

# Graphics and C++

This term you can create programs on UNIX or you can create programs using any C++ compiler (on your own computer). There is open source software available for free, so you don't have to buy a compiler....

*For fun we will be demonstrating Graphics  
using PC C++ Compilers*

# Some of the Choices

- In CS161 our focus is on problem solving and learning how to apply these solutions to a high level programming language, like C++
- We will also compare this to C and Java frequently, other high level languages
- You can work with graphics, if you want to challenge yourself (and have fun), but there is no requirement that you do this.

# Some of the Choices

- If you want to work on your own PC with a C++ compiler, rather than being logged in remotely to the PSU systems
  - You have many choices – there are many compilers available for free download
  - Many provide Integrated Development Environments (IDE's)
    - Which just means they have a graphical front end and aren't just text based when you enter in your program.

# Some of the Choices

- Some of your choices are *(for free)*
  - Dev-C++
  - Visual Student C++ Express 2008
  - NetBeans
  - Eclipse for C++
- These all support the basic language features
- But, they are not equal in terms of computer graphics

# Some of the Choices

- Here is how they rank...
  - Dev-C++ provides a single graphics.h library that we use for in-class demos. It is easy to use.
    - It is limited in support and functionality
    - But it *is* easy to use!
  - Visual and NetBeans are environments many Computer Science students use,
    - but they more complicated
  - Eclipse for C++ requires more advanced OpenGL programming, which is beyond the scope of CS161
    - In CS202 ... we will use Eclipse

# What is Dev-Cpp?

- Dev-C++, developed by Bloodshed Software, is a fully featured graphical IDE (Integrated Development Environment), which is able to create Windows or console-based C/C++ programs.
- It is recommended because it is easy to use, doesn't require knowing a lot to get started, and is a great way to create some fun programs quickly.
- It is based on MinGW (Minimalist GNU\* for Windows) which uses the same family of compilers that we use on PSU's unix environment ( a GNU g++ compiler collection).
- Although there are some differences, we don't need to be too concerned with that in CS161. Differences between Cygwin and MinGW for more information.
- Links of interest: <http://www.bloodshed.net/devcpp.html>

# What does it allow me to do?

- With an IDE, we can do all of our work on our home computer without logging in and without being on the internet.
- You can also use some cool features that allow you to turn your screen into a graphical paradise.
- In class some programs were demonstrated using Dev-C++ -- such as painting programs, tic-tac-toe, and more.

# Where you can get Dev-Cpp...

- You can get Dev-C++ as free software (under GPL) but also offers a CD for purchase.
- Go to the author's site to get a list of sites where you can get it: Dev-C++ download sites. (<http://www.bloodshed.net/dev/devcpp.html>)
- You should let the installer put Dev-C++ in the default directory of C:\Dev-Cpp, as it will make it easier to later install add-ons or upgrades.
- I downloaded:  
***Dev-C++ 5.0 beta 9.2 (4.9.9.2) (9.0 MB) with Mingw/GCC 3.4.2***



# Adding in Graphics Capabilities

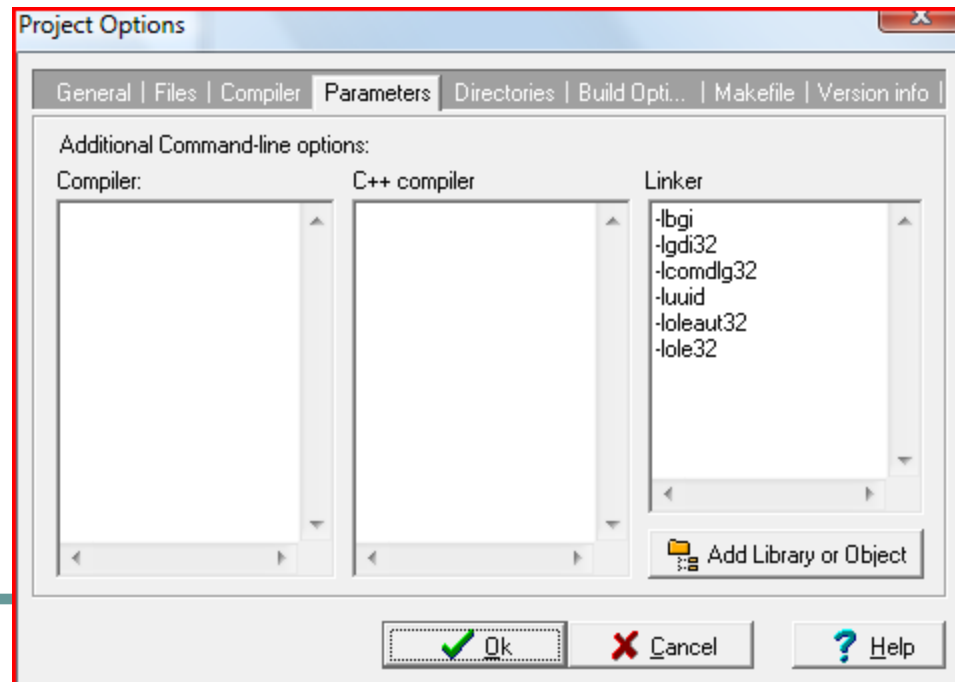
- The graphics functions that we use in examples in this course are not automatically part of Dev-C++, so you would need to download them at:  
(<http://www.uniqueness-template.com/devcpp>)
- graphics.h (download to C:\Dev-Cpp\include) and
- libbgi.a (download to C:\Dev-Cpp\lib)
- Then, you must tell Dev-C++ where to find the graphics library!
- First go to the **File** menu and start a **New Project**
- Then, go to the **Project** menu and select **Project Options**
- *See the next slide.....*

