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**Факультет інформатики та обчислювальної техніки**

**Кафедра обчислювальної техніки**

**Лабораторна робота №4**

з дисципліни

«Вдосконалення структури коду графічного редактора об’єктів на C++»

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Номер у списку: 9

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**Мета:**

Мета роботи – отримати вміння та навички використовувати інкапсуляцію,

абстракцію типів, успадкування та поліморфізм на основі класів С++, запрограмувавши графічний інтерфейс користувача.

**Завдання:**

1. Створити у середовищі MS Visual Studio C++ проект Win32 з ім’ям Lab4.

2. Написати вихідний текст програми згідно варіанту завдання.

3. Скомпілювати вихідний текст і отримати виконуваний файл програми.

4. Перевірити роботу програми. Налагодити програму.

5. Проаналізувати та прокоментувати результати та вихідний текст програми.

6. Оформити звіт

**Варіанти завдань**

- глобальний статичний об'єкт класу MyEditor.

- статичний масив для Shape (10 mod 3 = 1) обсягом 110 об’єктів

- "гумовий" слід (10 mod 4 = 2) – суцільна лінія синього кольору

- прямокутник:

- по двом протилежним кутам (10 mod 2 = 0)

- чорний контур з білим заповненням (10 mod 5 = 0)

- еліпс:

- від центру до одного з кутів охоплюючого прямокутника (10 mod 2 = 0)

- чорний контур еліпсу без заповнення (10 mod 5 = 0)

-позначка поточного типу об’єкту:-в меню (метод OnInitMenuPopup) (10 mod 2 = 0)

**Вихідні тексти файлів:**

**Lab2.cpp:**

// Lab1.cpp : Defines the input point for the application.

//

// First Part

#include "framework.h"

#include "pch.h"

#include "Lab3.h"

#include "Resource.h"

#include "shape\_editor.h"

#include "toolbar.h"

#define MAX\_LOADSTRING 100

#pragma region VariablesAndFunctions

// Global variables:

HINSTANCE hInst**;** // Current instance

WCHAR szTitle**[**MAX\_LOADSTRING**];** // Header row text

WCHAR szWindowClass**[**MAX\_LOADSTRING**];** // Class name of main window

ShapeObjectsEditor editorShape**;**

LPCSTR currentShape**;**

const LPCSTR POINT\_NAME **=** "Крапка"**;**

const LPCSTR LINE\_NAME **=** "Лінія"**;**

const LPCSTR RECTANGLE\_NAME **=** "Прямокутник"**;**

const LPCSTR ELLIPSE\_NAME **=** "Овал"**;**

Toolbar toolbar**;**

// Send declarations of functions included in this code module:

ATOM MyRegisterClass**(**HINSTANCE hInstance**);**

BOOL InitInstance**(**HINSTANCE**,** int**);**

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

INT\_PTR CALLBACK About**(**HWND**,** UINT**,** WPARAM**,** LPARAM**);**

static void CallToolPoint**();**

static void CallToolLine**();**

static void CallToolRectangle**();**

static void CallToolEllipse**();**

#pragma endregion VariablesAndFunctions

#pragma region DefaultFunctions

// Second Part

// Enter Point "wWinMain"

int APIENTRY wWinMain**(**\_In\_ HINSTANCE hInstance**,**

\_In\_opt\_ HINSTANCE hPrevInstance**,**

\_In\_ LPWSTR lpCmdLine**,**

\_In\_ int nCmdShow**)**

**{**

UNREFERENCED\_PARAMETER**(**hPrevInstance**);**

UNREFERENCED\_PARAMETER**(**lpCmdLine**);**

InitCommonControls**();**

// TODO: Place the code here.

// Global line initialization

LoadStringW**(**hInstance**,** IDS\_APP\_TITLE**,** szTitle**,** MAX\_LOADSTRING**);**

LoadStringW**(**hInstance**,** IDC\_LAB3**,** szWindowClass**,** MAX\_LOADSTRING**);**

MyRegisterClass**(**hInstance**);**

// Perform application initialization:

**if** **(!**InitInstance**(**hInstance**,** nCmdShow**))**

**{**

**return** FALSE**;**

**}**

HACCEL hAccelTable **=** LoadAccelerators**(**hInstance**,** MAKEINTRESOURCE**(**IDC\_LAB3**));**

MSG msg**;**

// Main message cycle:

**while** **(**GetMessage**(&**msg**,** **nullptr,** 0**,** 0**))**

**{**

**if** **(!**TranslateAccelerator**(**msg**.**hwnd**,** hAccelTable**,** **&**msg**))**

**{**

TranslateMessage**(&**msg**);**

DispatchMessage**(&**msg**);**

**}**

**}**

**return** **(**int**)**msg**.**wParam**;**

**}**

//

// FUNCTION: MyRegisterClass()

//

// OBJECTIVE: To register the window class.

// Text of Function

/// <summary>

/// Register the window class.

/// </summary>

/// <param name="hInstance">The h instance.</param>

/// <returns></returns>

ATOM MyRegisterClass**(**HINSTANCE hInstance**)**

**{**

WNDCLASSEXW wcex**;**

wcex**.**cbSize **=** **sizeof(**WNDCLASSEX**);**

wcex**.**style **=** CS\_HREDRAW **|** CS\_VREDRAW**;**

wcex**.**lpfnWndProc **=** WndProc**;**

wcex**.**cbClsExtra **=** 0**;**

wcex**.**cbWndExtra **=** 0**;**

wcex**.**hInstance **=** hInstance**;**

wcex**.**hIcon **=** LoadIcon**(**hInstance**,** MAKEINTRESOURCE**(**IDI\_LAB3**));**

wcex**.**hCursor **=** LoadCursor**(nullptr,** IDC\_ARROW**);**

wcex**.**hbrBackground **=** **(**HBRUSH**)(**COLOR\_WINDOW **+** 1**);**

wcex**.**lpszMenuName **=** MAKEINTRESOURCEW**(**IDC\_LAB3**);**

wcex**.**lpszClassName **=** szWindowClass**;**

wcex**.**hIconSm **=** LoadIcon**(**wcex**.**hInstance**,** MAKEINTRESOURCE**(**IDI\_SMALL**));**

**return** RegisterClassExW**(&**wcex**);**

**}**

//

// FUNCTION: InitInstance(HINSTANCE, int)

//

// OBJECTIVE: Saves the instance marker and creates the main window

//

// COMMENTARIES:

//

// In this function, the instance marker is saved in a global variable, and also

// the main program window is created and displayed.

