.cpp
// radio button example
#include <afxwin.h>
#include "radiobutton_ids.h"
#include "CRadioButtonDialog.h"

// clicked the "OK" button
afx_msg void CRadioButtonDialog::OnOK()
{
   // get flavor ID of selected radiobutton from group
   int nFlavor = GetCheckedRadioButton( IDC_CHOCOLATE,
                                        IDC_STRAWBERRY );
   switch ( nFlavor ) {
      case IDC_CHOCOLATE:
         m_lpszFlavor = "Chocolate";
         break;
      case IDC_STRAWBERRY:
         m_lpszFlavor = "Strawberry";
         break;
      default:
         m_lpszFlavor = "Vanilla";
   }

   // get container ID of selected radiobutton from group
   int nContainer = GetCheckedRadioButton( IDC_CONE,
                                           IDC_CUP );
   switch ( nContainer ) {
      case IDC_CONE:
         m_lpszContainer = "Cone";
```

```
         break;
      default:
         m_lpszContainer = "Cup";
   }

   // concatenate the flavor and container in a string
   strcpy( m_szOrder, m_lpszFlavor );
   strcat( m_szOrder, " " );
   strcat( m_szOrder, m_lpszContainer );

   MessageBox( m_szOrder, "Ice Cream Order:" );
}

BEGIN_MESSAGE_MAP( CRadioButtonDialog, CDialog )
   ON_COMMAND( IDOK, OnOK )
END_MESSAGE_MAP()

// start application, create dialog window
class CRadioButtonApp : public CWinApp
{
public:
   BOOL InitInstance()
   {
      CRadioButtonDialog radioButtonDialog( "CRadioButton" );
      radioButtonDialog.DoModal();  // run dialog window
      return FALSE;                 // exit
   }

} radioButtonApp;
```




```
// Fig. 4.3: radiobutton_ids.h
// radio button message identifiers
#define IDC_CHOCOLATE  2200
#define IDC_VANILLA    2201
#define IDC_STRAWBERRY 2202

#define IDC_CONE       2210
#define IDC_CUP        2211
```

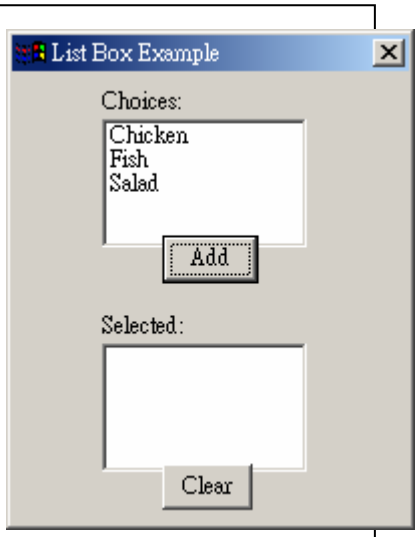
```
// Fig. 4.3: radiobutton.rc
// radio button resource file
#include <afxres.h>
#include "radiobutton_ids.h"

CRadioButton DIALOG  50, 50, 115, 130
CAPTION "Radio Button Example"
{
  GROUPBOX        "Flavors",     IDC_STATIC,     15, 10, 80, 50
  AUTORADIOBUTTON "Chocolate",   IDC_CHOCOLATE,  20, 20, 60, 10,
                                 WS_GROUP
  AUTORADIOBUTTON "Vanilla",     IDC_VANILLA,    20, 30, 60, 10
  AUTORADIOBUTTON "Strawberry",  IDC_STRAWBERRY, 20, 40, 60, 10

  GROUPBOX        "Container",   IDC_STATIC,     15, 60, 80, 40
  AUTORADIOBUTTON "Cone",        IDC_CONE,       20, 70, 60, 10,
                                 WS_GROUP
  AUTORADIOBUTTON "Cup",         IDC_CUP,        20, 80, 60, 10

  DEFPUSHBUTTON   "OK",          IDOK,           40,105, 30, 15
}
```

4.4 使用列示方塊(List Box)

```
// Fig. 4.4: CListBoxDialog.h
// list box control example

class CListBoxDialog : public CDialog {
public:
   CListBoxDialog( char *lpszName ) : CDialog( lpszName ) {}

   BOOL OnInitDialog();

   afx_msg void OnAdd();
   afx_msg void OnClear();

private:
   static char *s_alpszChoices[];

