Assignment 6

Class - SE IT
Roll NO - 21480
Batch - F4
DOP - 08/10/2020
DOS - 08/10/2020

Problem statement :-
Write C++ program to implement cohen Southerland line clipping algorithm.

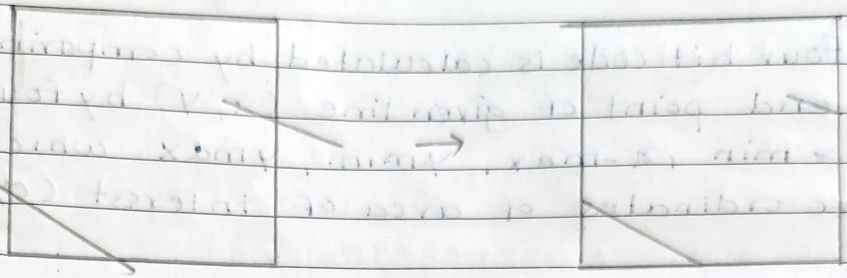
Objectives :-
To learn cohen sutherland line clipping algorithm

Outcomes :-
It will be able to clip the line using line clipping algorithm.
We will be able to learn and implement cohen sutherland algorithm.

S/W and H/W requirement :-
1. Qt creator.
2. Windows 10 64 bit

Theory :-
Cohen sutherland Algorithm is a line clipping algorithm that cuts lines to portions which are within a rectangular area. It eliminates the lines from a given set of lines and rectangle area of interest (view port) which belongs outside the area of interest and clips those lines which are partially inside the area of interest.

E.g.



Algorithm:-

The algorithm devides a two-dimensional space into 9 regions (either outside regions and one inside region) and then efficiently determines the lines and portions of lines that are visible in the central region of interest (the view port)

Following image illustrate the 9 regions:

1001	1000	1010
0001	0000 Window	0010
0101	0100	0110

3	2	1	0
above	below	right	left

Region code Legend.

As you seen each region is denoted by 4 bit code like 0101 for the bottom right region.

four bit code is calculated by comparing extreme end point of given line (x, y) by four co-ordinate x_{min}, x_{max}, y_{min}, y_{max} which are the co-ordinates of area of interest (0,0,0,0)

Calculate the four bit code as follow:-

1. Set first bit if 1 points lies to left of window $(x < x_{min})$
2. set second bit if 1 points lies to right to of window $(x > x_{max})$
3. Set third bit if 1 points lies to left of window $(y < y_{min})$
4. Set fourth bit if 1 points lies to right of window $(y > y_{max})$

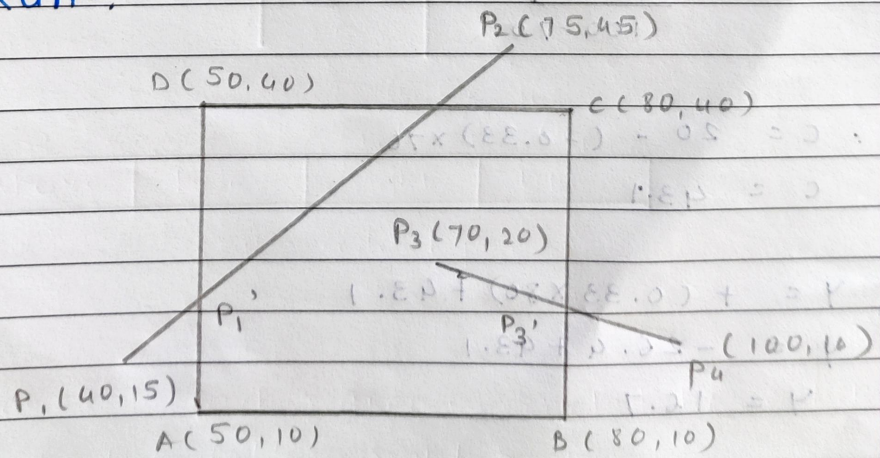
	x_{min}, y_{max}	x_{max}, y_{max}
complexty outside	completly inside	
	x_{min}, y_{min}	x_{max}, y_{min}
	partially inside	

The more efficient cohen-sutherland Algorithm performs initial tests on a line to determine whether intersection calculations can be avoided.

Pseudocode-:

1. Assign a region code for two endpoints of given line
2. If both endpoints have a region code 0000 then given line is completly inside and we will keep this line.
3. If step 2 fails perform the logical AND operations for both region codes.
   - 3.1. If the result is not 0000, then given line is completely outside.
   - 3.2. Else line is partially inside.
     - 3.2.1. Choose an endpoint of line that is outside the given rectangle.
     - 3.2.2. Find the intersection point of the rectangle boundary
     - 3.2.3. Replace endpoint with the intersection point and upgrade the region code
     - 3.2.4. Repeat step 2 until we find a clipped line either trivally accepted or rejected.
4. Repeat steps 1 for all lines.

* Dry Run-:



For Line P_1P_2 -

$$m = \frac{45-15}{75-40} = \frac{30}{35} = 0.857$$

$$c = 15 + (0.857) \times 40 = -19.28$$

Now, $x_{min} = 50$

$\therefore y = mx + c$

$\therefore y = 0.857 \times 50 - 19.28$

$y = 23.57$

$P_1' = (50, 23.57)$

$$\therefore x = \frac{40 + 19.28}{0.857} = 69.17$$

$P_2' = (69.17, 40)$

Line P_3P_4 -

$$m = \frac{10-20}{100-70} = -0.33$$

$\therefore c = 20 - (-0.33) \times 70$

$c = 43.1$

$y = +(0.33 \times 80) + 43.1$

$y = -26.4 + 43.1$

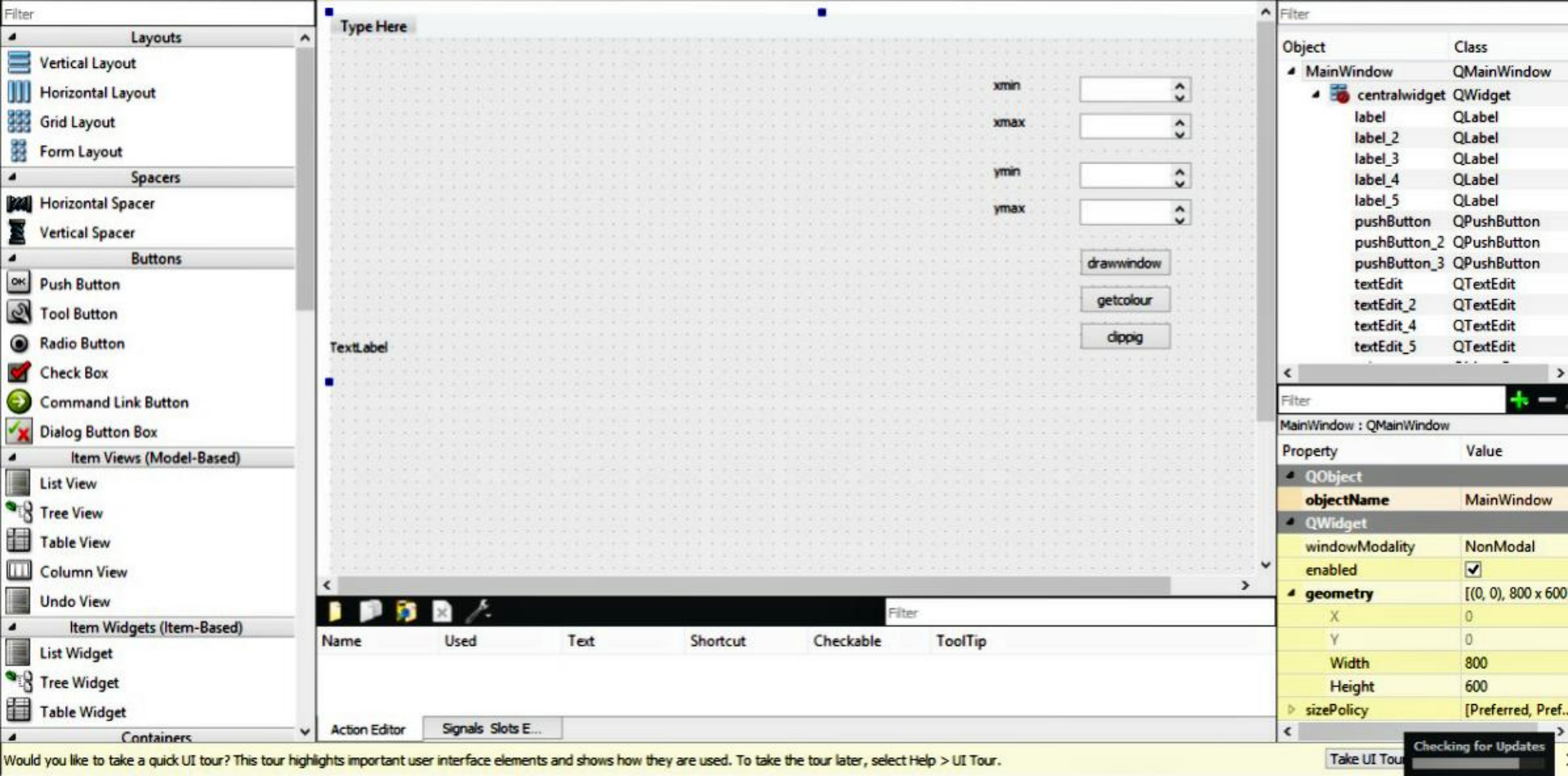
$y = 16.7$

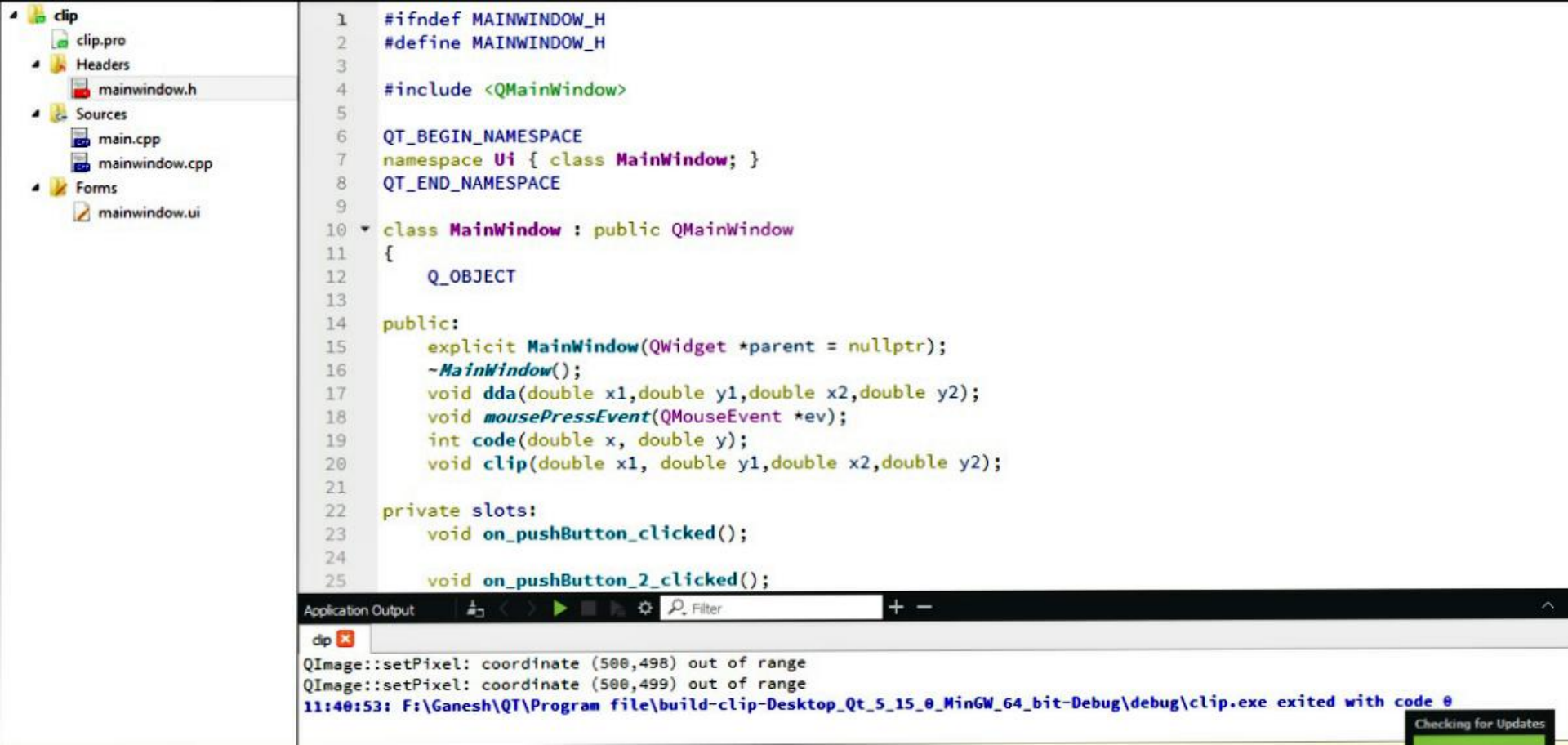
$\therefore P_3' = (80, 16.7)$

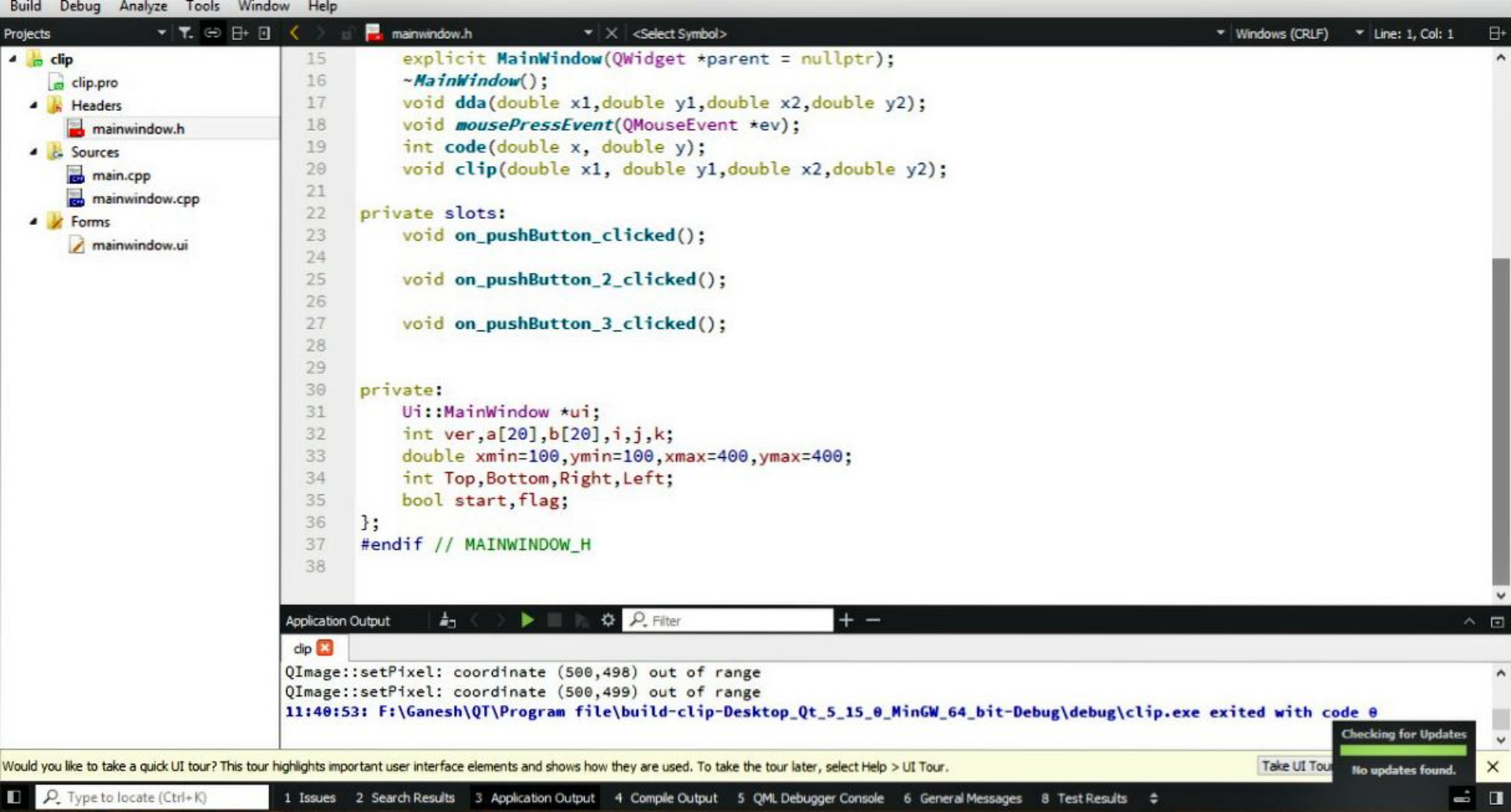
	Given Points of line Segments	Visible points of line Segments.
1.	P_1 (40, 15) P_2 (75, 45)	P_1' (50, 23.57) P_2' (69.17, 40)
2.	P_3 (70, 20) P_4 (100, 10)	P_3' (70, 20) P_4' (80, 16.7)