//

/// <summary>

/// Saves the instance marker and creates the main window

/// </summary>

/// <param name="hInstance">The h instance.</param>

/// <param name="nCmdShow">The n command show.</param>

/// <returns></returns>

BOOL InitInstance**(**HINSTANCE hInstance**,** int nCmdShow**)**

**{**

hInst **=** hInstance**;** // Save instance marker in global variable

HWND hWnd **=** CreateWindowW**(**szWindowClass**,** szTitle**,** WS\_OVERLAPPEDWINDOW **|** WS\_CLIPCHILDREN**,**

CW\_USEDEFAULT**,** 0**,** CW\_USEDEFAULT**,** 0**,** **nullptr,** **nullptr,** hInstance**,** **nullptr);**

**if** **(!**hWnd**)**

**{**

**return** FALSE**;**

**}**

ShowWindow**(**hWnd**,** nCmdShow**);**

UpdateWindow**(**hWnd**);**

**return** TRUE**;**

**}**

/// <summary>

/// Message handler for "About" window.

/// </summary>

/// <param name="hDlg">The h dialog.</param>

/// <param name="message">The message.</param>

/// <param name="wParam">The w parameter.</param>

/// <param name="lParam">The l parameter.</param>

/// <returns></returns>

INT\_PTR CALLBACK About**(**HWND hDlg**,** UINT message**,** WPARAM wParam**,** LPARAM lParam**)**

**{**

UNREFERENCED\_PARAMETER**(**lParam**);**

**switch** **(**message**)**

**{**

**case** WM\_INITDIALOG**:**

**return** **(**INT\_PTR**)**TRUE**;**

**case** WM\_COMMAND**:**

**if** **(**LOWORD**(**wParam**)** **==** IDOK **||** LOWORD**(**wParam**)** **==** IDCANCEL**)**

**{**

EndDialog**(**hDlg**,** LOWORD**(**wParam**));**

**return** **(**INT\_PTR**)**TRUE**;**

**}**

**break;**

**}**

**return** **(**INT\_PTR**)**FALSE**;**

**}**

#pragma endregion

#pragma region ModifiedFuntions

// Third Part

// FUNCTION: WndProc(HWND, UINT, WPARAM, LPARAM)

//

// OBJECTIVE: Processes messages in the main window.

//

// WM\_COMMAND - Process the application menu

// WM\_PAINT - Drawing of the main window

// WM\_DESTROY - Send message about exit and return

//

//

/// <summary>

/// Processes messages in the main window.

/// </summary>

/// <param name="hWnd">The h WND.</param>

/// <param name="message">The message.</param>

/// <param name="wParam">The w parameter.</param>

/// <param name="lParam">The l parameter.</param>

/// <returns></returns>

LRESULT CALLBACK WndProc**(**HWND hWnd**,** UINT message**,** WPARAM wParam**,** LPARAM lParam**)**

**{**

**switch** **(**message**)**

**{**

**case** WM\_CREATE**:**

toolbar**.**OnCreate**(**hWnd**);** // here we will create Toolbar

**break;**

**case** WM\_SIZE**:** // this message is sent if the window resizes

toolbar**.**OnSize**(**hWnd**);**

**break;**

**case** WM\_NOTIFY**:** // message from the buttons

toolbar**.**OnNotify**(**hWnd**,** lParam**);**

**break;**

**case** WM\_LBUTTONDOWN**:**

editorShape**.**OnLBdown**(**hWnd**);**

**break;**

**case** WM\_LBUTTONUP**:**

editorShape**.**OnLBup**(**hWnd**);**

**break;**

**case** WM\_MOUSEMOVE**:**

editorShape**.**OnMouseMove**(**hWnd**);**

**break;**

**case** WM\_PAINT**:**

editorShape**.**OnPaint**(**hWnd**);**

**break;**

**case** WM\_INITMENUPOPUP**:**

editorShape**.**OnInitMenuPopup**(**hWnd**,** wParam**);**

**break;**

**case** WM\_COMMAND**:**

**{**

int wmId **=** LOWORD**(**wParam**);**

**switch** **(**wmId**)**

**{**

**case** ID\_TOOL\_POINT**:**

CallToolPoint**();**

**break;**

**case** ID\_TOOL\_LINE**:**

CallToolLine**();**

**break;**

**case** ID\_TOOL\_RECTANGLE**:**

CallToolRectangle**();**

**break;**

**case** ID\_TOOL\_ELLIPSE**:**

CallToolEllipse**();**

**break;**

**case** IDM\_ABOUT**:**

DialogBox**(**hInst**,** MAKEINTRESOURCE**(**IDD\_ABOUTBOX**),** hWnd**,** About**);**

