126 2x: Reverse Engineering with IDA Pro Freeware (10-40 pts.)

What you need:

- A Windows computer (real or virtual) with an Internet connection

Purpose

You will use IDA Pro Free to disassemble and analyze Windows executable files.

Downloading an EXE to Examine

Create a working directory C:\IDA.

Download this file and move it to C:\IDA

- crackme-121-1.exe

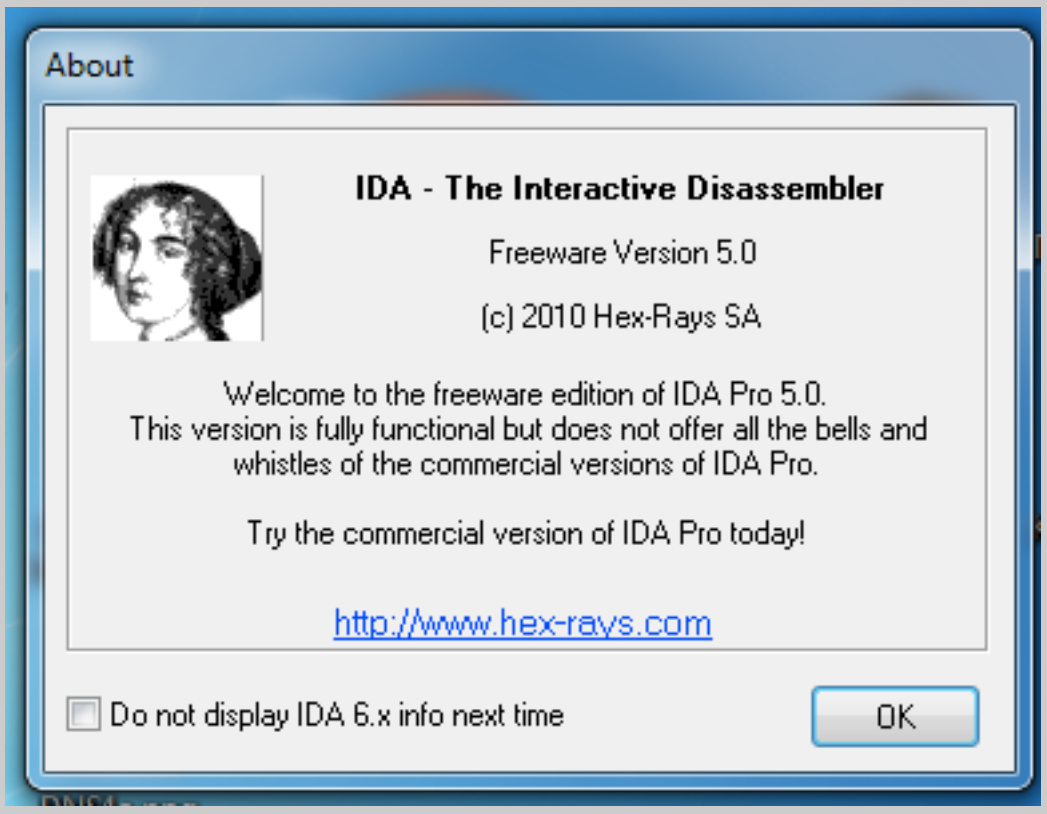
Downloading IDA Pro Free

Open a Web browser and go to http://www.hex-rays.com/products/ida/support/download_freeware.shtml

At the bottom of the page, click the "IDA Freeware (16mb)" link.