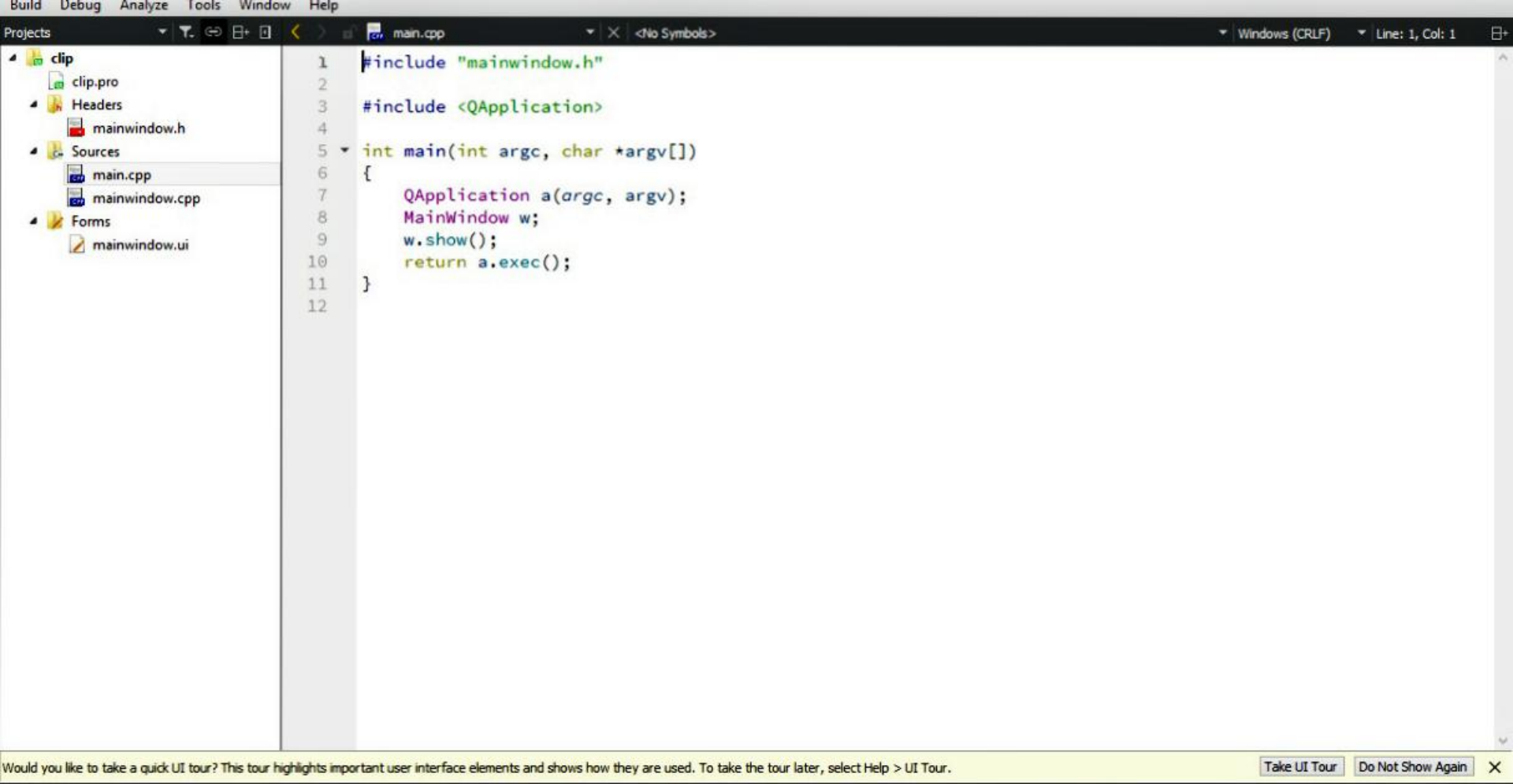
Conclusion -:

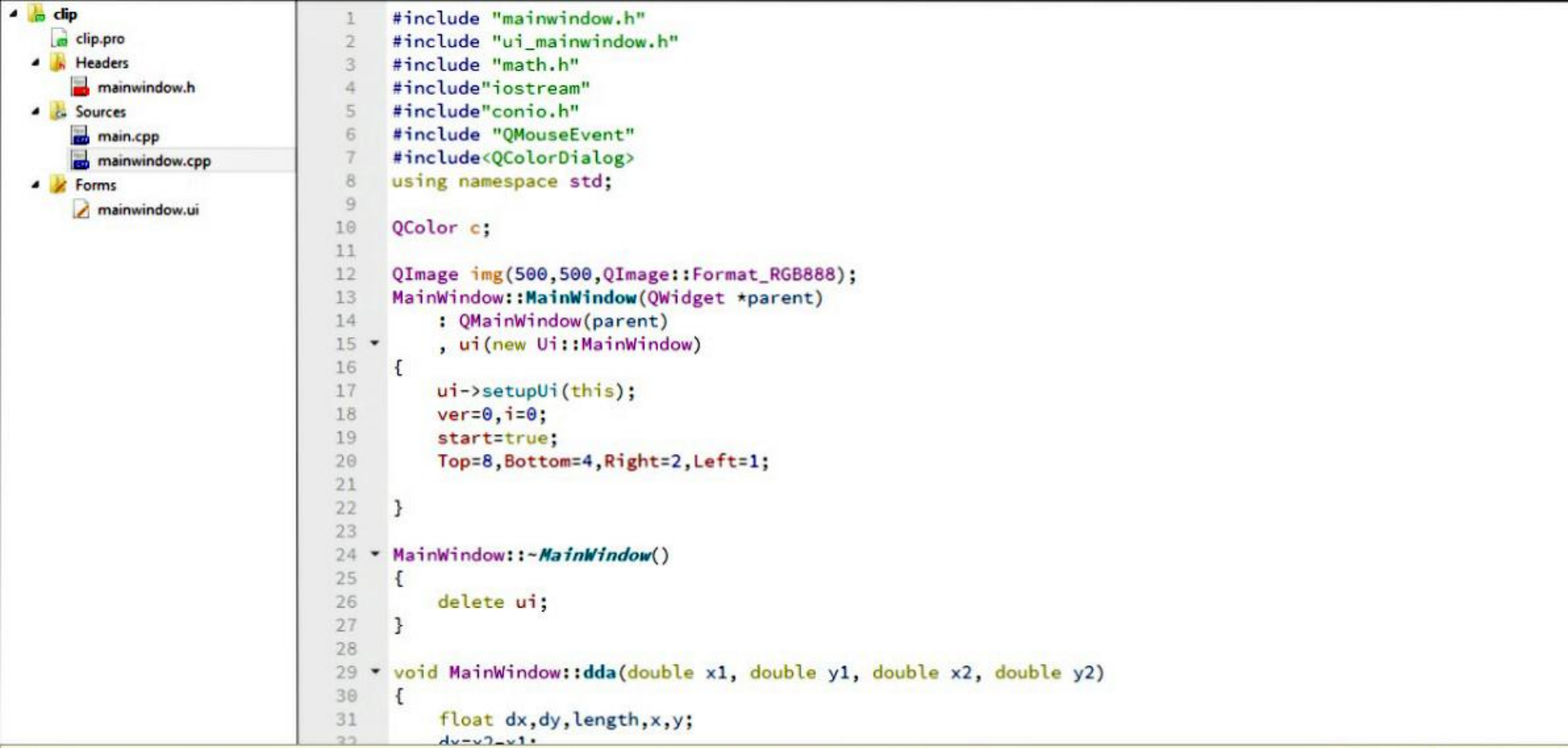
We learn to implement Cohen Sutherland line clipping algorithm to clip the line in the given clip window.