# YOU MUST DO THIS!

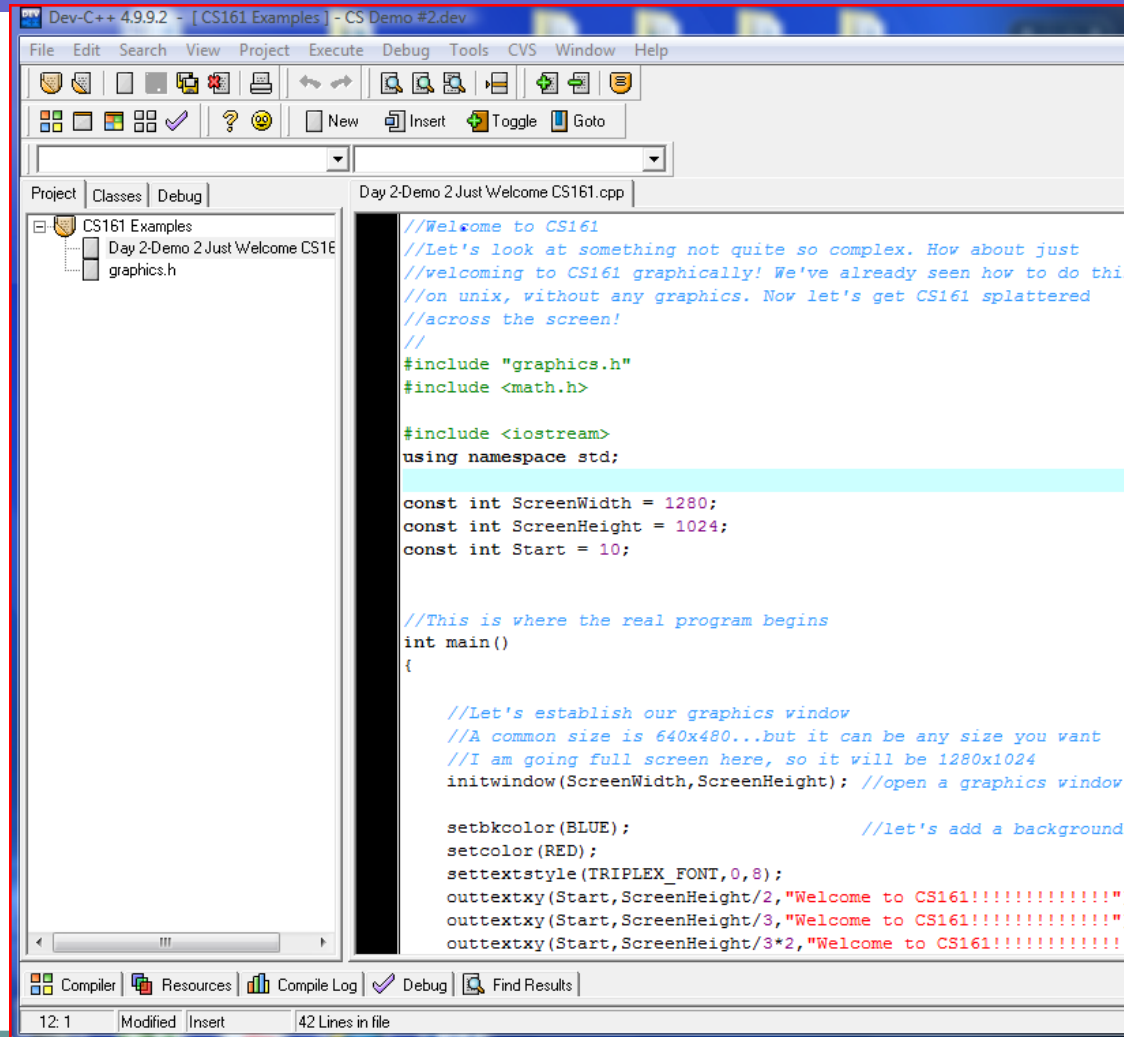
- After you go to the **Project** menu and select **Project Options**
- Go to the **Parameters** tab
- In the **Linker** field, enter the following text