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 4.4: listbox.cpp
// list box control example
#include <afxwin.h>
#include "listbox_ids.h"
#include "CListBoxDialog.h"

BOOL CListBoxDialog::OnInitDialog()
{
   // call base class initialization first
   CDialog::OnInitDialog();

   // Get address of List Box
   CListBox *pChoices;
   pChoices = ( CListBox * ) GetDlgItem( IDC_CHOICES );

   // add items to list box
   for ( int i = 0; s_alpszChoices[ i ] != NULL; i++ )
      pChoices->AddString( s_alpszChoices[ i ] );

   return TRUE;
}

// clicked the "Add" button
afx_msg void CListBoxDialog::OnAdd()
{
   CListBox *pChoices;
   pChoices = ( CListBox *) GetDlgItem( IDC_CHOICES );

   int iCurSel = pChoices->GetCurSel();
```

```
   if ( iCurSel == LB_ERR ) {
      MessageBox( "Select an item.", "Choices",
                  MB_ICONWARNING );
      return;
   }

   CListBox *pSelected;
   pSelected = ( CListBox * ) GetDlgItem( IDC_SELECTED );
   char szText[ 32 ];
   pChoices->GetText( iCurSel, szText );
   pSelected->AddString( szText );
}

afx_msg void CListBoxDialog::OnClear()
{
   CListBox *pSelected;
   pSelected = ( CListBox * ) GetDlgItem( IDC_SELECTED );
   pSelected->ResetContent();     // clear list box
}

char *CListBoxDialog::s_alpszChoices[]
      = { "Chicken", "Fish", "Salad", NULL };

BEGIN_MESSAGE_MAP( CListBoxDialog, CDialog )
   ON_COMMAND( IDC_ADD,    OnAdd )
   ON_COMMAND( IDC_CLEAR, OnClear )
END_MESSAGE_MAP()


class CListBoxApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      CListBoxDialog listBoxDialog( "ListBoxDialog" );
      listBoxDialog.DoModal();
      return FALSE;
   }

} listBoxApp;
```




```
// Fig. 4.4: listbox_ids.h
// listbox message ID definitions

#define IDC_CHOICES  2101
#define IDC_SELECTED 2102

#define IDC_ADD      2103
#define IDC_CLEAR    2104
```

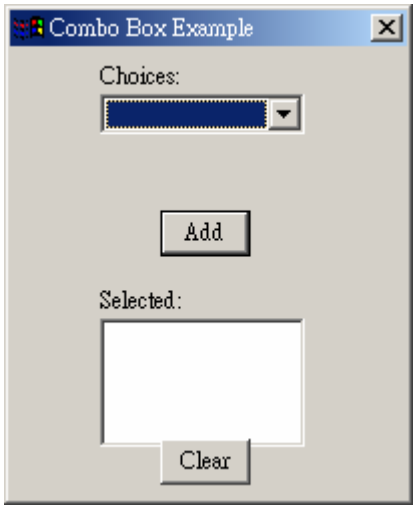
```
// Fig 4.4: listbox.rc
// ListBox resource file

#include "afxres.h"
#include "listbox_ids.h"

ListBoxDialog DIALOG   20, 20, 132, 150
CAPTION "List Box Example"
{
    LTEXT          "Choices:", IDC_STATIC,   30,   5, 50,   8
    LISTBOX        IDC_CHOICES,              30,  15  68,  48

    DEFPUSHBUTTON "Add", IDC_ADD,            50,  54  32,  16

    LTEXT          "Selected:", IDC_STATIC,  30,  80  50,   8
    LISTBOX        IDC_SELECTED,             30,  90  68,  48,
                   WS_VSCROLL

    PUSHBUTTON     "Clear",   IDC_CLEAR,     50, 130, 30,  15
}
```

4.5 使用 Combo Box

```
// Fig. 4.5: CComboBoxDialog.h
// combo box control example

class CComboBoxDialog : public CDialog {
public:
   CComboBoxDialog( char *lpszName ) : CDialog( lpszName ) {}

   BOOL OnInitDialog();
   afx_msg void OnAdd();     // clicked the "Add" button
   afx_msg void OnClear();   // clicked the "Clear" button

private:
   static char *s_alpszChoices[];

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 4.5: combobox.cpp
// combo box control example
#include <afxwin.h>
#include "combobox_ids.h"
#include "CComboBoxDialog.h"