Filter
Layouts
Vertical Layout
Horizontal Layout
Grid Layout
Form Layout
Spacers
Horizontal Spacer
Vertical Spacer
Buttons
Push Button
Tool Button
Radio Button
Check Box
Command Link Button
Dialog Button Box
Item Views (Model-Based)
List View
Tree View
Table View
Column View
Undo View
Item Widgets (Item-Based)
List Widget
Tree Widget
Table Widget
Containers
Type Here
xmin
xmax
ymin
ymax
drawwindow
getcolour
clippig
TextLabel
Filter
Name
Used
Text
Shortcut
Checkable
ToolTip
Action Editor
Signals Slots E...
Filter
Object
Class
MainWindow
QMainWindow
centralwidget
QWidget
label
QLabel
label_2
QLabel
label_3
QLabel
label_4
QLabel
label_5
QLabel
pushButton
QPushButton
pushButton_2
QPushButton
pushButton_3
QPushButton
textEdit
QTextEdit
textEdit_2
QTextEdit
textEdit_4
QTextEdit
textEdit_5
QTextEdit
Filter
MainWindow : QMainWindow
Property
Value
QObject
objectName
MainWindow
QWidget
windowModality
NonModal
enabled
geometry
[(0, 0), 800 x 600
X
0
Y
0
Width
800
Height
600
sizePolicy
[Preferred, Pref...
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Checking for Updates


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
#ifndef MAINWINDOW_H
#define MAINWINDOW_H
#include <QMainWindow>
QT_BEGIN_NAMESPACE
namespace Ui { class MainWindow; }
QT_END_NAMESPACE
class MainWindow : public QMainWindow
{
Q_OBJECT
public:
explicit MainWindow(QWidget *parent = nullptr);
~MainWindow();
void dda(double x1,double y1,double x2,double y2);
void mousePressEvent(QMouseEvent *ev);
int code(double x, double y);
void clip(double x1, double y1,double x2,double y2);
private slots:
void on_pushButton_clicked();
void on_pushButton_2_clicked();
Application Output
Filter
clip
QImage::setPixel: coordinate (500,498) out of range
QImage::setPixel: coordinate (500,499) out of range
11:40:53: F:\Ganesh\QT\Program file\build-clip-Desktop_Qt_5_15_0_MinGW_64_bit-Debug\debug\clip.exe exited with code 0
Checking for Updates


Build Debug Analyze Tools Window Help
Projects
clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
mainwindow.h
<Select Symbol>
Windows (CRLF)
Line: 1, Col: 1
15 explicit MainWindow(QWidget *parent = nullptr);
16 ~MainWindow();
17 void dda(double x1,double y1,double x2,double y2);
18 void mousePressEvent(QMouseEvent *ev);
19 int code(double x, double y);
20 void clip(double x1, double y1,double x2,double y2);
21
22 private slots:
23 void on_pushButton_clicked();
24
25 void on_pushButton_2_clicked();
26
27 void on_pushButton_3_clicked();
28
29
30 private:
31 Ui::MainWindow *ui;
32 int ver,a[20],b[20],i,j,k;
33 double xmin=100,ymin=100,xmax=400,ymax=400;
34 int Top,Bottom,Right,Left;
35 bool start,flag;
36 };
37 #endif // MAINWINDOW_H
38
Application Output
Filter
clip
QImage::setPixel: coordinate (500,498) out of range
QImage::setPixel: coordinate (500,499) out of range
11:40:53: F:\Ganesh\QT\Program file\build-clip-Desktop_Qt_5_15_0_MinGW_64_bit-Debug\debug\clip.exe exited with code 0
Checking for Updates
No updates found.
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Type to locate (Ctrl+K)
1 Issues
2 Search Results
3 Application Output
4 Compile Output
5 QML Debugger Console
6 General Messages
8 Test Results