-lbgi  
-lgdi32  
-lcomdlg32  
-luuid  
-loleaut32  
-ole32

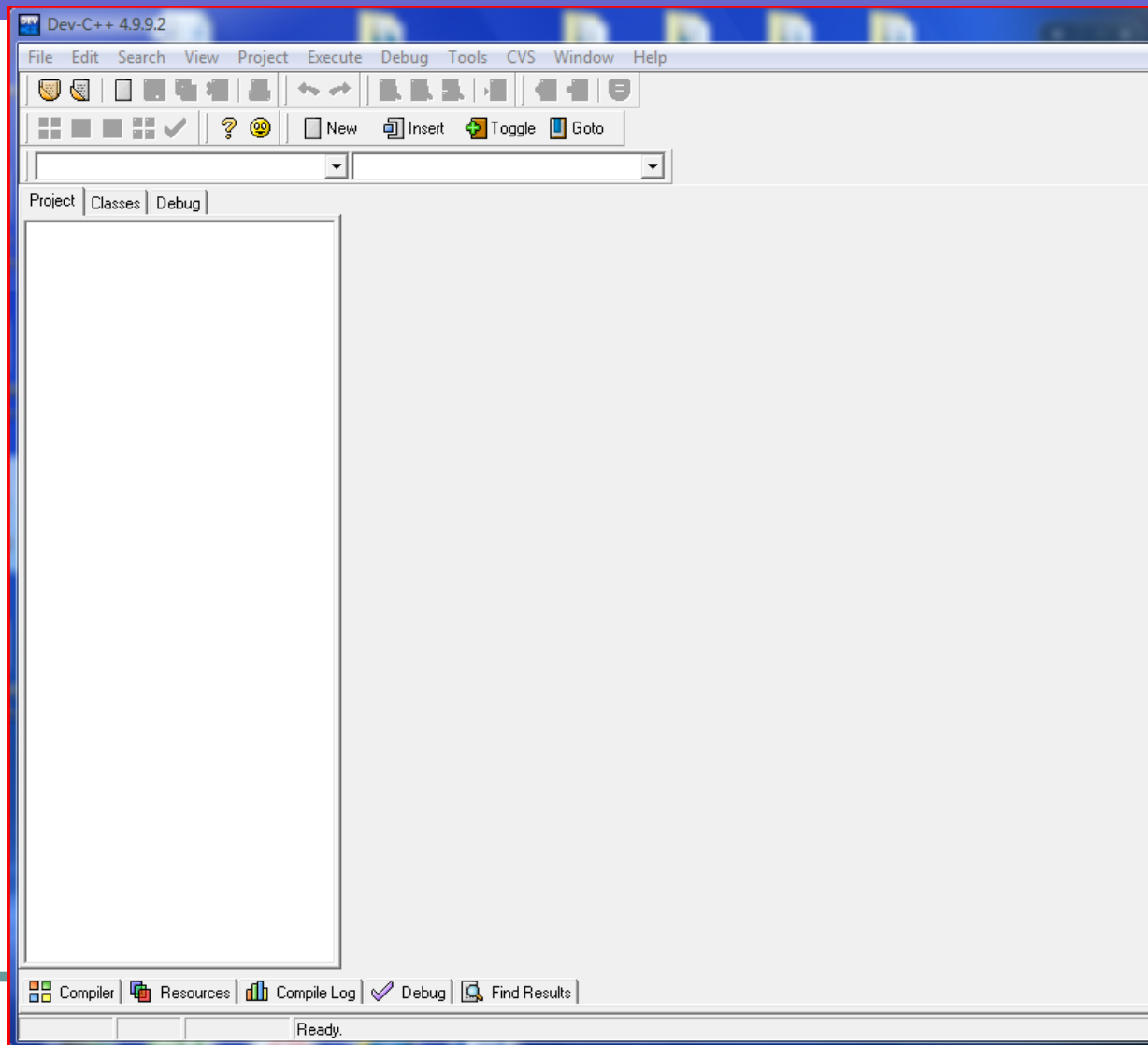
- Click **OK**



# This is what Dev C++ Looks like



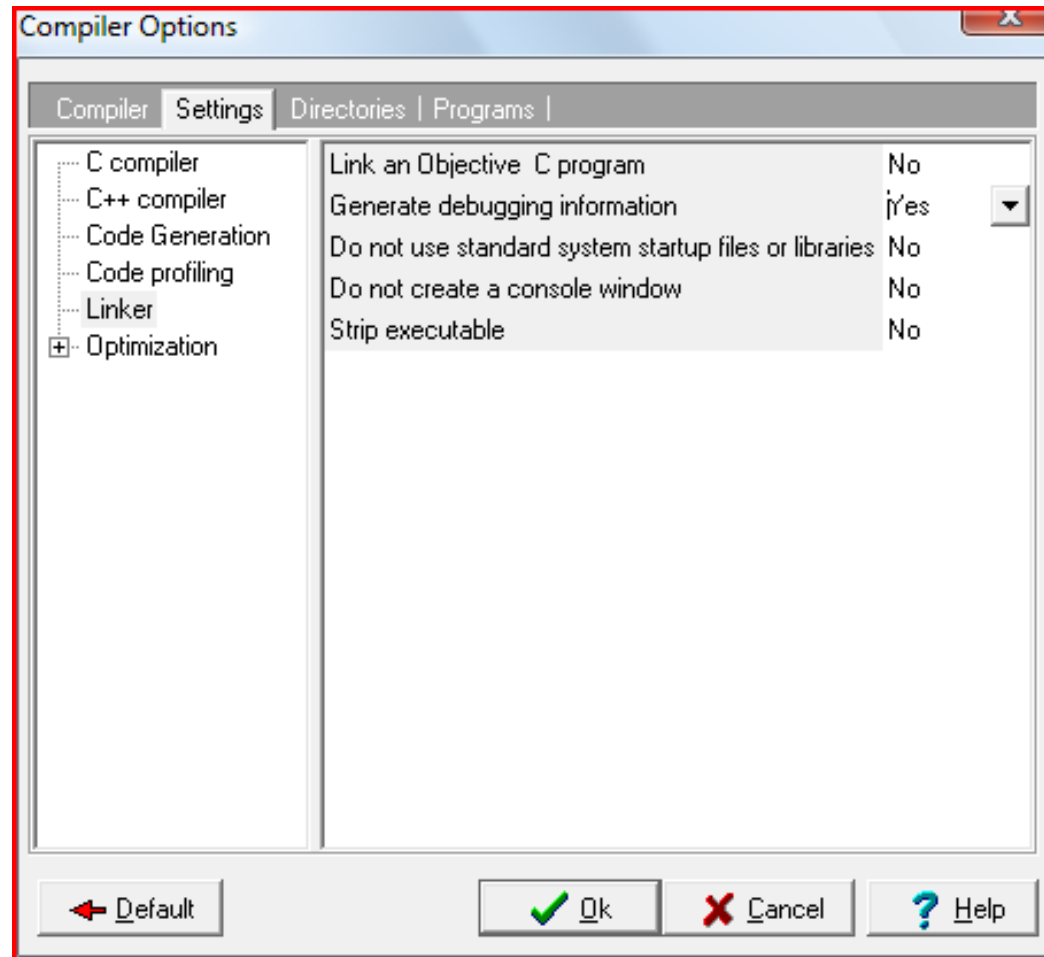
# The First time, it looks like this



# To Configure Dev-C++...

- All programming done for CS161 will require separate compilation projects. *This process is pretty easy as long as you know what goes where, which we will show in class and demonstrate here in these slides.*
- The first time you use Dev-C++ you will need to configure it so that it will allow you to more easily get your work done and allow you to perform computer graphics, if you so desire.
- Go to the **Tools** menu and select **Compiler Options**
- In the **Settings** tab, click on **Linker** in the left panel and change **Generate debugging information** to **Yes**
- Click **OK**