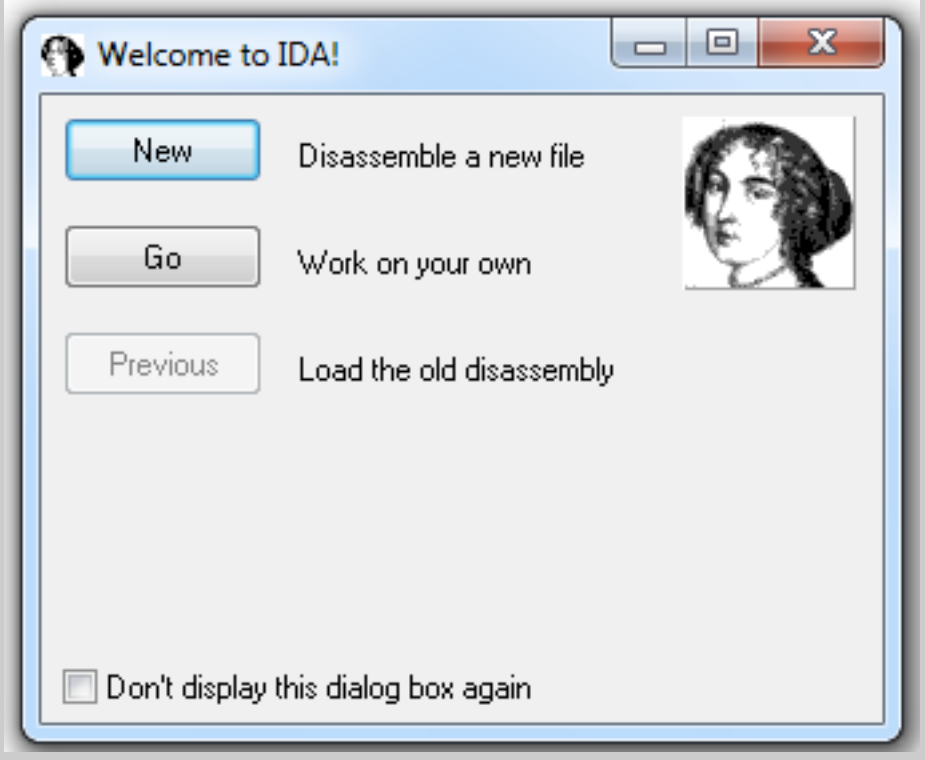
Install the software with the default options. I saw an error message saying something about a single-quote directory not found, but just closed it and it seemed not to matter.

When you see the IDA window shown below, click the **OK** button.



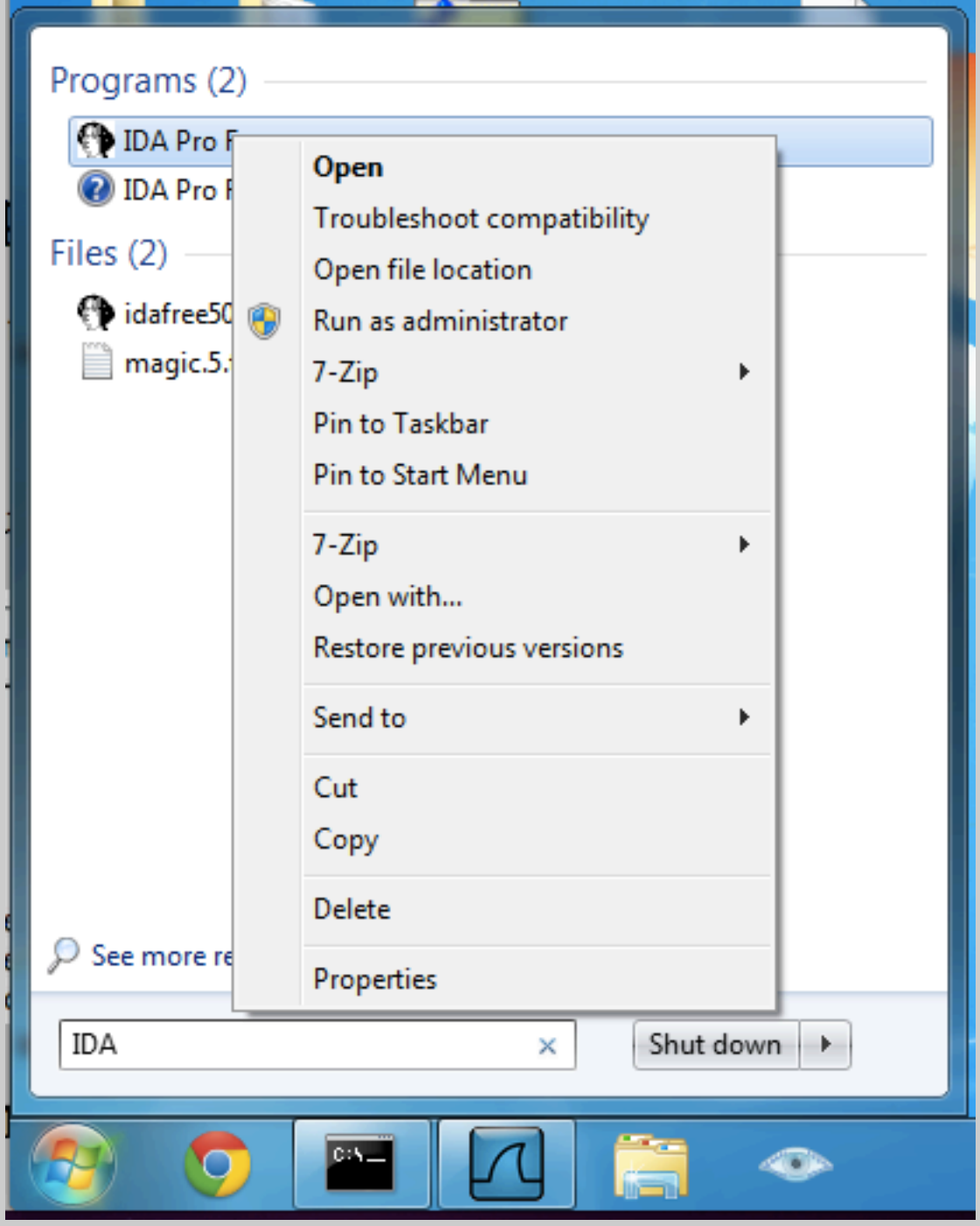
Click "**I Agree**".