BOOL CComboBoxDialog::OnInitDialog()
{
   CDialog::OnInitDialog();
   CComboBox *pChoices;
   pChoices = ( CComboBox * ) GetDlgItem( IDC_CHOICES );

   // add strings to combo box
   for ( int i = 0; s_alpszChoices[ i ] != NULL; i++ )
      pChoices->AddString( s_alpszChoices[ i ] );

   return TRUE;
}

// clicked the "Add" button
afx_msg void CComboBoxDialog::OnAdd()
{
   CComboBox *pChoices;
   pChoices = ( CComboBox * ) GetDlgItem( IDC_CHOICES );

   int iCurSel = pChoices->GetCurSel();

   if ( iCurSel == CB_ERR ) {
      MessageBox( "Select an item.", "Choices",
                  MB_ICONWARNING );
```

```
      return;
   }

   char lpszText[ 32 ];
   pChoices->GetLBText( iCurSel, lpszText );

   CListBox *pSelected =
            ( CListBox * ) GetDlgItem( IDC_SELECTED );
   pSelected->AddString( lpszText );
}


afx_msg void CComboBoxDialog::OnClear()
{
   CListBox *pSelected =
            ( CListBox * ) GetDlgItem( IDC_SELECTED );
   pSelected->ResetContent();     // clear list box
}

char *CComboBoxDialog::s_alpszChoices[]
   = { "Chicken", "Fish", "Salad", NULL };

BEGIN_MESSAGE_MAP( CComboBoxDialog, CDialog )
   ON_COMMAND( IDC_ADD,    OnAdd )
   ON_COMMAND( IDC_CLEAR, OnClear )
END_MESSAGE_MAP()


class CComboBoxApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      CComboBoxDialog comboBoxDialog( "ComboBoxDialog" );
      comboBoxDialog.DoModal();     // returns IDOK or IDCANCEL
      return FALSE;
   }

} comboBoxApp;
```




```
// Fig. 4.5: combobox_ids.h
// combo box message identifiers

#define IDC_CHOICES  2101
#define IDC_ADD      2102
#define IDC_SELECTED 2103
#define IDC_CLEAR    2104
```

```
// Fig 4.5: combobox.rc
// combo box resource file
#include <afxres.h>
#include "combobox_ids.h"

ComboBoxDialog DIALOG 20, 20, 132, 150
CAPTION "Combo Box Example"
{
    LTEXT          "Choices:", IDC_STATIC,   30,   5, 50,  8
    COMBOBOX       IDC_CHOICES,              30,  15, 68, 48,
                   CBS_SORT | CBS_DROPDOWNLIST

    DEFPUSHBUTTON "Add", IDC_ADD,            50,  54, 30, 15

    LTEXT          "Selected:", IDC_STATIC, 30,  80, 50,  8
    LISTBOX        IDC_SELECTED,             30,  90, 68, 48,
                   WS_VSCROLL