# Compiler Options under Tools

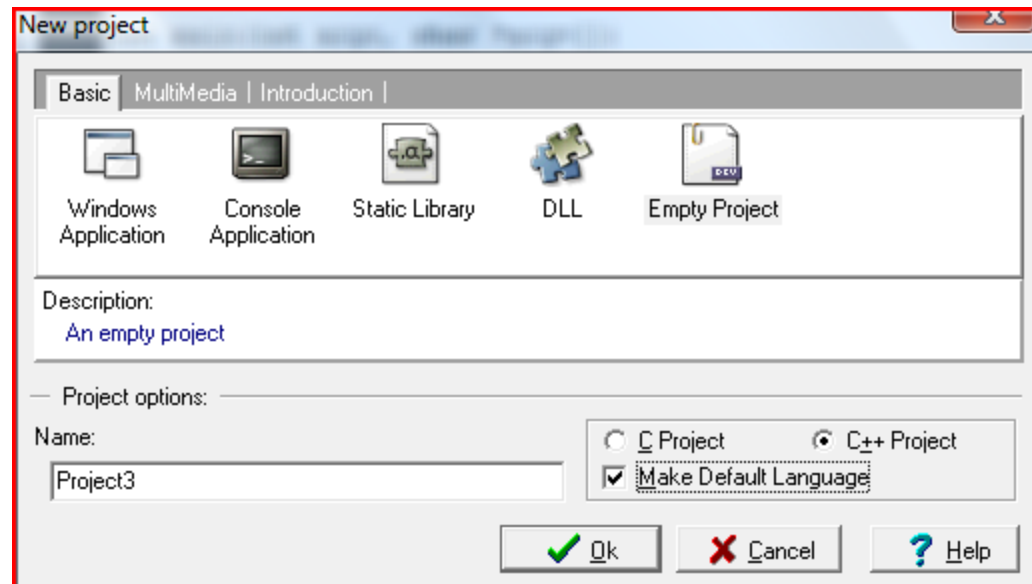


# To Create a new Project

- Think of a project as a container used to store all of the pieces needed to compile a program
- Go to the **File** menu and select **New** and then **Project**
- Choose **Empty Project** unless you use one of the projects I have posted on my website, make sure **C++ project** is selected
- This is also where you will give your project a name.
- If you reuse a project, you essentially will write over whatever was there, so you will probably want to start with a fresh project name. The name of your project will also be the name of your executable.
- Once you have entered a name of your project, click **OK**
- Dev-C++ will then ask you where you want to save your file

# Make it a C++ Empty Project

- Select **Empty Project**
- Select **C++ Project**
- I checked “Make Default Language”
- Click **OK**