Build Debug Analyze Tools Window Help
Projects
main.cpp
<No Symbols>
Windows (CRLF)
Line: 1, Col: 1
clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
#include "mainwindow.h"
#include <QApplication>
int main(int argc, char *argv[])
{
QApplication a(argc, argv);
MainWindow w;
w.show();
return a.exec();
}
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
#include "mainwindow.h"
#include "ui_mainwindow.h"
#include "math.h"
#include"iostream"
#include"conio.h"
#include "QMouseEvent"
#include<QColorDialog>
using namespace std;
QColor c;
QImage img(500,500,QImage::Format_RGB888);
MainWindow::MainWindow(QWidget *parent)
: QMainWindow(parent)
, ui(new Ui::MainWindow)
{
ui->setupUi(this);
ver=0,i=0;
start=true;
Top=8,Bottom=4,Right=2,Left=1;
}
MainWindow::~MainWindow()
{
delete ui;
}
void MainWindow::dda(double x1, double y1, double x2, double y2)
{
float dx,dy,length,x,y;
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
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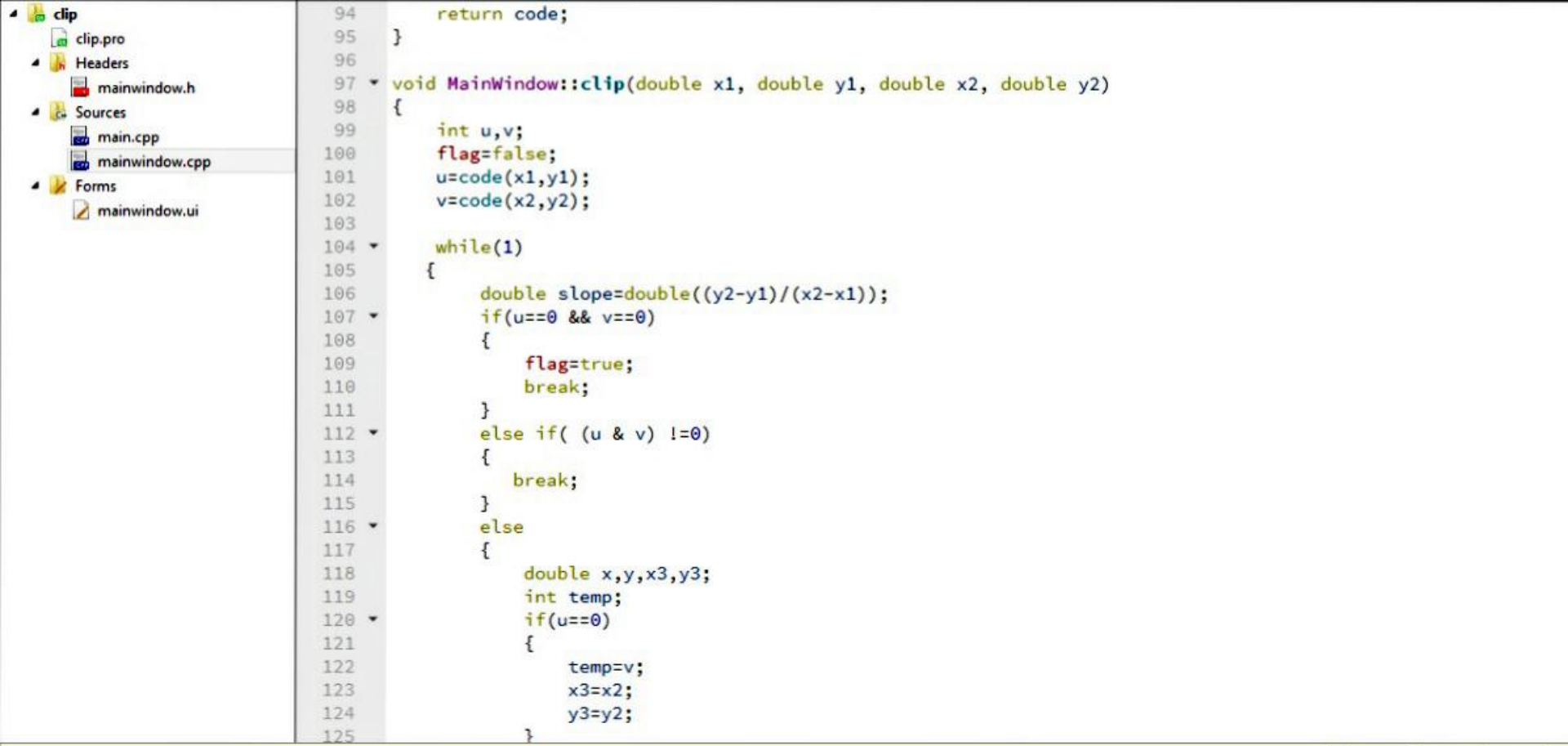
Do Not Show Again


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
31 float dx,dy,length,x,y;
32 dx=x2-x1;
33 dy=y2-y1;
34 if(abs(dx)>=abs(dy))
35 {
36 length=abs(dx);
37 }
38 else {
39 length=abs(dy);
40 }
41 dx=dx/length;
42 dy=dy/length;
43 int i=0;
44 x=x1;
45 y=y1;
46 img.setPixel(x,y,c.rgb());
47 while(i<length)
48 {
49 x=x+dx;
50 y=y+dy;
51 img.setPixel(x,y,c.rgb());
52 i=i+1;
53 }
54 ui->label->setPixmap(QPixmap::fromImage(img));
55 }
56
57 void MainWindow::mousePressEvent(QMouseEvent *ev)
58 {
59 if(start)
60 {
61 int p=ev->pos().x();
62 int q=ev->pos().y();
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again


```
62      int q=ev->pos().y();
63      a[ver]=p;
64      b[ver]=q;
65
66      if(ev->button()==Qt::RightButton)
67      {
68
69          start=false;
70      }
71      else{
72          if(ver%2!=0)
73          {
74              dda(a[ver],b[ver],a[ver-1],b[ver-1]);
75          }
76      }
77      ver++;
78
79      }
80
81  }
82
83  int MainWindow::code(double x, double y)
84  {
85      int code=0;
86      if (x<xmin)
87          code=Left;
88      else if(x>xmax)
89          code=Right;
90      if (y<ymin)
91          code=Top;
92      else if(y>ymax)
93          code=Bottom;
```


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
94 return code;
95 }
96
97 void MainWindow::clip(double x1, double y1, double x2, double y2)
98 {
99 int u,v;
100 flag=false;
101 u=code(x1,y1);
102 v=code(x2,y2);
103
104 while(1)
105 {
106 double slope=double((y2-y1)/(x2-x1));
107 if(u==0 && v==0)
108 {
109 flag=true;
110 break;
111 }
112 else if((u & v) !=0)
113 {
114 break;
115 }
116 else
117 {
118 double x,y,x3,y3;
119 int temp;
120 if(u==0)
121 {
122 temp=v;
123 x3=x2;
124 y3=y2;
125 }
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
125 }
126 else{ temp=u ;
127 x3=x1;
128 y3=y1; }
129 if(temp & Left){
130 x=xmin;
131 y=y3+slope*(xmin-x3);
132 }
133 else if(temp & Bottom){
134 y=ymax;
135 x=x3+(ymax-y3)/slope;
136 }
137 else if(temp & Right){
138 x=xmax;
139 y=y3+slope*(xmax-x3);
140 }
141 else if(temp & Top){
142 y=ymin;
143 x=x3+(ymin-y3)/slope;
144 }
145 if(temp==u){
146 x1=x;
147 y1=y;
148 u=code(x1,y1);
149 }
150 else{
151 x2=x;
152 y2=y;
153 v=code(x2,y2);
154 }
155 }
156 }
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again


clip
clip.pro
Headers
mainwindow.h
Sources
main.cpp
mainwindow.cpp
Forms
mainwindow.ui
157 if(flag==true){
158
159
160 dda(x1,y1,x2,y2);
161 }
162
163 }
164
165
166 void MainWindow::on_pushButton_clicked()
167 {
168 int xmin=ui->textEdit->toPlainText().toInt();
169 int xmax=ui->textEdit_2->toPlainText().toInt();
170 int ymin=ui->textEdit_4->toPlainText().toInt();
171 int ymax=ui->textEdit_5->toPlainText().toInt();
172 dda(xmin,ymin,xmax,ymin);
173 dda(xmax,ymin,xmax,ymax);
174 dda(xmax,ymax,xmin,ymax);
175 dda(xmin,ymax,xmin,ymin);
176 ui->label->setPixmap(QPixmap::fromImage(img));
177 }
178
179 void MainWindow::on_pushButton_2_clicked()
180 {
181 c=QColorDialog::getColor();
182 }
183
184 void MainWindow::on_pushButton_3_clicked()
185 {
186
187 for(k=0; k<=500; k++){
188 for(i=0; i<500; i++){
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Do Not Show Again