    PUSHBUTTON     "Clear",   IDC_CLEAR,     50, 130, 30, 15
}
```

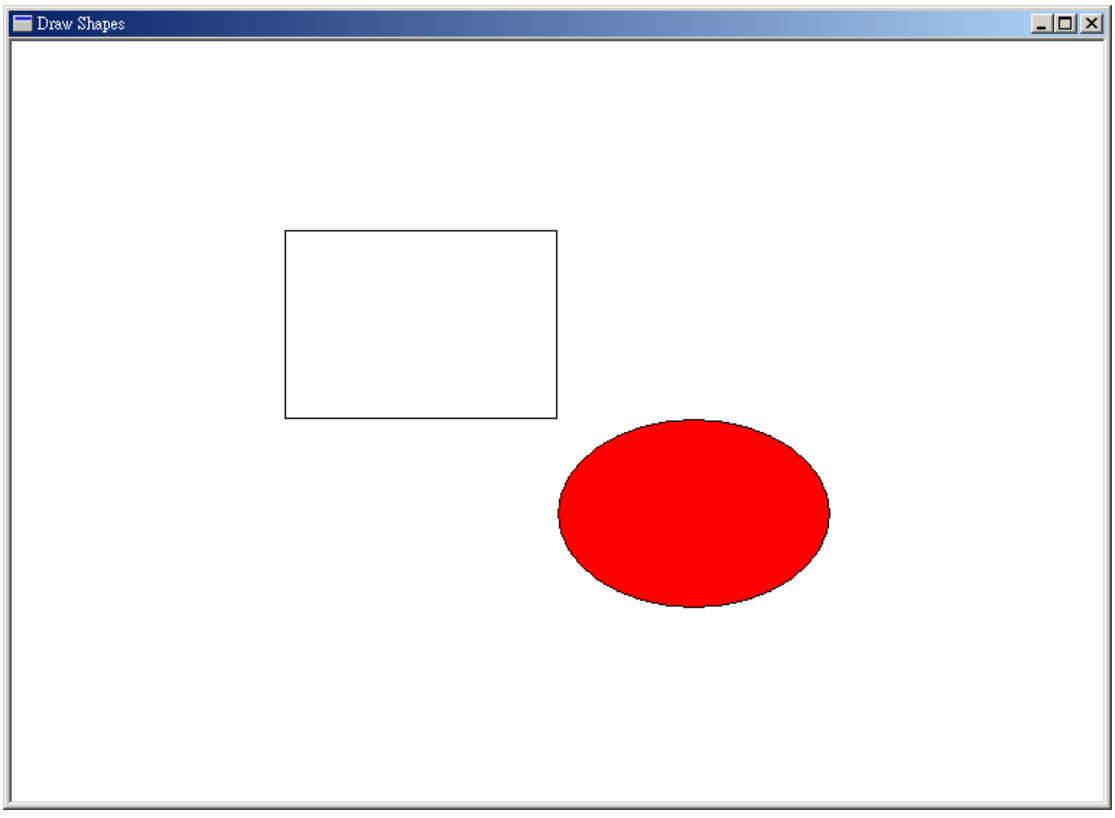
五、MFC 圖形程式設計

5.1 繪製矩形及圓形

```
// Fig. 5.2: shapes.h
// Draw shapes

class CShapesWin : public CFrameWnd {
public:
   CShapesWin();

   // refresh window when requested to by the system
   afx_msg void OnPaint();

private:
   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 5.2: shapes.cpp
// Draw shapes and colors example
#include <afxwin.h>
#include "shapes.h"

CShapesWin::CShapesWin()
{
   Create( NULL, "Draw Shapes" );

}  // end CShapesWin()

// refresh window when requested to by the system
afx_msg void CShapesWin::OnPaint()
{
   CPaintDC dc( this );   // get device context for paint

   // get current window size
   CRect rect;
   GetClientRect( &rect ); // get current client area size

   int x = rect.right  / 4; // quarter x
   int y = rect.bottom / 4; // quarter y

   // draw a rectangle giving left, top, right, bottom edges
   dc.Rectangle( x, y, 2 * x, 2 * y );

   // create solid red brush and make it the current brush
   CBrush redBrush;
   redBrush.CreateSolidBrush( RGB( 255, 0, 0 ) );
   CBrush *pBrushSv = dc.SelectObject( &redBrush );

   // draw an ellipse, giving bounding rectangle
   dc.Ellipse( 2 * x, 2 * y,    // left, top coord
```

```
                3 * x, 3 * y ); // right, bottom

   dc.SelectObject( pBrushSv );  // revert to original brush
}  // end OnPaint()

BEGIN_MESSAGE_MAP( CShapesWin, CFrameWnd )
   ON_WM_PAINT()     // OnPaint() when screen changes
END_MESSAGE_MAP()

class CShapesApp : public CWinApp {
public:

   BOOL InitInstance()
   {
      m_pMainWnd = new CShapesWin;           // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );  // make visible
      m_pMainWnd->UpdateWindow();            // force refresh

      return TRUE;         // run until user closes program
   }

} shapesApp;
```

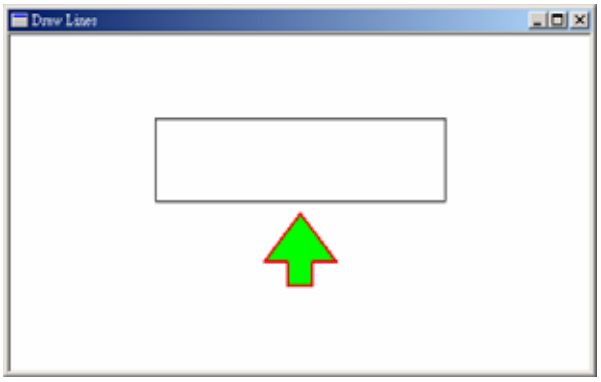


5.2 畫線

```
// Fig. 5.3: lines.h
// Draw lines

class CLinesWin : public CFrameWnd {
public:
   CLinesWin();      // window constructor