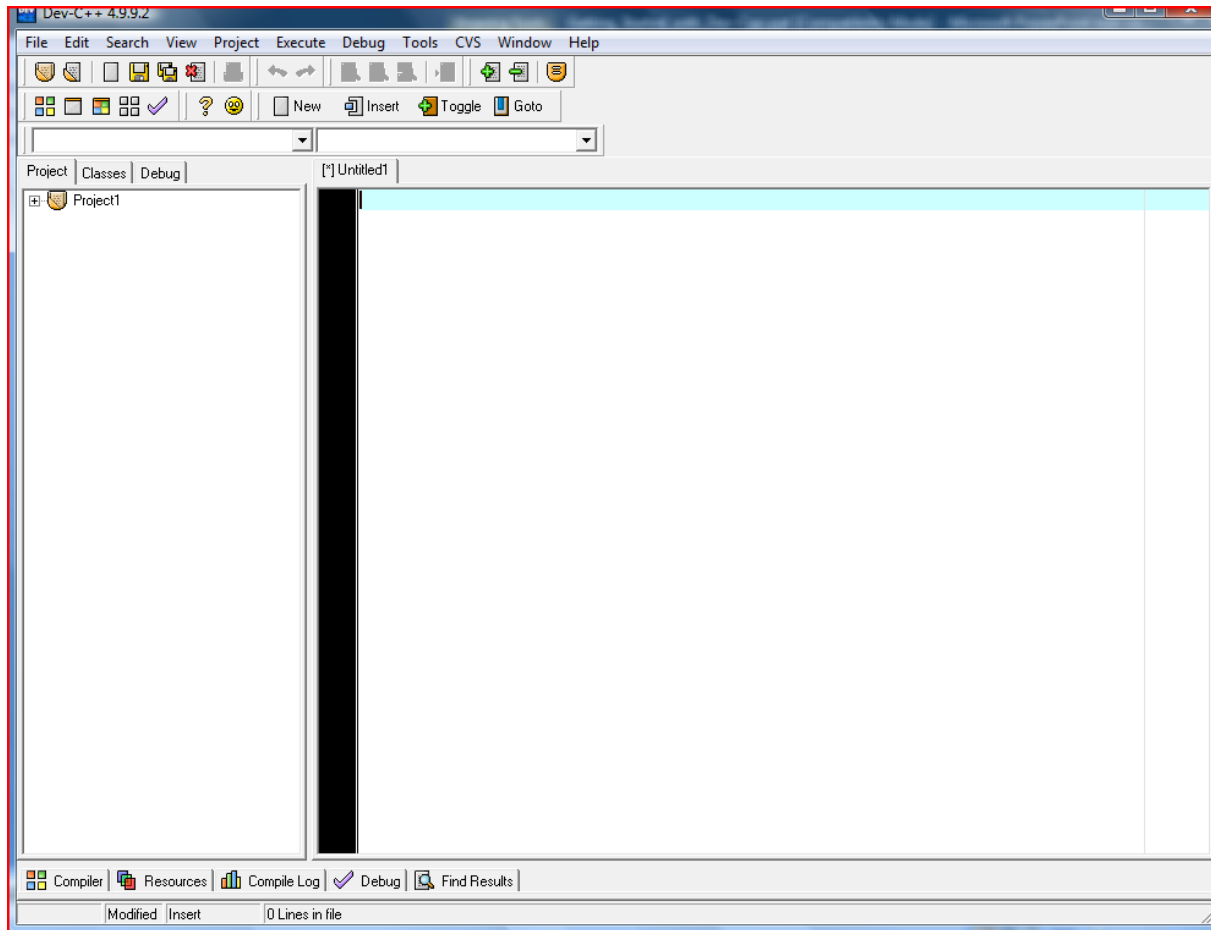




# Add Source Files

- Here are some ways to add source files
  - Go to the **File** menu and select **New Source File**
  - Or, go to the **Project** menu and select **New File**
  - I like to go to the **green +** symbol which allows me to add files to this project; you can use it to add one of the examples that has been posted on our website

# After opening a new file...



# Opening a Demonstration Program

- To open one a file, go to the **Project** menu and select **Add to Project**
- Or, right click on the project name in the left-hand panel and select **Add to Project**
- Make sure when you are adding a project, that it has a **.cpp** extension.
- You can see the contents of the file in the large window by clicking on the name in the left-hand panel

Project Classes Debug

Project1  
Happy Face.cpp

Happy Face.cpp

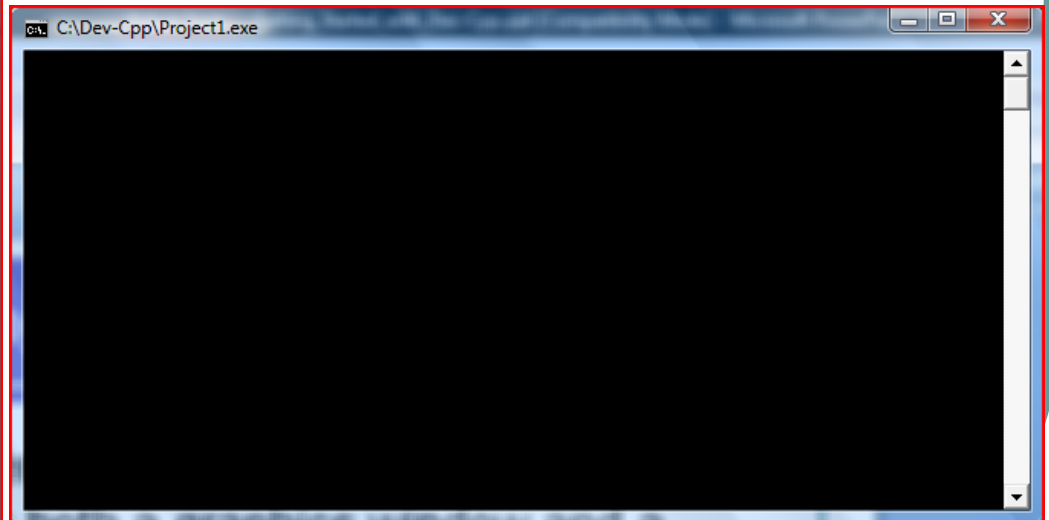
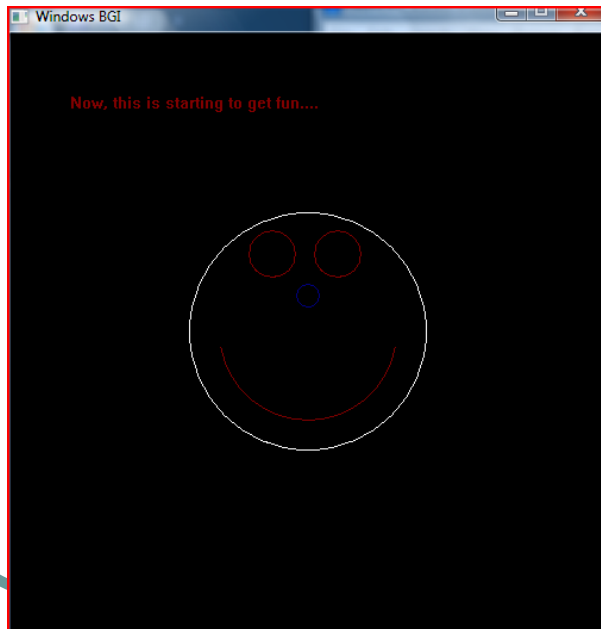
```
//This program displays a simple happy face...  
//The key piece of this program is that it gives us an example of  
//how to get started, and have a little fun while do so!  
  
//You always need to include the iostream library  
//Those of you playing with graphics on your PC's and Dev C++  
//also need to include graphics.h  
#include "graphics.h"  
#include <iostream>  
using namespace std;  
  
//This is where the program really begins!  
int main()  
{  
    //Start by deciding about the size of your graphics window  
    initwindow(500,500); //open a graphics window  
  
    //Before drawing, we need to set a color  
    setcolor(RED);  
    outtextxy(50,50,"Now, this is starting to get fun....");  
  
    //We begin the happy face with circles for the eyes and nose  
    circle(220,185,20);  
    circle(275,185,20);  
    setcolor(BLUE);  
    circle(250,220,10);  
  
    // now the mouth  
    setcolor(RED);  
    arc(250,250,190,350,75);  
  
    //now the face
```