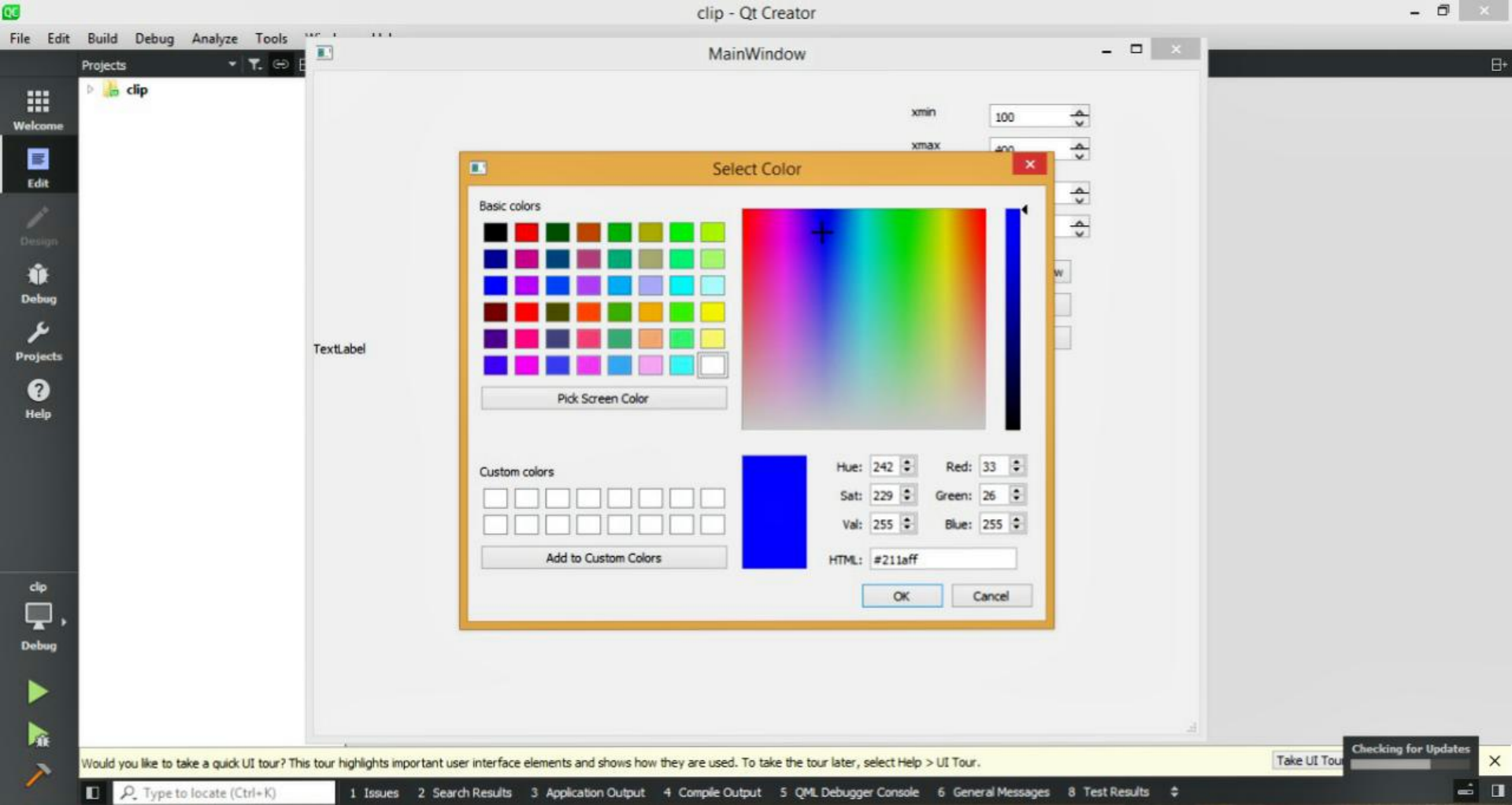
Build Debug Analyze Tools Window Help

Projects

- clip
  - clip.pro
  - Headers
    - mainwindow.h
  - Sources
    - main.cpp
    - mainwindow.cpp
  - Forms
    - mainwindow.ui

mainwindow.cpp <No Symbols> Windows (CRLF) Line: 181, Col: 5

```
175     dda(xmin,ymax,xmin,ymin);
176     ui->label->setPixmap(QPixmap::fromImage(img));
177 }
178
179 void MainWindow::on_pushButton_2_clicked()
180 {
181     c=QColorDialog::getColor();
182 }
183
184 void MainWindow::on_pushButton_3_clicked()
185 {
186
187     for(k=0; k<=500; k++){
188         for(j=0; j<500; j++){
189             img.setPixel(k,j,qRgb(0,0,0));
190         }
191     }
192     dda(xmin,ymin,xmax,ymin);
193     dda(xmax,ymin,xmax,ymax);
194     dda(xmax,ymax,xmin,ymax);
195     dda(xmin,ymax,xmin,ymin);
196     while(i<=ver){
197         if(i%2!=0){
198             clip(a[i-1],b[i-1],a[i],b[i]);
199         }
200         i++;
201     }
202
203
204 }
205
```