**break;**

**case** IDM\_EXIT**:**

DestroyWindow**(**hWnd**);**

**break;**

**default:**

**return** DefWindowProcW**(**hWnd**,** message**,** wParam**,** lParam**);**

**}**

**}**

**break;**

**case** WM\_DESTROY**:**

PostQuitMessage**(**0**);**

**break;**

**default:**

**return** DefWindowProcW**(**hWnd**,** message**,** wParam**,** lParam**);**

**}**

**return** 0**;**

**}**

/// <summary>

/// Do something when Point tool is used

/// </summary>

void CallToolPoint**()**

**{**

toolbar**.**OnToolPoint**();**

editorShape**.**StartPointEditor**();**

**}**

/// <summary>

/// Do something when Line tool is used

/// </summary>

void CallToolLine**()**

**{**

toolbar**.**OnToolLine**();**

editorShape**.**StartLineEditor**();**

**}**

/// <summary>

/// Do something when Rectangle tool is used

/// </summary>

void CallToolRectangle**()**

**{**

toolbar**.**OnToolRectangle**();**

editorShape**.**StartRectangleEditor**();**

**}**

/// <summary>

/// Do something when Ellipse tool is used

/// </summary>

void CallToolEllipse**()**

**{**

toolbar**.**OnToolEllipse**();**

editorShape**.**StartEllipseEditor**();**

**}**

/// <summary>

/// Sets the shape name

/// </summary>

void SetShape**(**int ShapeNumber**)**

**{**

**switch** **(**ShapeNumber**)**

**{**

**case(**0**):**

currentShape **=** POINT\_NAME**;**

**break;**

**case(**1**):**

currentShape **=** LINE\_NAME**;**

**break;**

**case(**2**):**

currentShape **=** RECTANGLE\_NAME**;**

**break;**

**case(**3**):**

currentShape **=** ELLIPSE\_NAME**;**

**break;**

**default:**

**break;**

**}**

**}**

#pragma endregion ModifiedFuntions

**Shape.cpp:**

#include "framework.h"

#include "pch.h"

#include "shape.h"

#include "colors.h"

#pragma region Functions

/// <summary>

/// // Get coords of points

/// </summary>

/// <param name="x1">first point</param>

/// <param name="y1">second point</param>

/// <param name="x2">third point</param>

/// <param name="y2">fourth point</param>

void Shape**::**Set**(**long x1**,** long y1**,** long x2**,** long y2**)**

**{**

xs1 **=** x1**;**

ys1 **=** y1**;**

xs2 **=** x2**;**

ys2 **=** y2**;**

**}**

/// <summary>

/// Shows the pixel

/// </summary>

/// <param name="hdc">handle to a device context</param>

void PointShape**::**Show**(**HDC hdc**)**

**{**

SetPixel**(**hdc**,** xs1**,** ys1**,** black**);**

**}**

/// <summary>

/// Shows the line

/// </summary>

/// <param name="hdc">handle to a device context</param>

void LineShape**::**Show**(**HDC hdc**)**

**{**

HPEN hPen**,** hPenOld**;**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** black**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

MoveToEx**(**hdc**,** xs1**,** ys1**,** **NULL);**

LineTo**(**hdc**,** xs2**,** ys2**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

**}**

/// <summary>

/// Shows the rectangle

/// </summary>

/// <param name="hdc">handle to a device context</param>

void RectangleShape**::**Show**(**HDC hdc**)**

**{**

HPEN hPen**,** hPenOld**;**

HBRUSH hBrush**,** hBrushOld**;**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** black**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

hBrush **=** CreateSolidBrush**(**white**);**

hBrushOld **=** **(**HBRUSH**)**SelectObject**(**hdc**,** hBrush**);**

SelectObject**(**hdc**,** hBrush**);**

Rectangle**(**hdc**,** xs1**,** ys1**,** xs2**,** ys2**);**

SelectObject**(**hdc**,** hBrushOld**);**

DeleteObject**(**hBrush**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

**}**

/// <summary>

/// Shows the ellipse

/// </summary>

/// <param name="hdc">handle to a device context</param>

void EllipseShape**::**Show**(**HDC hdc**)**

**{**

HPEN hPen**,** hPenOld**;**

HBRUSH hBrush**,** hBrushOld**;**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** black**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

Arc**(**hdc**,** xs1**,** ys1**,** xs2**,** ys2**,** 0**,** 0**,** 0**,** 0**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

**};**

#pragma endregion Functions

**Shape.h:**

#include "pch.h"

/// <summary>

/// Main class for shapes

/// </summary>

class Shape

**{**

protected**:**

long xs1**,** ys1**,** xs2**,** ys2**;**

public**:**

void Set**(**long x1**,** long y1**,** long x2**,** long y2**);**

virtual void Show**(**HDC**)** **=** 0**;**

**};**

/// <summary>

/// Class for points

/// </summary>

class PointShape **:** public Shape

**{**

public**:**

void Show**(**HDC**);**

**};**

/// <summary>

/// Class for lines

/// </summary>

class LineShape **:** public Shape

**{**

public**:**

void Show**(**HDC**);**

**};**

/// <summary>

/// Class for rectangles

/// </summary>

class RectangleShape **:** public Shape

**{**

public**:**

void Show**(**HDC**);**

**};**

/// <summary>

/// Class for ellipses

/// </summary>

class EllipseShape **:** public Shape

**{**

public**:**

void Show**(**HDC**);**

**};**

**Shape\_editor.cpp:**

#include "framework.h"

#include "pch.h"

#include "shape\_editor.h"

#include "shape.h"