   // refresh window when requested to by the system
   afx_msg void OnPaint();

private:
   CBrush m_greenBrush;     // green brush
   CPen m_redPen;           // red pen

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig 5.3: lines.cpp
// line drawing example

#include <afxwin.h>     // MFC application framework
#include "lines.h"      // application class

CLinesWin::CLinesWin()  // main window
{
   Create( NULL, "Draw Lines" ); // Frame window with title

   // create a pen for solid, 2 pixel wide, red lines
   m_redPen.CreatePen( PS_SOLID, 2, RGB( 255, 0, 0 ) ); // red
   m_greenBrush.CreateSolidBrush( RGB( 0, 255, 0 ) ); // green
}

// refresh window when requested to by the system
afx_msg void CLinesWin::OnPaint()
{
   CPaintDC dc( this );   // get device context for paint

   // get current window size
   CRect rect;
   GetClientRect( rect ); // get current client area size

   int x = rect.right  / 4; // quarter x
   int y = rect.bottom / 4; // quarter y

   // draw rectangle, a line at a time
   dc.MoveTo( x, y );         // set starting point
   dc.LineTo( 3 * x, y );     // draw top line
   dc.LineTo( 3 * x, 2 * y ); // draw right line
   dc.LineTo( x, 2 * y );     // draw bottom line
   dc.LineTo( x, y );         // draw left line
```

```
   x *= 2;      // point to the middle of the window
   y *= 2;

   // create a list of points for a shape

   CPoint alpPoints[] = {  // arrow shape
      CPoint( x + 00, y + 10 ),
      CPoint( x + 30, y + 50 ),
      CPoint( x + 10, y + 50 ),
      CPoint( x + 10, y + 70 ),
      CPoint( x - 10, y + 70 ),
      CPoint( x - 10, y + 50 ),
      CPoint( x - 30, y + 50 ),
      CPoint( x + 00, y + 10 )
   };
   const int POLY_POINTS         // array size
      = sizeof( alpPoints ) / sizeof( alpPoints[ 0 ] );

   // select solid green brush, saving default brush
   CBrush *pBrushSv = dc.SelectObject( &m_greenBrush );

   // select red pen, saving default pen
   CPen *pPenSv = dc.SelectObject( &m_redPen );

   // display a polygon from a list of points
   dc.Polygon( alpPoints, POLY_POINTS );

   // restore default pen and brush
   dc.SelectObject( pBrushSv );
   dc.SelectObject( pPenSv );
}

BEGIN_MESSAGE_MAP( CLinesWin, CFrameWnd )
   ON_WM_PAINT()     // OnPaint() when screen changes
END_MESSAGE_MAP()

class CDrawApp : public CWinApp {
public:

   BOOL InitInstance()
   {
      m_pMainWnd = new CLinesWin;            // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );  // make visible
      m_pMainWnd->UpdateWindow();            // force refresh
      return TRUE;         // run until user closes program
   }

} linesApp;
```



5.3 計時器（做一個動態改變顏色的視窗）

```
// Fig. 5.4: colors.h
// Draw with many colors

class CColorsWin : public CFrameWnd {
public:
   CColorsWin();

   // refresh window when requested to by the system
   afx_msg void OnPaint();

   // cyclic timer tells when to update colors
   afx_msg void OnTimer();

   // release resources at end of program
   afx_msg void OnDestroy();

private:
   // draw a colorful square a pixel at a time
   void colorSquare();

   char *m_lpszText;     // text to draw
   int m_nLength;        // text length

   int m_cRed;           // red component of a color
   int m_cGreen;         // green component of a color
   int m_cBlue;          // blue component of a color

   CDC m_memDC;          // memory device context
   CBitmap m_bitmap;     // memory bitmap

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig 5.4: colors.cpp
// Draw with many colors example
#include <afxwin.h>
#include "colors.h"

CColorsWin::CColorsWin()
{
   Create( NULL, "Draw with many colors" );

   m_lpszText = "DYNAMIC COLORS";
   m_nLength = strlen( m_lpszText );
   m_cRed = m_cGreen = m_cBlue = 0;

   // get physical screen limits
   int xMax = GetSystemMetrics( SM_CXSCREEN );
   int yMax = GetSystemMetrics( SM_CYSCREEN );
```