# To Compile a Program

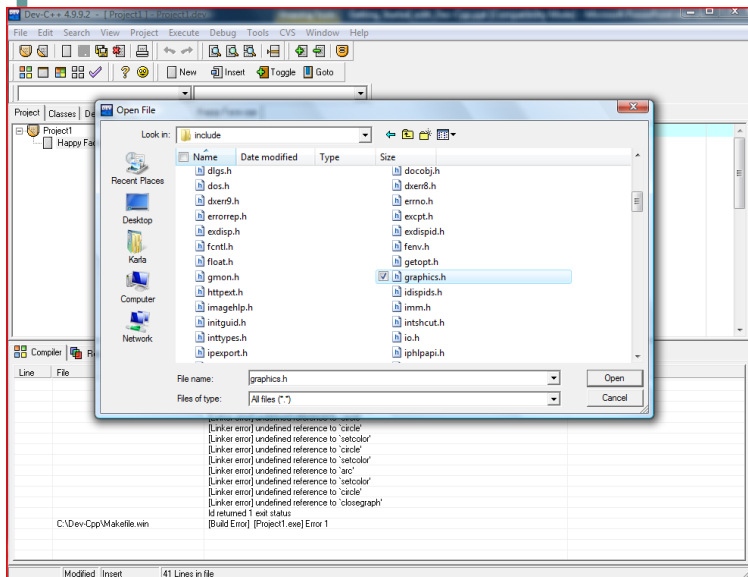
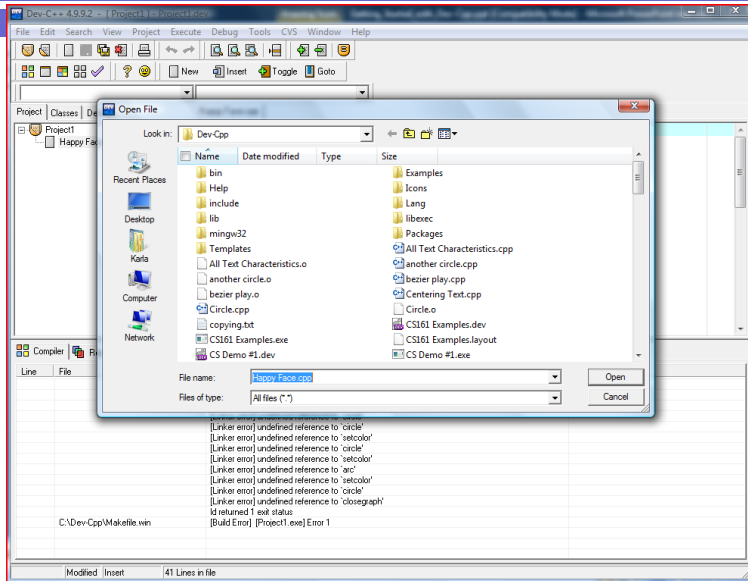
- Once you have either entered in a program or opened one of the demonstration files,
  - It is time to compile and run the program
  - Go to the **Execute** menu and select **Compile**
  - Instead, I use: **control key F9**
  - Errors will display at the bottom window

# Running the program!

- If there were no errors, you will get in this case both a graphics window *and a* console window:



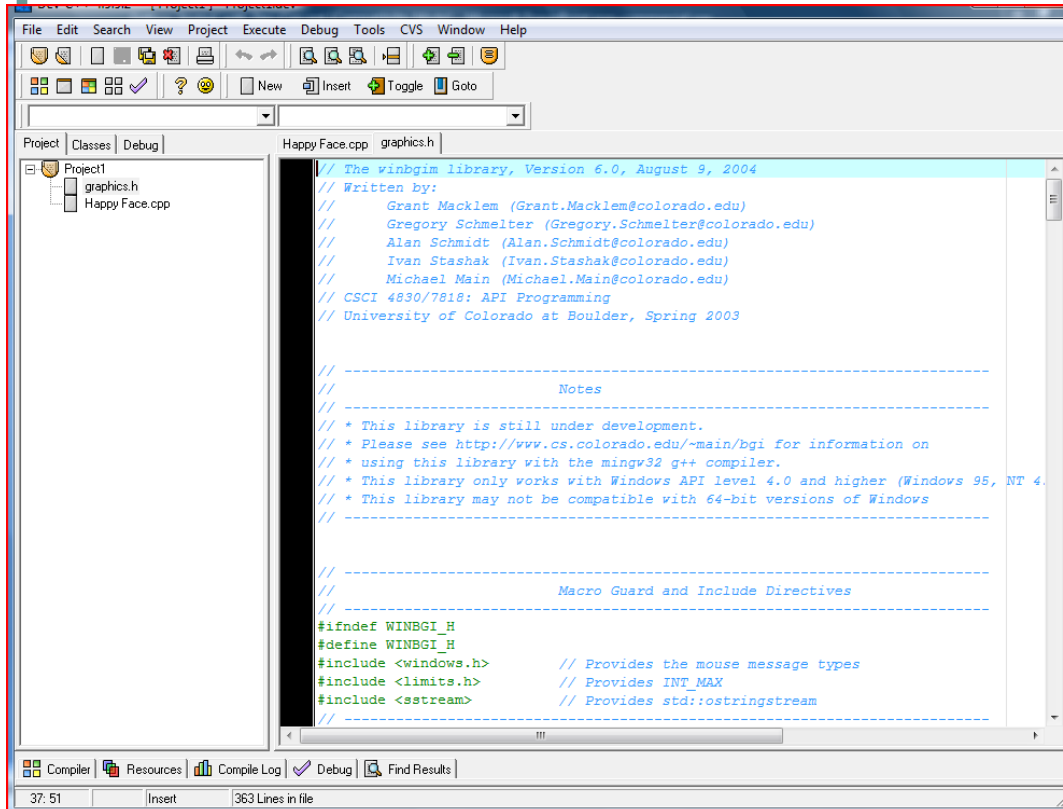
# Placing graphics.h in the package



- I like to put the graphics.h library in the project, so that I can see a summary of the functions available
  - So, go back to the **green +** symbol and select graphics.h from the **include** directory
  - From the **include** directory, select **graphics.h**:

# Select **open**....you'll see this....

- Notice the graphics.h in the left-hand window under the name of the project:



By Clicking on the graphics.h file name in the left-hand window, that file is displayed now in the large window.

Don't modify this file!



# Compile again...

- Every time you fix errors or change your program, you will need to compile again
  - Go to the **Execute** menu and select **Compile**
  - Or use: **control key F9**
  - Errors will display at the bottom window
  - I made a couple of typos ... so you could see what it would look like.....

File Edit Search View Project Execute Debug Tools CVS Window Help



Project Classes Debug

Project1  
graphics.h  
Happy Face.cpp

Happy Face.cpp graphics.h

```
circle(275,185,20);  
setcolor(BLUE);  
circle(250,220,10);  
  
// now the mouth  
setcolor(RED);  
arc(250,250,190,350,75);  
  
//now the face  
setcolor(WHITE);  
circle(250,250,100);  
while(!kbhit()); //wait for user to press a key  
  
//I added these two lines of code and made a couple of typos!  
cout <<"Are you having fun yet?" <<end  
cout <<"Hit enter when you are done;"  
cin.get(); //we are done  
  
closegraph(); //close graphics window  
return 0;  
}
```

Compiler Resources Compile Log Debug Find Results Close

| Line | File                      | Message   |
|------|---------------------------|---|
| 39   | C:\Dev-Cpp\Happy Face.cpp | In function 'int main()':   |
|      | C:\Dev-Cpp\Happy Face.cpp | 'end' undeclared (first use this function)  |
|      |                           | (Each undeclared identifier is reported only once for each function it appears in.) |
| 39   | C:\Dev-Cpp\Happy Face.cpp | expected ';' before "cout"  |
|      | C:\Dev-Cpp\Makefile.win   | [Build Error] ["Happy Face.o"] Error 1  |

# When we get error messages

- Many times, in C and C++ when we get errors, the errors actually occur on the line above
- When a compiler encounters something unexpected, it tries to correct the situation, but typically by the next line it can't resolve it and gives an error
- Sometimes the error messages are relevant...but sometimes they are not.
- Notice the error occurs in this case on the line above the highlighted line
  - I mis-typed end (forgot the lower case L after)
  - I forgot a semicolon!

# Disappearing Windows

- If you run your program, you may notice the console window flashes (or maybe you don't even see it), or the graphics window flashes up and goes away
- You will need to add, at the end, code to ask the user to hit enter ... to pause the system until the user is ready, for both the graphics window and console window

# Console Window

- The console window is where all input and output occurs that is normal in C++
- If you say `cout << "blablabla";` it will go to the console window
- Most input from the keyboard works with the console window
- Any use of `cout` or `cin` works with the console window...in the same way as we will learn in unix

# Graphics Window

- The graphics window is where all drawing will occur
- cin/cout do not work in the graphics window
- We can easily do some basic input,
  - Single character input from the keyboard
  - Mouse input