In the "Welcome to IDA!" box, as shown below, click the **New** button.



If you are using Windows 7, IDA crashes. It needs Administrator privileges.

Click **Start**, type **IDA**, right-click "**IDA Pro Free**", and click "**Run as Administrator**", as shown below:



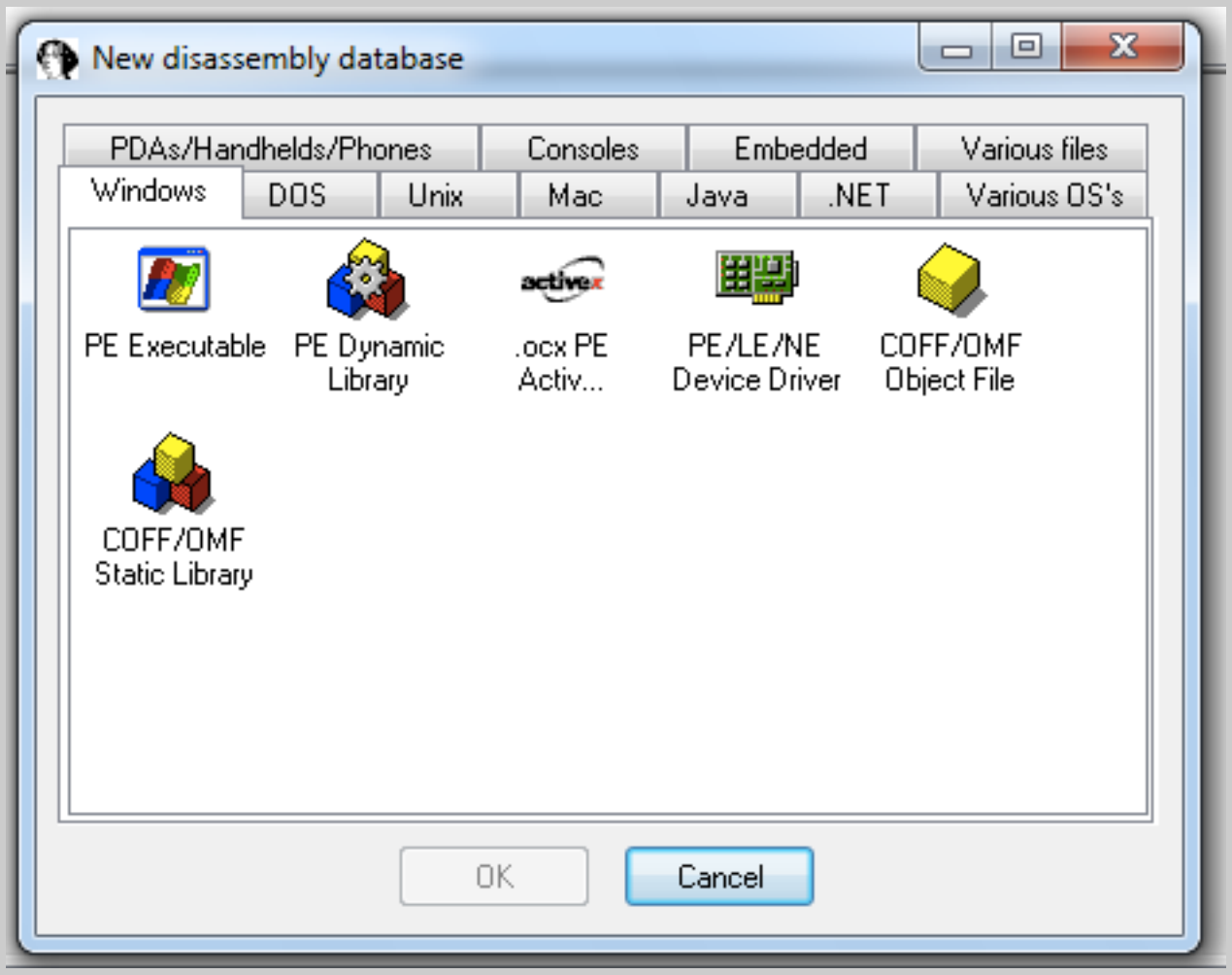
If a "User Account Control" box pops up, click **Yes**.

In the "About" box, click the **OK** button.