```
   CClientDC dc( this );   // get client area device context

   // create a memory device context and bitmap to save
   // the color square so it can be copied quickly
   m_memDC.CreateCompatibleDC( &dc );
   m_bitmap.CreateCompatibleBitmap( &dc, xMax, yMax );
   m_memDC.SelectObject( &m_bitmap );
   colorSquare();    // compute once rather than on each tick
}  // end CColorsWin()

// draw a colorful square a pixel at a time
void CColorsWin::colorSquare()
{
   // step through red intensity values
   for ( int cRed = 0, x = 0;      // red increases with x
         cRed <= 255;
         cRed++, x++ )
      // step through green intensity values
      for ( int cGreen = 0, y = 0; // green increases with y
            cGreen <= 255;
            cGreen++, y++ )
      {
         // make blue balance the average of red and green
         int cBlue = 255 - ( cRed + cGreen ) / 2;

         // set pixel (x,y) to RGB value
         m_memDC.SetPixel( x, y, RGB( cRed, cGreen, cBlue ) );
      }
}

// refresh window when requested to by the system
afx_msg void CColorsWin::OnPaint()
{
   CPaintDC dc( this );   // get device context for paint

   // get current window size
   CRect rect;
   GetClientRect( rect ); // get current client area size

   int x = rect.right  / 2; // middle x
   int y = rect.bottom / 4; // quarter y

   // display text with dynamically changing colors
   dc.SetTextColor( RGB( m_cRed, m_cGreen, m_cBlue ) );
   dc.SetBkColor( RGB( 255, 255, 255 ) );
   dc.TextOut( x - 60, y / 2, m_lpszText, m_nLength );

   x -= 128;    // center 256 pixel square in window
   y += 10;     // color square position
```

```
   // copy color square from memory bitmap to screen bitmap
   dc.BitBlt( x, y,            // destination
              256, 256,        // width, height
              &m_memDC, 0, 0,  // source, x, y
              SRCCOPY );       // straight copy

   // draw a shaded rectangle around the color square
   dc.Draw3dRect( x - 2, y - 2,            // left, top
                  260, 260,                // width, height
                  RGB( 150, 150, 150 ),    // gray left, top
                  RGB(  10,  10,  10 ) );  // dark gray shadow
}  // end OnPaint()

// cyclic timer tells when to update colors
afx_msg void CColorsWin::OnTimer()
{
   // cycle through colors in prime number steps
   m_cRed = ( m_cRed + 3 ) % 256;
   m_cGreen = ( m_cGreen + 7 ) % 256;
   m_cBlue = ( m_cBlue + 11 ) % 256;

   InvalidateRect( NULL, FALSE ); // redraw all, no erase
}

// release resources at end of program
afx_msg void CColorsWin::OnDestroy()
{
   KillTimer( 1 );    // release timer 1
}

BEGIN_MESSAGE_MAP( CColorsWin, CFrameWnd )
   ON_WM_TIMER()     // OnTimer() when timer ticks
   ON_WM_PAINT()     // OnPaint() when screen changes
   ON_WM_DESTROY()   // OnDestroy() when program ends
END_MESSAGE_MAP()


class CColorsApp : public CWinApp {
public:
   BOOL InitInstance()
   {
      m_pMainWnd = new CColorsWin;           // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );  // make visible
      m_pMainWnd->UpdateWindow();            // force refresh

      // start timer id 1, 30 milliseconds, use WM_TIMER
      if ( !m_pMainWnd->SetTimer( 1, 30, NULL ) )
         return FALSE;     // quit on failure
      return TRUE;         // run until user closes program
   }