#pragma region Variables

const int Size\_Of\_Array **=** 110**;**

Shape**\*** pcshape**[**Size\_Of\_Array**];**

int size **=** 0**;**

bool isPressed**;**

#pragma endregion Variables

#pragma region Functions

#pragma region ShapeObjectsEditor

/// <summary>

/// Constructor

/// </summary>

ShapeObjectsEditor**::**ShapeObjectsEditor**()**

**{**

pse **=** **new** PointEditor**;**

**}**

/// <summary>

/// Destructor

/// </summary>

ShapeObjectsEditor**::~**ShapeObjectsEditor**()**

**{**

**for** **(**int i **=** 0**;** i **<** size**;** i**++)**

**{**

**delete** pcshape**[**i**];**

**}**

**}**

/// <summary>

/// Starts the PointEditor

/// </summary>

void ShapeObjectsEditor**::**StartPointEditor**()**

**{**

**if** **(**pse**)**

**{**

**delete** pse**;**

**}**

pse **=** **new** PointEditor**;**

SetShape**(**0**);**

**}**

/// <summary>

/// Starts the LineEditor

/// </summary>

void ShapeObjectsEditor**::**StartLineEditor**()**

**{**

**if** **(**pse**)**

**{**

**delete** pse**;**

**}**

pse **=** **new** LineEditor**;**

SetShape**(**1**);**

**}**

/// <summary>

/// Starts the RectangleEditor

/// </summary>

void ShapeObjectsEditor**::**StartRectangleEditor**()**

**{**

**if** **(**pse**)**

**{**

**delete** pse**;**

**}**

pse **=** **new** RectangleEditor**;**

SetShape**(**2**);**

**}**

/// <summary>

/// Starts the EllipseEditor

/// </summary>

void ShapeObjectsEditor**::**StartEllipseEditor**()**

**{**

**if** **(**pse**)**

**{**

**delete** pse**;**

**}**

pse **=** **new** EllipseEditor**;**

SetShape**(**3**);**

**}**

/// <summary>

/// Do something on left mouse button clicked

/// </summary>

/// <param name="hWnd">window</param>

void ShapeObjectsEditor**::**OnLBdown**(**HWND hWnd**)**

**{**

**if** **(**pse**)**

**{**

pse**->**OnLBdown**(**hWnd**);**

**}**

**}**

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void ShapeObjectsEditor**::**OnLBup**(**HWND hWnd**)**

**{**

**if** **(**pse**)**

**{**

pse**->**OnLBup**(**hWnd**);**

**}**

**}**

/// <summary>

/// Do something on left mouse moving

/// </summary>

/// <param name="hWnd">window</param>

void ShapeObjectsEditor**::**OnMouseMove**(**HWND hWnd**)**

**{**

**if** **(**pse **&&** isPressed**)**

**{**

pse**->**OnMouseMove**(**hWnd**);**

**}**

**}**

/// <summary>

/// Do something on paint

/// </summary>

/// <param name="hWnd">window</param>

void ShapeObjectsEditor**::**OnPaint**(**HWND hWnd**)**

**{**

ShapeEditor**\*** draw **=** **new** ShapeEditor**;**

draw**->**OnPaint**(**hWnd**);**

**}**

/// <summary>

/// Sets the mark in figures menu

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void ShapeObjectsEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)**

**{**

**if** **(**pse**)**

**{**

pse**->**OnInitMenuPopup**(**hWnd**,** wParams**);**

**}**

**}**

#pragma endregion ShapeObjectsEditor

#pragma region ShapeEditor

void ShapeEditor**::**OnMouseMove**(**HWND hWnd**)** **{};**

/// <summary>

/// Do something on left mouse button clicked

/// </summary>

/// <param name="hWnd">window</param>

void ShapeEditor**::**OnLBdown**(**HWND hWnd**)**

**{**

isPressed **=** TRUE**;**

POINT pt**;**

GetCursorPos**(&**pt**);**

ScreenToClient**(**hWnd**,** **&**pt**);**

x1 **=** x2 **=** pt**.**x**;**

y1 **=** y2 **=** pt**.**y**;**

**}**

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void ShapeEditor**::**OnLBup**(**HWND hWnd**)**

**{**

POINT pt**;**

GetCursorPos**(&**pt**);**

ScreenToClient**(**hWnd**,** **&**pt**);**

x2 **=** pt**.**x**;**

y2 **=** pt**.**y**;**

isPressed **=** FALSE**;**

**}**

/// <summary>

/// InitMenu Popup

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void ShapeEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)** **{};**

/// <summary>

/// Do something on paint

/// </summary>

/// <param name="hWnd">window</param>

void ShapeEditor**::**OnPaint**(**HWND hWnd**)**

**{**

PAINTSTRUCT ps**;**

HDC hdc**;**

hdc **=** BeginPaint**(**hWnd**,** **&**ps**);**

**for** **(**int i **=** 0**;** i **<** size**;** i**++)**

**{**

**if** **(**pcshape**[**i**])**

**{**

pcshape**[**i**]->**Show**(**hdc**);**

**}**

**}**

EndPaint**(**hWnd**,** **&**ps**);**

**}**

#pragma endregion ShapeEditor

#pragma region PointEditor

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void PointEditor**::**OnLBup**(**HWND hWnd**)**

**{**

\_\_super**::**OnLBup**(**hWnd**);**

PointShape**\*** Point **=** **new** PointShape**;**

Point**->**Set**(**x1**,** y1**,** x2**,** y2**);**

pcshape**[**size**]** **=** Point**;**

size**++;**

InvalidateRect**(**hWnd**,** **NULL,** TRUE**);**

**}**

/// <summary>

/// Sets the Check

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void PointEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)**

**{**

HMENU hMenu**,** hSubMenu**;**

hMenu **=** GetMenu**(**hWnd**);**

hSubMenu **=** GetSubMenu**(**hMenu**,** 1**);**

**if** **((**HMENU**)**wParams **==** hSubMenu**)**

**{**

CheckMenuItem**(**hSubMenu**,** IDM\_POINT**,** MF\_CHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_LINE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_RECTANGLE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_ELLIPSE**,** MF\_UNCHECKED**);**

**}**

**}**

#pragma endregion PointEditor

#pragma region LineEditor

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void LineEditor**::**OnLBup**(**HWND hWnd**)**

**{**

\_\_super**::**OnLBup**(**hWnd**);**

LineShape**\*** Line **=** **new** LineShape**;**

Line**->**Set**(**x1**,** y1**,** x2**,** y2**);**

pcshape**[**size**]** **=** Line**;**

size**++;**

InvalidateRect**(**hWnd**,** **NULL,** TRUE**);**

**}**

/// <summary>

/// Sets the Check

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void LineEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)**