Loading the EXE File

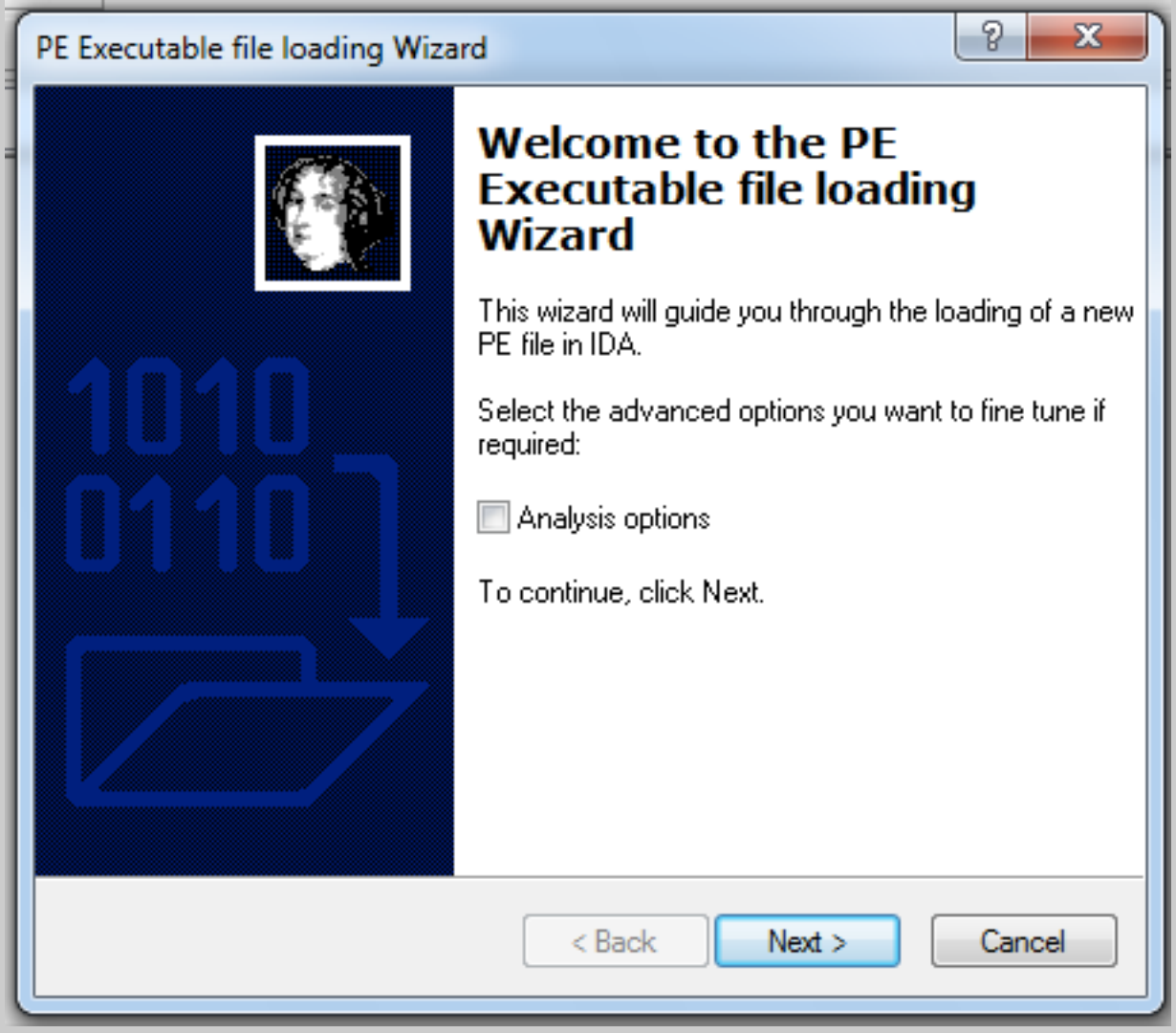
In the "Welcome to IDA" box, click the **New** button.

In the "New disassembly database" box, click "**PE Executable**", and then click **OK**, as shown below:



In the "Select PE Executable to disassemble" box, navigate to the **crackme-121-1.exe** file you saved earlier in the C:\IDA directory and double-click it.

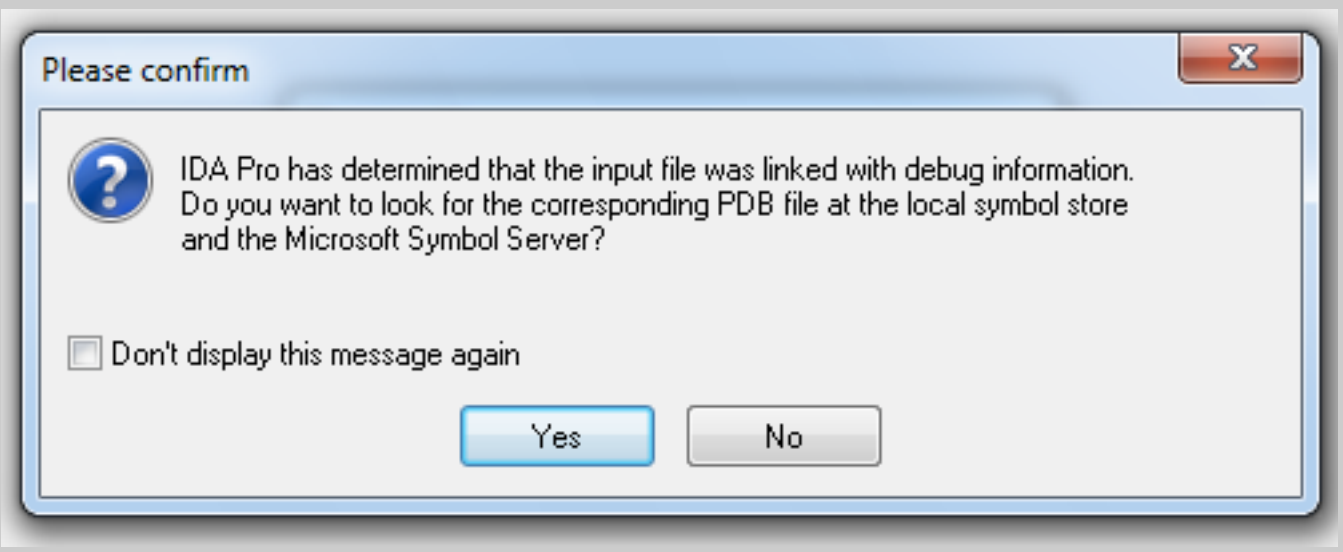
In the "Welcome to the PE Executable file loading Wizard" box, click the **Next** button, as shown below:



In the "Segment Creation" box, click **Next**.

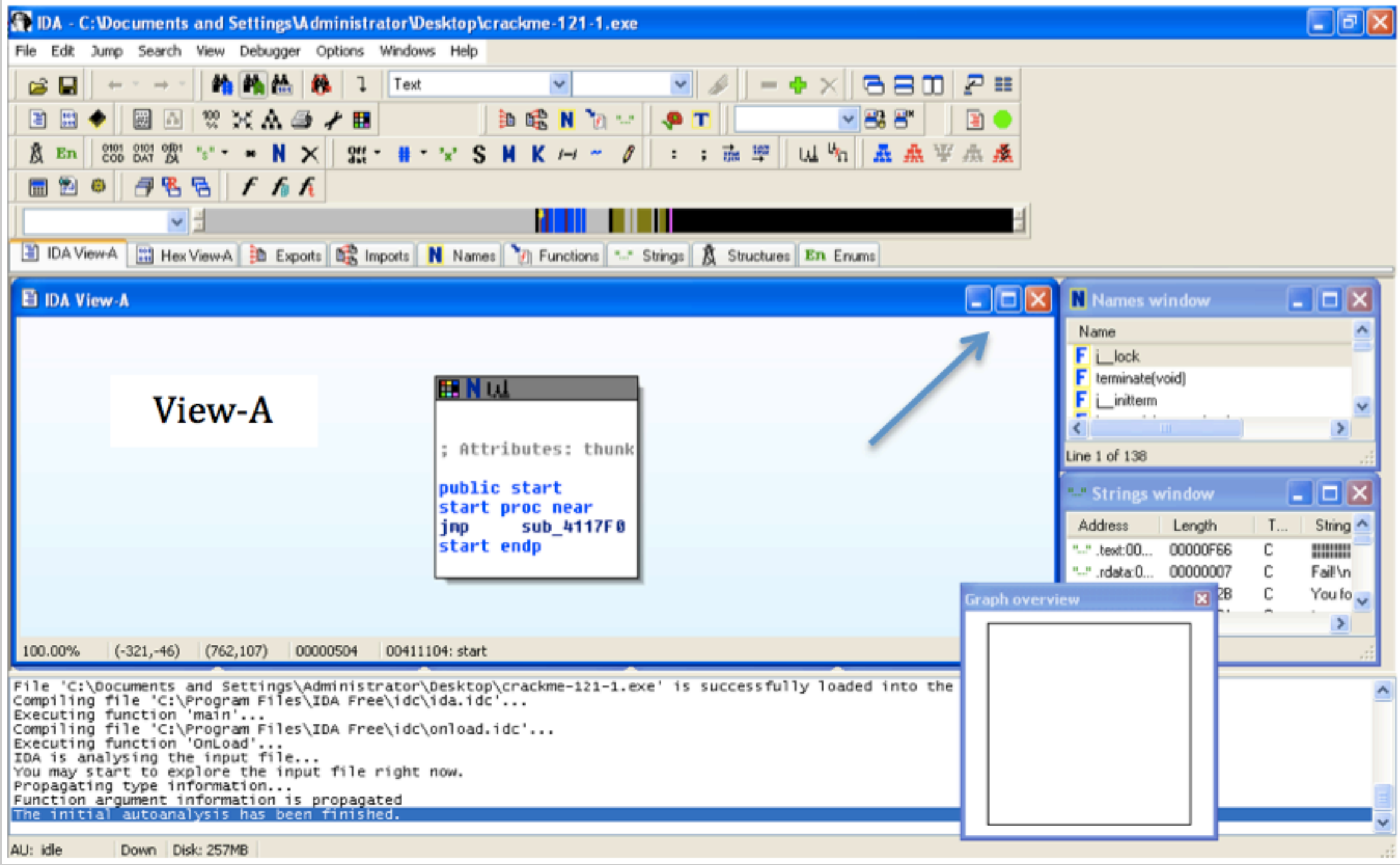
In the "File loading" box, click **Finish**.