clip - Qt Creator
File Edit Build Debug Analyze Tools
Projects
clip
Welcome
Edit
Design
Debug
Projects
Help
clip
Debug
MainWindow
xmin
100
xmax
TextLabel
Select Color
Basic colors
Pick Screen Color
Custom colors
Add to Custom Colors
Hue: 242
Sat: 229
Val: 255
Red: 33
Green: 26
Blue: 255
HTML: #211aff
OK
Cancel
Would you like to take a quick UI tour? This tour highlights important user interface elements and shows how they are used. To take the tour later, select Help > UI Tour.
Take UI Tour
Checking for Updates
Type to locate (Ctrl+K)
1 Issues
2 Search Results
3 Application Output
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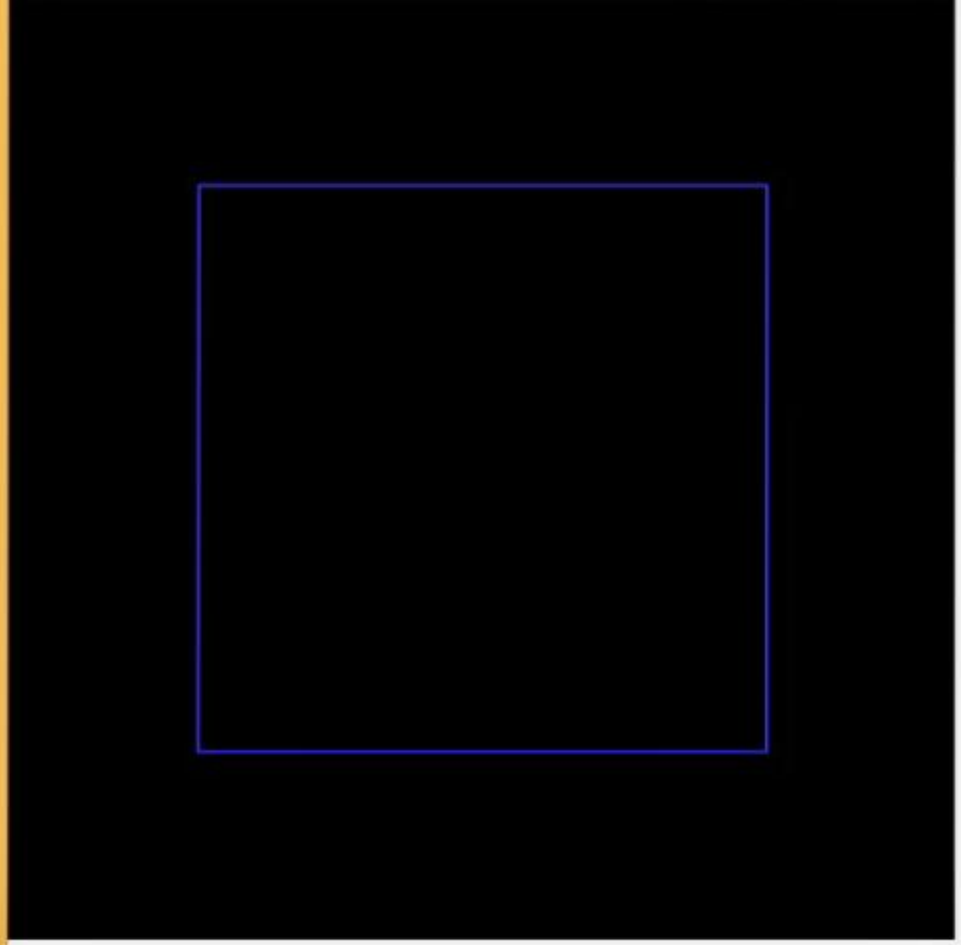
6 General Messages
8 Test Results

clip



xmin 100

xmax 400

ymin 100

ymax 400

drawwindow

getcolour

clippig

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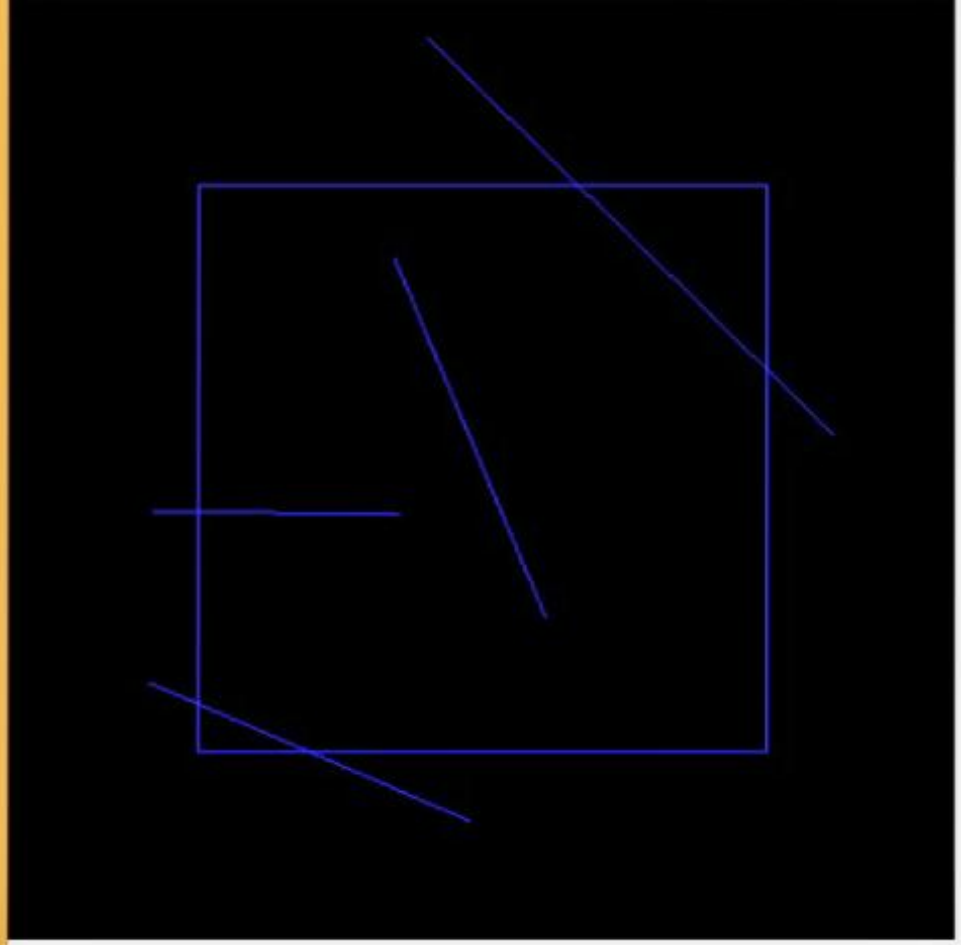
clip



xmin 100

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clip

xmin 100

xmax 400

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drawwindow

getcolour

clippig

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