**{**

HMENU hMenu**,** hSubMenu**;**

hMenu **=** GetMenu**(**hWnd**);**

hSubMenu **=** GetSubMenu**(**hMenu**,** 1**);**

**if** **((**HMENU**)**wParams **==** hSubMenu**)**

**{**

CheckMenuItem**(**hSubMenu**,** IDM\_POINT**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_LINE**,** MF\_CHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_RECTANGLE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_ELLIPSE**,** MF\_UNCHECKED**);**

**}**

**}**

/// <summary>

/// Do something on Mouse moving

/// </summary>

/// <param name="hWnd">window</param>

void LineEditor**::**OnMouseMove**(**HWND hWnd**)**

**{**

POINT pt**;**

HPEN hPen**,** hPenOld**;**

HDC hdc **=** GetDC**(**hWnd**);**

SetROP2**(**hdc**,** R2\_NOTXORPEN**);**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** blue**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

MoveToEx**(**hdc**,** x1**,** y1**,** **NULL);**

LineTo**(**hdc**,** x2**,** y2**);**

GetCursorPos**(&**pt**);**

ScreenToClient**(**hWnd**,** **&**pt**);**

x2 **=** pt**.**x**;**

y2 **=** pt**.**y**;**

MoveToEx**(**hdc**,** x1**,** y1**,** **NULL);**

LineTo**(**hdc**,** x2**,** y2**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

ReleaseDC**(**hWnd**,** hdc**);**

**}**

#pragma endregion LineEditor

#pragma region RectangleEditor

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void RectangleEditor**::**OnLBup**(**HWND hWnd**)**

**{**

\_\_super**::**OnLBup**(**hWnd**);**

RectangleShape**\*** Rectangle **=** **new** RectangleShape**;**

Rectangle**->**Set**(**x1**,** y1**,** x2**,** y2**);**

pcshape**[**size**]** **=** Rectangle**;**

size**++;**

InvalidateRect**(**hWnd**,** **NULL,** TRUE**);**

**}**

/// <summary>

/// Sets the Check

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void RectangleEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)**

**{**

HMENU hMenu**,** hSubMenu**;**

hMenu **=** GetMenu**(**hWnd**);**

hSubMenu **=** GetSubMenu**(**hMenu**,** 1**);**

**if** **((**HMENU**)**wParams **==** hSubMenu**)**

**{**

CheckMenuItem**(**hSubMenu**,** IDM\_POINT**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_LINE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_RECTANGLE**,** MF\_CHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_ELLIPSE**,** MF\_UNCHECKED**);**

**}**

**}**

/// <summary>

/// Do something on Mouse moving

/// </summary>

/// <param name="hWnd">window</param>

void RectangleEditor**::**OnMouseMove**(**HWND hWnd**)**

**{**

POINT pt**;**

HPEN hPen**,** hPenOld**;**

HDC hdc **=** GetDC**(**hWnd**);**

SetROP2**(**hdc**,** R2\_NOTXORPEN**);**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** blue**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

Rectangle**(**hdc**,** x1**,** y1**,** x2**,** y2**);**

GetCursorPos**(&**pt**);**

ScreenToClient**(**hWnd**,** **&**pt**);**

x2 **=** pt**.**x**;**

y2 **=** pt**.**y**;**

Rectangle**(**hdc**,** x1**,** y1**,** x2**,** y2**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

ReleaseDC**(**hWnd**,** hdc**);**

**}**

#pragma endregion RectangleEditor

#pragma region EllipseEditor

/// <summary>

/// Do something on left mouse button unclicked

/// </summary>

/// <param name="hWnd">window</param>

void EllipseEditor**::**OnLBup**(**HWND hWnd**)**

**{**

\_\_super**::**OnLBup**(**hWnd**);**

EllipseShape**\*** Ellipse **=** **new** EllipseShape**;**

Ellipse**->**Set**(**2 **\*** x1 **-** x2**,** 2 **\*** y1 **-** y2**,** x2**,** y2**);**

pcshape**[**size**]** **=** Ellipse**;**

size**++;**

InvalidateRect**(**hWnd**,** **NULL,** TRUE**);**

**}**

/// <summary>

/// Sets the Check

/// </summary>

/// <param name="hWnd"></param>

/// <param name="wParams"></param>

void EllipseEditor**::**OnInitMenuPopup**(**HWND hWnd**,** WPARAM wParams**)**

**{**

HMENU hMenu**,** hSubMenu**;**

hMenu **=** GetMenu**(**hWnd**);**

hSubMenu **=** GetSubMenu**(**hMenu**,** 1**);**

**if** **((**HMENU**)**wParams **==** hSubMenu**)**

**{**

CheckMenuItem**(**hSubMenu**,** IDM\_POINT**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_LINE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_RECTANGLE**,** MF\_UNCHECKED**);**

CheckMenuItem**(**hSubMenu**,** IDM\_ELLIPSE**,** MF\_CHECKED**);**

**}**

**}**

/// <summary>

/// Do something on Mouse moving

/// </summary>

/// <param name="hWnd">window</param>

void EllipseEditor**::**OnMouseMove**(**HWND hWnd**)**

**{**

POINT pt**;**

HPEN hPen**,** hPenOld**;**

HDC hdc **=** GetDC**(**hWnd**);**

SetROP2**(**hdc**,** R2\_NOTXORPEN**);**

hPen **=** CreatePen**(**PS\_SOLID**,** 1**,** blue**);**

hPenOld **=** **(**HPEN**)**SelectObject**(**hdc**,** hPen**);**

Arc**(**hdc**,** 2 **\*** x1 **-** x2**,** 2 **\*** y1 **-** y2**,** x2**,** y2**,** 0**,** 0**,** 0**,** 0**);**