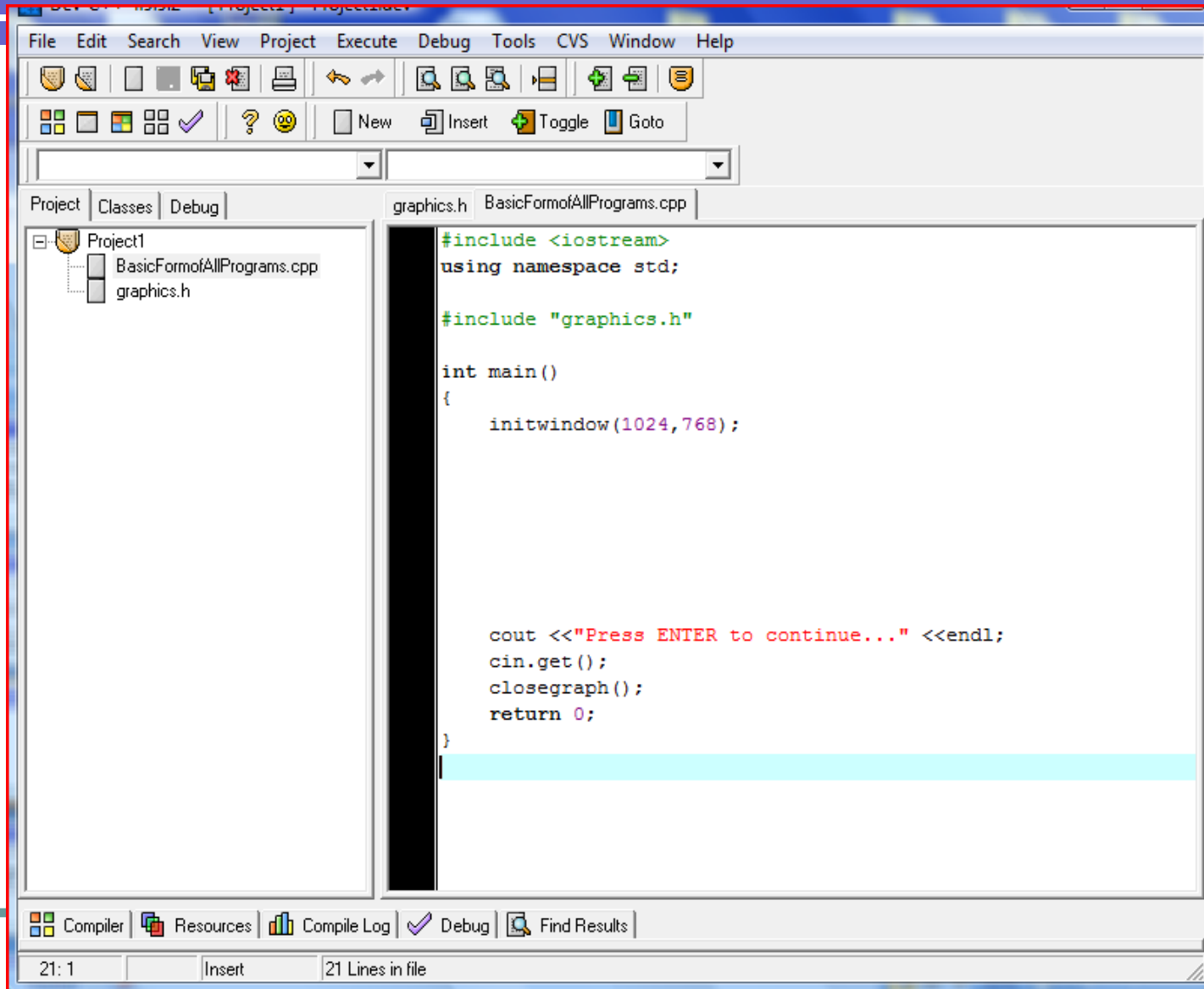
# At the end of All Programs

- At the end of all programs you will want the following:
- For managing the console window:  

```
cout << "Press ENTER to continue..." << endl;  
cin.get();
```
- For managing the graphics window:  
*(you don't have to do this if you also do the above)*  

```
outtext("Hit any Key when Done");  
getch();
```

# So, the form of all programs is...





# Some of the Graphics Features

- Initialize the graphics window

*(the maximum width is usually 1024x768 or 1280x1024)*

`initwindow(width,height);`

- Clearing the graphics window...

`cleardevice();`

- Delay the program, so that users can see what is happening... *sending in the number of msec*

`delay(milliseconds);`

- Wait for a keyboard hit:

`getch();`                      or,        `kbhit();`

# Setting Graphics Attributes....

- Set Drawing Color (for lines and edges)

*(colors typically range from 0-15; 0 is usually black and 15 is white)*

**setcolor(color);**

- Set Background Color *(usually for text)*

**setbkcolor(color);**

- Set Fill Style and Color (for interiors)

- *Pattern 0-12, 0 = empty, 1 = solid*

**setfillstyle(pattern, color)**

- Set Line Style and Thickness

- Style: 0 = solid, 1 = dotted, 3 = dashed
- Thickness is the width in terms of pixels

**setlinestyle(style, pattern, thickness)**

# The Current Position...for graphics

- *Origin on graphics system is Upper Left*
  - *So, positive y values move DOWN*
  - *X,Y coordinate data are always whole numbers*
- **Setting the Current Position**
  - Move to a current position (*x,y are whole numbers*)  
**moveto(x,y);**
  - Move relative to the current position  
**moverel(x,y);**

# Drawing...Lines

- Drawing a line
  - Drawing from Current Position *(from current position to the specified coordinate)*  
`lineto(x,y);`
  - Drawing relative *(a delta amount from the current position)*
    - The delta amounts would be whole numbers  
`linerel(deltax,deltay);`
  - Drawing absolute *(from one coordinate to another)*  
`linerel(from_x, from_y, to_x, to_y);`

# Drawing...Areas

- Drawing a Circle

- Given center and radius as whole numbers  
`circle (center_x, center_y, radius);`

- Drawing a filled Rectangle

*(given upper left and lower right corners)*

`bar(ul_x, ul_y, lr_x,lr_y);`

- Drawing an unfilled Rectangle

*(given upper left and lower right corners)*

`rectangle(ul_x, ul_y, lr_x, lr_y);`

# How Text Look....

- Text Formatting

- Set the justification

- Horizontal: (0 = left, 1 = center, 2= right)
- Vertical: (0 = bottom, 1 = center, 2 = top)

**settextjustify(horizontal, vertical)**

- Set the text style

- Font: (0-11)
- Direction: 0 = left to right direction
- Character Size: 0 = normal, 6 is really big!

**settextstyle(font,direction, character size)**

# Messages in the Graphics Window

- Text Output

- Set Text color (index ranges 0-15)

`setcolor(index);`

- Output a message on the graphics window at the current position

`outtext("messages on graphics window");`

- Output a message on the graphics window at the given x,y coordinate

`outtextxy(x,y,"message");`

# Mouse Input!

- Has there been a mouse click?

- Right Click is 513
- Left Click is 516      Middle Click is 519 (the wheel...)

`answer = ismouseclick(kind)`

- Clear the mouse click

*(if you don't do this you can't get the next mouse click!)*

`clearmouseclick(kind);`

- What was the coordinate when the mouse click happens...

`x = mousex();      y = mousey();`