} colorsApp;
```

5.4 圖片顯示

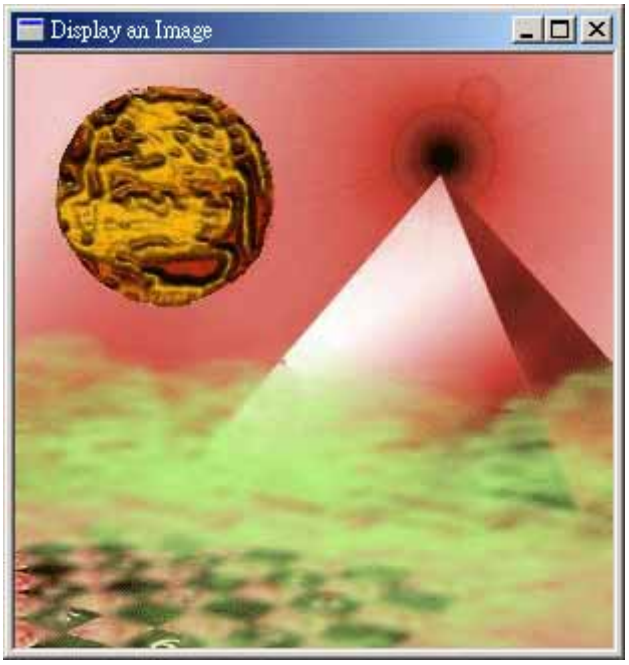
```
// Fig. 5.5: CImageWin.h
// display a bitmap image

class CImageWin : public CFrameWnd {
public:
   CImageWin();

   // refresh window when requested to by the system
   afx_msg void OnPaint();
private:
   CBitmap m_bmpCool;  // bitmap stores image
   CDC m_memDC;        // memory device context

   DECLARE_MESSAGE_MAP()
};
```

```
// Fig. 5.5: image.cpp
// display a bitmap image
#include <afxwin.h>
#include "CImageWin.h"

CImageWin::CImageWin()
{
   // create frame window
   Create( NULL, "Display an Image", WS_OVERLAPPEDWINDOW );

   // load bitmap image from resources by name
   m_bmpCool.LoadBitmap( "COOL_BMP" );

   // device context of client area of window
   CClientDC dc( this );

   // create memory device context to hold image
   m_memDC.CreateCompatibleDC( &dc );
   m_memDC.SelectObject( &m_bmpCool );
}

// refresh window when requested to by the system
afx_msg void CImageWin::OnPaint()
{
   CPaintDC dc( this );    // get paint device context

   // bit block transfer image from memory DC to paint DC
   dc.BitBlt( 0, 0, 300, 300, &m_memDC, 0, 0, SRCCOPY );
}

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

```
class CImageApp : public CWinApp {
public:

   BOOL InitInstance()
   {
      m_pMainWnd = new CImageWin;             // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );  // make visible
      m_pMainWnd->UpdateWindow();             // force refresh

      return TRUE;
   }
} imageApp;
```

// Fig. 5.5: image.rc
// bitmap image resource file

// bitmap name BITMAP file name
COOL_BMP BITMAP cool.bmp



5.5 字型

```
// Fig. 5.6: CFontWin.h
// manipulate fonts

class CFontWin : public CFrameWnd {
public:
   CFontWin();

   // refresh window when requested to by the system
   afx_msg void OnPaint();

private:
   CFont m_sysFont;        // system font
   CFont m_italicFont;     // italic font

   DECLARE_MESSAGE_MAP()
};
```


```
// Fig. 5.6: fonts.cpp
// manipulate fonts
#include <afxwin.h>
#include "CFontWin.h"

CFontWin::CFontWin()
{
   // finish Windows frame in MFC CFrameWnd
   Create( NULL, "Font Example" );

   // create client area device context for this window
   CClientDC dc( this );

   // make default font
   m_sysFont.CreateStockObject( SYSTEM_FONT );

   // make 32 bit high bold italic font
   m_italicFont.CreateFont( 32, 0, 0, 0, FW_BOLD, 1, 0, 0, 0,
                            0, 0, 0, 0, "Times New Roman" );
}

// refresh window when requested to by the system
afx_msg void CFontWin::OnPaint()
{
   static char *aText[] =     // sample text to display
   {
      "Welcome to C++ and MFC!",
      " ",
      "Height is 32 pixels.",
      "Font weight is Bold.",
      "Italic is set.",
      "Face name is Times New Roman.",
      NULL
   };
```

```
   CPaintDC dc( this );    // get paint device context

   // select italic font for text display
   CFont *pFontSv = dc.SelectObject( &m_italicFont );

   int x = 10;   // top margin
   int y = 10;   // left margin

   // display lines of text centered in region of screen
   for ( int nLine = 0; aText[ nLine ] != 0; nLine++ )
   {
      int nLength = strlen( aText[ nLine ] );

      // get size of text in current font
      CSize nCSizeText
         = dc.GetTextExtent( aText[ nLine ], nLength );

      // set text color, display text at computed position
      dc.SetTextColor( RGB( 255, 64, 64 ) ); // light red text
      dc.TextOut( x, y, aText[ nLine ], nLength );

      y += nCSizeText.cy;  // advance to next line
   }

   char *lpszText = "This line uses SYSTEM_FONT.";

   // select system font for text display
   dc.SelectObject( &m_sysFont );
   dc.SetTextColor( RGB( 0, 0, 0 ) );  // black text
   y += 20;      // space down the screen
   dc.TextOut( 10, y, lpszText, strlen( lpszText ) );
   dc.SelectObject( pFontSv );    // original font
}

BEGIN_MESSAGE_MAP( CFontWin, CFrameWnd )
   ON_WM_PAINT()
END_MESSAGE_MAP()


class CFontApp : public CWinApp {
public:

   BOOL InitInstance()
   {
      m_pMainWnd = new CFontWin;             // create window
      m_pMainWnd->ShowWindow( m_nCmdShow );  // make visible
      m_pMainWnd->UpdateWindow();            // force refresh
      return TRUE;
   }

} fontApp;
```