GetCursorPos**(&**pt**);**

ScreenToClient**(**hWnd**,** **&**pt**);**

x2 **=** pt**.**x**;**

y2 **=** pt**.**y**;**

Arc**(**hdc**,** 2 **\*** x1 **-** x2**,** 2 **\*** y1 **-** y2**,** x2**,** y2**,** 0**,** 0**,** 0**,** 0**);**

SelectObject**(**hdc**,** hPenOld**);**

DeleteObject**(**hPen**);**

ReleaseDC**(**hWnd**,** hdc**);**

**}**

#pragma endregion EllipseEditor

#pragma endregion Functions

**Shape\_editor.h:**

#pragma once

#include "pch.h"

#include "editor.h"

#include "Resource.h"

#pragma region Editors

/// <summary>

/// Shape editor class for figures

/// </summary>

class ShapeEditor **:** public Editor

**{**

protected**:**

long x1**,** x2**,** y1**,** y2**;**

public**:**

void OnLBdown**(**HWND**);**

void OnLBup**(**HWND**);**

void OnMouseMove**(**HWND**);**

void OnPaint**(**HWND**);**

virtual void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

/// <summary>

/// Shape editor class for figure objects

/// </summary>

class ShapeObjectsEditor

**{**

private**:**

ShapeEditor**\*** pse**;**

public**:**

ShapeObjectsEditor**(**void**);**

**~**ShapeObjectsEditor**();**

void StartPointEditor**();**

void StartLineEditor**();**

void StartRectangleEditor**();**

void StartEllipseEditor**();**

void OnLBdown**(**HWND**);**

void OnLBup**(**HWND**);**

void OnMouseMove**(**HWND**);**

void OnPaint**(**HWND**);**

void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

/// <summary>

/// Point editor class for points

/// </summary>

class PointEditor **:** public ShapeEditor

**{**

public**:**

void OnLBup**(**HWND**);**

void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

/// <summary>

/// Line editor class for lines

/// </summary>

class LineEditor **:** public ShapeEditor

**{**

public**:**

void OnLBup**(**HWND**);**

void OnMouseMove**(**HWND**);**

void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

/// <summary>

/// Rectangle editor class for rectangles

/// </summary>

class RectangleEditor **:** public ShapeEditor

**{**

public**:**

void OnLBup**(**HWND**);**

void OnMouseMove**(**HWND**);**

void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

/// <summary>

/// Ellipse editor class for ellipses

/// </summary>

class EllipseEditor **:** public ShapeEditor

**{**

public**:**

void OnLBup**(**HWND**);**

void OnMouseMove**(**HWND**);**

void OnInitMenuPopup**(**HWND**,** WPARAM**);**

**};**

#pragma endregion Editors

**Editor.h:**

#pragma once

#include "pch.h"

/// <summary>

/// Main interface

/// </summary>

class Editor

**{**

public**:**

virtual void OnLBdown**(**HWND**)** **=** 0**;**

virtual void OnLBup**(**HWND**)** **=** 0**;**

virtual void OnMouseMove**(**HWND**)** **=** 0**;**

virtual void OnPaint**(**HWND**)** **=** 0**;**

**};**

**Toolbar.cpp:**

#include "framework.h"

#include "pch.h"

#include "lab3.h"

#include "toolbar.h"

#include "resource1.h"

#pragma region Variables

HWND hwndToolBar **=** **NULL;**

int point**,** line**,** rectangle**,** ellipse**,** buttonToChange **=** 0**;**

const int allShapes **=** 5**;**

int shapes**[**allShapes**]** **=** **{** point **,**line **,**rectangle **,**ellipse **,**buttonToChange **};**

const LPCSTR pointName **=** "Крапка"**;**

const LPCSTR lineName **=** "Лінія"**;**

const LPCSTR rectangleName **=** "Прямокутник"**;**

const LPCSTR ellipseName **=** "Овал"**;**

const LPCSTR unnkownName **=** "Щось невідоме"**;**

#pragma endregion Variables

#pragma region Functions

/// <summary>

/// Creates toolbar

/// </summary>

/// <param name="hWnd"></param>

void Toolbar**::**OnCreate**(**HWND hWnd**)**

**{**

TBBUTTON tbb**[**5**];**

ZeroMemory**(**tbb**,** **sizeof(**tbb**));**

tbb**[**0**].**iBitmap **=** 0**;**

tbb**[**0**].**fsState **=** TBSTATE\_ENABLED**;**

tbb**[**0**].**fsStyle **=** TBSTYLE\_BUTTON**;**

tbb**[**0**].**idCommand **=** ID\_TOOL\_POINT**;**

tbb**[**1**].**iBitmap **=** 1**;**

tbb**[**1**].**fsState **=** TBSTATE\_ENABLED**;**

tbb**[**1**].**fsStyle **=** TBSTYLE\_BUTTON**;**

tbb**[**1**].**idCommand **=** ID\_TOOL\_LINE**;**

tbb**[**2**].**iBitmap **=** 2**;** // image index in BITMAP

tbb**[**2**].**fsState **=** TBSTATE\_ENABLED**;**

tbb**[**2**].**fsStyle **=** TBSTYLE\_BUTTON**;**

tbb**[**2**].**idCommand **=** ID\_TOOL\_RECTANGLE**;**

tbb**[**3**].**iBitmap **=** 3**;**

tbb**[**3**].**fsState **=** TBSTATE\_ENABLED**;**

tbb**[**3**].**fsStyle **=** TBSTYLE\_BUTTON**;**

tbb**[**3**].**idCommand **=** ID\_TOOL\_ELLIPSE**;**

tbb**[**4**].**iBitmap **=** 4**;**

tbb**[**4**].**fsState **=** TBSTATE\_ENABLED**;**

tbb**[**4**].**fsStyle **=** TBSTYLE\_SEP**;** // separator of groups of buttons

tbb**[**4**].**idCommand **=** 0**;**

hwndToolBar **=** CreateToolbarEx**(**hWnd**,**

WS\_CHILD **|** WS\_VISIBLE **|** WS\_BORDER **|** WS\_CLIPSIBLINGS **|** CCS\_TOP **|** TBSTYLE\_TOOLTIPS**,**

IDC\_MY\_TOOLBAR**,**

4**,** // number of images in BITMAP

hInst**,**

IDB\_BITMAP1**,** // BITMAP resource ID

tbb**,**

5**,** // number of buttons (with separator)