SDK Style Windows Programming

```
/*------------------------------------------------------------
   HELLOWIN.C -- Displays "Hello, Windows 98!" in client area
                 (c) Charles Petzold, 1998
  ------------------------------------------------------------*/

#include <windows.h>

LRESULT CALLBACK WndProc (HWND, UINT, WPARAM, LPARAM) ;

int WINAPI WinMain (HINSTANCE hInstance, HINSTANCE hPrevInstance,
                    PSTR szCmdLine, int iCmdShow)
{
     static TCHAR szAppName[] = TEXT ("HelloWin") ;
     HWND         hwnd ;
     MSG          msg ;
     WNDCLASS     wndclass ;

     wndclass.style         = CS_HREDRAW | CS_VREDRAW ;
     wndclass.lpfnWndProc   = WndProc ;
     wndclass.cbClsExtra    = 0 ;
     wndclass.cbWndExtra    = 0 ;
     wndclass.hInstance     = hInstance ;
     wndclass.hIcon         = LoadIcon (NULL, IDI_APPLICATION) ;
     wndclass.hCursor       = LoadCursor (NULL, IDC_ARROW) ;
     wndclass.hbrBackground = (HBRUSH) GetStockObject (WHITE_BRUSH) ;
     wndclass.lpszMenuName  = NULL ;
     wndclass.lpszClassName = szAppName ;

     if (!RegisterClass (&wndclass))
     {
          MessageBox (NULL, TEXT ("This program requires Windows NT!"),
                      szAppName, MB_ICONERROR) ;
          return 0 ;
     }

     hwnd = CreateWindow (szAppName,                  // window class name
                          TEXT ("The Hello Program"), // window caption
                          WS_OVERLAPPEDWINDOW,        // window style
                          CW_USEDEFAULT,              // initial x position
                          CW_USEDEFAULT,              // initial y position
                          CW_USEDEFAULT,              // initial x size
                          CW_USEDEFAULT,              // initial y size
                          NULL,                       // parent window handle
                          NULL,                       // window menu handle
                          hInstance,                  // program instance handle
                          NULL) ;                     // creation parameters

     ShowWindow (hwnd, iCmdShow) ;
     UpdateWindow (hwnd) ;

     while (GetMessage (&msg, NULL, 0, 0))
     {
```

```
          TranslateMessage (&msg) ;
          DispatchMessage (&msg) ;
     }
     return msg.wParam ;
}

LRESULT CALLBACK WndProc (HWND hwnd, UINT message, WPARAM wParam, LPARAM lParam)
{
     HDC         hdc ;
     PAINTSTRUCT ps ;
     RECT        rect ;

     switch (message)
     {
     case WM_CREATE:
          PlaySound (TEXT ("hellowin.wav"), NULL, SND_FILENAME | SND_ASYNC) ;
          return 0 ;

     case WM_PAINT:
          hdc = BeginPaint (hwnd, &ps) ;

          GetClientRect (hwnd, &rect) ;

          DrawText (hdc, TEXT ("Hello, Windows 98!"), -1, &rect,
                    DT_SINGLELINE | DT_CENTER | DT_VCENTER) ;

          EndPaint (hwnd, &ps) ;
          return 0 ;

     case WM_DESTROY:
          PostQuitMessage (0) ;
          return 0 ;
     }
     return DefWindowProc (hwnd, message, wParam, lParam) ;
}
```