24**,** 24**,** 24**,** 24**,** // BITMAP button and image sizes

**sizeof(**TBBUTTON**));**

**}**

// --- message handler WM\_SIZE ---

/// <summary>

/// Change size of toolbar

/// </summary>

/// <param name="hWnd"></param>

void Toolbar**::**OnSize**(**HWND hWnd**)**

**{**

RECT rc**,** rw**;**

**if** **(**hwndToolBar**)**

**{**

GetClientRect**(**hWnd**,** **&**rc**);** // new dimensions of the main window

GetWindowRect**(**hwndToolBar**,** **&**rw**);** // we need to know the height of the Toolbar

MoveWindow**(**hwndToolBar**,** 0**,** 0**,** rc**.**right **-** rc**.**left**,** rw**.**bottom **-** rw**.**top**,** FALSE**);**

**}**

**}**

/// <summary>

/// UnClick button and click button

/// </summary>

/// <param name="button"> button to unclick/click </param>

/// <param name="shape"> shape element </param>

void Toolbar**::**ChangeButton**(**int button**,** int shape**)**

**{**

SendMessage**(**hwndToolBar**,** TB\_PRESSBUTTON**,** buttonToChange**,** 0**);**

buttonToChange **=** button**;**

SendMessage**(**hwndToolBar**,** TB\_PRESSBUTTON**,** buttonToChange**,** shape**);**

**}**

/// <summary>

/// Set all elements to zero

/// </summary>

void Toolbar**::**SetToZeros**()**

**{**

**for** **(**auto**&** item **:** shapes**)**

**{**

item **=** 0**;**

**}**

**}**

/// <summary>

/// Sets value to opposite value

/// </summary>

/// <param name="value"></param>

void Toolbar**::**SetToOpposite**(**int value**)**

**{**

shapes**[**value**]** **=** **!**shapes**[**value**];**

**}**

/// <summary>

/// Function for drawing points with buttons animation

/// </summary>

void Toolbar**::**OnToolPoint**()**

**{**

SetToZeros**();**

SetToOpposite**(**0**);**

ChangeButton**(**ID\_TOOL\_POINT**,**shapes**[**0**]);**

**}**

/// <summary>

/// Function for drawing lines with buttons animation

/// </summary>

void Toolbar**::**OnToolLine**()**

**{**

SetToZeros**();**

SetToOpposite**(**1**);**

ChangeButton**(**ID\_TOOL\_LINE**,** shapes**[**1**]);**

**}**

/// <summary>

/// Function for drawing rectangles with buttons animation

/// </summary>

void Toolbar**::**OnToolRectangle**()**

**{**

SetToZeros**();**

SetToOpposite**(**2**);**

ChangeButton**(**ID\_TOOL\_RECTANGLE**,** shapes**[**2**]);**

**}**

/// <summary>

/// Function for drawing ellipses with buttons animation

/// </summary>

void Toolbar**::**OnToolEllipse**()**

**{**

SetToZeros**();**

SetToOpposite**(**3**);**

ChangeButton**(**ID\_TOOL\_ELLIPSE**,** shapes**[**3**]);**

**}**

/// <summary>

/// Function for tooltips

/// </summary>

/// <param name="hWnd"></param>

/// <param name="lParam"></param>

void Toolbar**::**OnNotify**(**HWND hWnd**,** LPARAM lParam**)**

**{**

LPNMHDR pnmh **=** **(**LPNMHDR**)**lParam**;**

LPCSTR pText**;**

**if** **(**pnmh**->**code **==** TTN\_NEEDTEXT**)**

**{**

LPTOOLTIPTEXT lpttt **=** **(**LPTOOLTIPTEXT**)**lParam**;**

**switch** **(**lpttt**->**hdr**.**idFrom**)**

**{**

**case** ID\_TOOL\_POINT**:**

pText **=** pointName**;**

**break;**

**case** ID\_TOOL\_LINE**:**

pText **=** lineName**;**

**break;**

**case** ID\_TOOL\_RECTANGLE**:**

pText **=** rectangleName**;**

**break;**

**case** ID\_TOOL\_ELLIPSE**:**

pText **=** ellipseName**;**

**break;**

**default:** pText **=** unnkownName**;**

**}**

lstrcpy**(**lpttt**->**szText**,** pText**);**

**}**

**}**

#pragma endregion Functions

**Toolbar.h:**

#pragma once

#define ID\_TOOL\_POINT 32805

#define ID\_TOOL\_LINE 32806

#define ID\_TOOL\_RECTANGLE 32807

#define ID\_TOOL\_ELLIPSE 32809

#define IDC\_MY\_TOOLBAR 32811

/// <summary>

/// Toolbar class for creating toolbar

/// </summary>

class Toolbar

**{**

private**:**

static void SetToZeros**();**

static void SetToOpposite**(**int value**);**

static void ChangeButton**(**int button**,** int shape**);**

public**:**

void OnSize**(**HWND hWnd**);**

void OnCreate**(**HWND hWnd**);**

void OnNotify**(**HWND hWnd**,** LPARAM lParam**);**

void OnToolPoint**();**

void OnToolLine**();**

void OnToolRectangle**();**

void OnToolEllipse**();**

**};**

**Діаграма класів (1.1)**

Editor

public:

* OnLBdown = 0
* OnLBup = 0
* OnMouseMove = 0
* OnPaint = 0

ShapeEditor

protected:

* x1, x2, y1, y2

public:

* OnLBdown
* OnLBup
* OnMouseMove
* OnPaint
* OnInitMenuPopup

PointEditor

public:

* OnLBup
* OnMouseMove
* OnInitMenuPopup

Shape

protected:

* xs1, ys1, xs2, ys2

public:

* Set
* Show = 0

Базовий клас

EllipseShape

public:

* Show

public:

* OnLBup
* OnInitMenuPopup

PointEditor

LineShape

public:

* Show

public:

* OnLBup
* OnMouseMove
* OnInitMenuPopup

LineEditor

Похідні класи

RectangleShape

public:

* Show

EllipseEditor

PointShape

public:

* OnLBup
* OnMouseMove
* OnInitMenuPopup

Похідні класи

public:

* Show

**Діаграма класів (1.2)**

**Скріншоти програми:**

public:

* OnSize
* OnCreate
* OnNotify
* OnToolPoint
* OnToolLine
* OnToolRectangle
* OnToolEllipse

private:

* SetToZeros
* SetToOpposite
* ChangeButton

Toolbar

private:

* pse

ShapeObjectsEditor

public:

* ShapeObjectsEditor
* ~ShapeObjectsEditor
* StartPointEditor
* StartLineEditor
* StartRectangleEditor
* ShapeEllipseEditor
* OnLBdown
* OnLBup
* OnMouseMove
* OnPaint
* OnInitMenuPopup

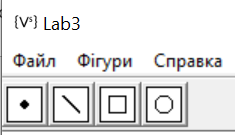
Початкове вікно:



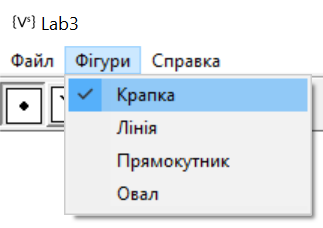
Бітмап:



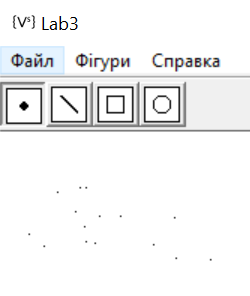
Тулбар:



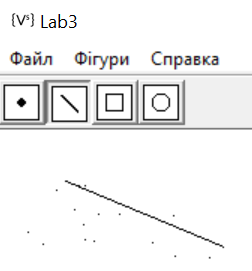
Вибір у меню:



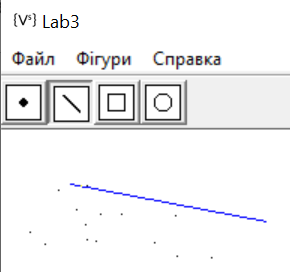
Введення крапок:



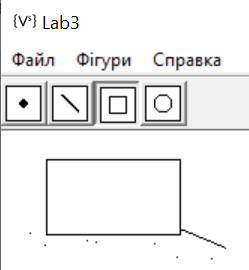
Введення ліній:



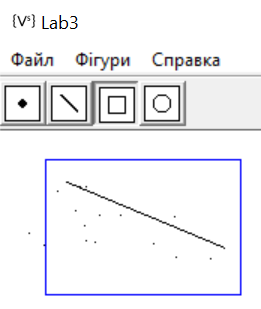
Гумовий слід ліній:



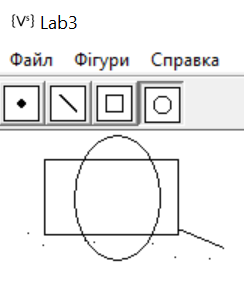
Введення прямокутників:



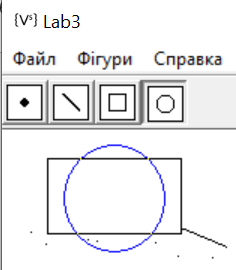
Гумовий слід прямокутників:



Введення еліпсів (овалів):



Гумовий слід еліпсів (овалів):



Також разом з іншими файлами є анімація (.gif) роботи програми

**Контрольні питання**

1. Обробку яких повідомлень потрібно виконувати у програмі Лаб3?

Початок вводу об’єктів (коли натискаєш на пункт у меню «Фігури»), натискання/відпускання лівої кнопки миші, рух миші, натискання на елементи toolbar, методи OnSize(), OnCreate(), OnNotify(),OnInitMenuPopup()

2. Що таке абстрактний клас і скільки іх у цій програмі?

Абстрактний клас – це базовий клас, від якого не можна створити екземпляру. В абстрактному класі можна описати абстрактні методи та властивості

У Нас їх три: Shape, ShapeEditor та Editor.

3. Як забезпечити відповідність пунктів меню і кнопок Toolbar?

За допомогою команди ВашМасив[ВашаКнопкаУмасиві].idCommand = IDвашоїКнопки;

4. Як запрограмувати показ власних зображень на кнопках Toolbar?

Під час створення toolbar треба надати бітмап та кількість зображень у ньому, розміри, кількість кнопок у toolbar

5. Як створити власні зображення кнопок і де вони зберігаються?

Треба намалювати (або взяти в іншому місці) бітмап для зображень кнопок. Зображення зберігаються у .rc

6. Як запрограмувати текст підказок (tooltips)?

При створенні toolbar треба додати "TBSTYLE\_TOOLTIPS" як стиль, запрограмувати OnNotify та додати WM\_NOTIFY у Lab3.cpp

**Висновок:**

Навчився малювати фігури. Ознайомився з ООП, абстрактними класами, рівнями захисту, створенням класів. Також навчився працювати з toolbar, з його елементами, створювати бітмапи та використовувати її для кнопок.