A box pops up saying "...the input file was linked with debug information...", as shown below. Click the **Yes** button.



Viewing Disassembled Code

In IDA Pro, find the "View-A" pane, which shows boxes containing code linked to other boxes in a flowchart style. Maximize this pane, by clicking the button indicated by the arrow in the figure below:



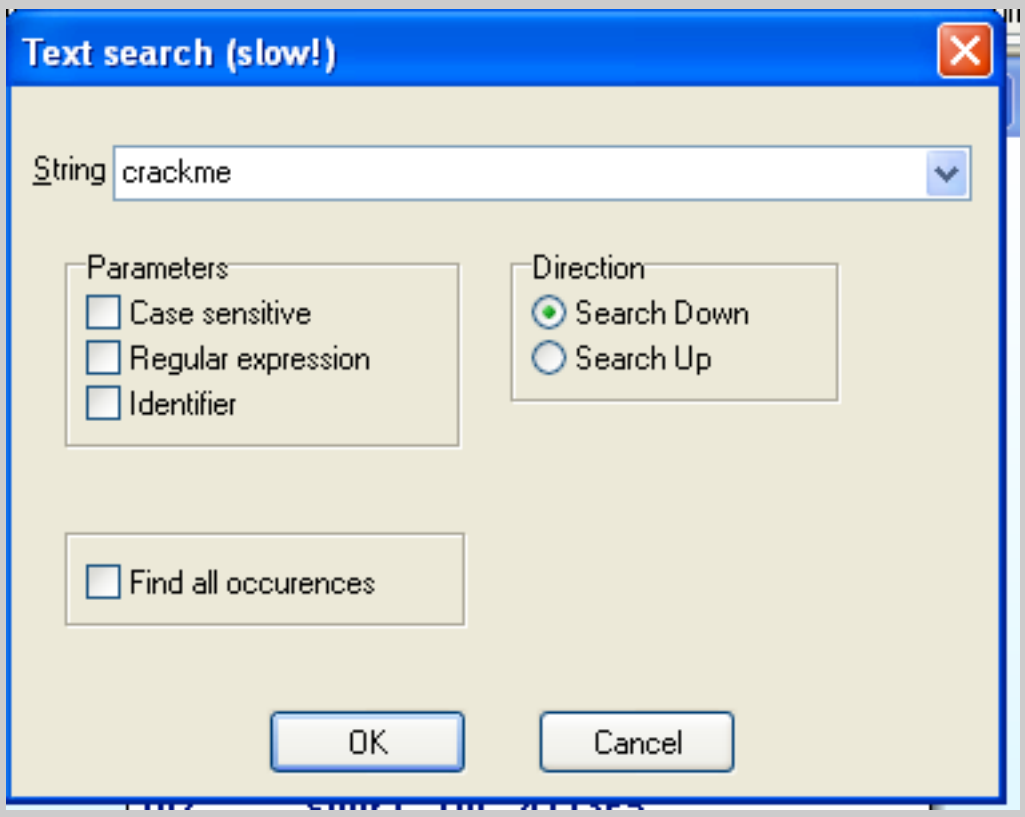
Close the "Graph Overview" box in the lower right corner.

Drag the lower border of the "View-A" pane down, to make as large a viewable area as possible.

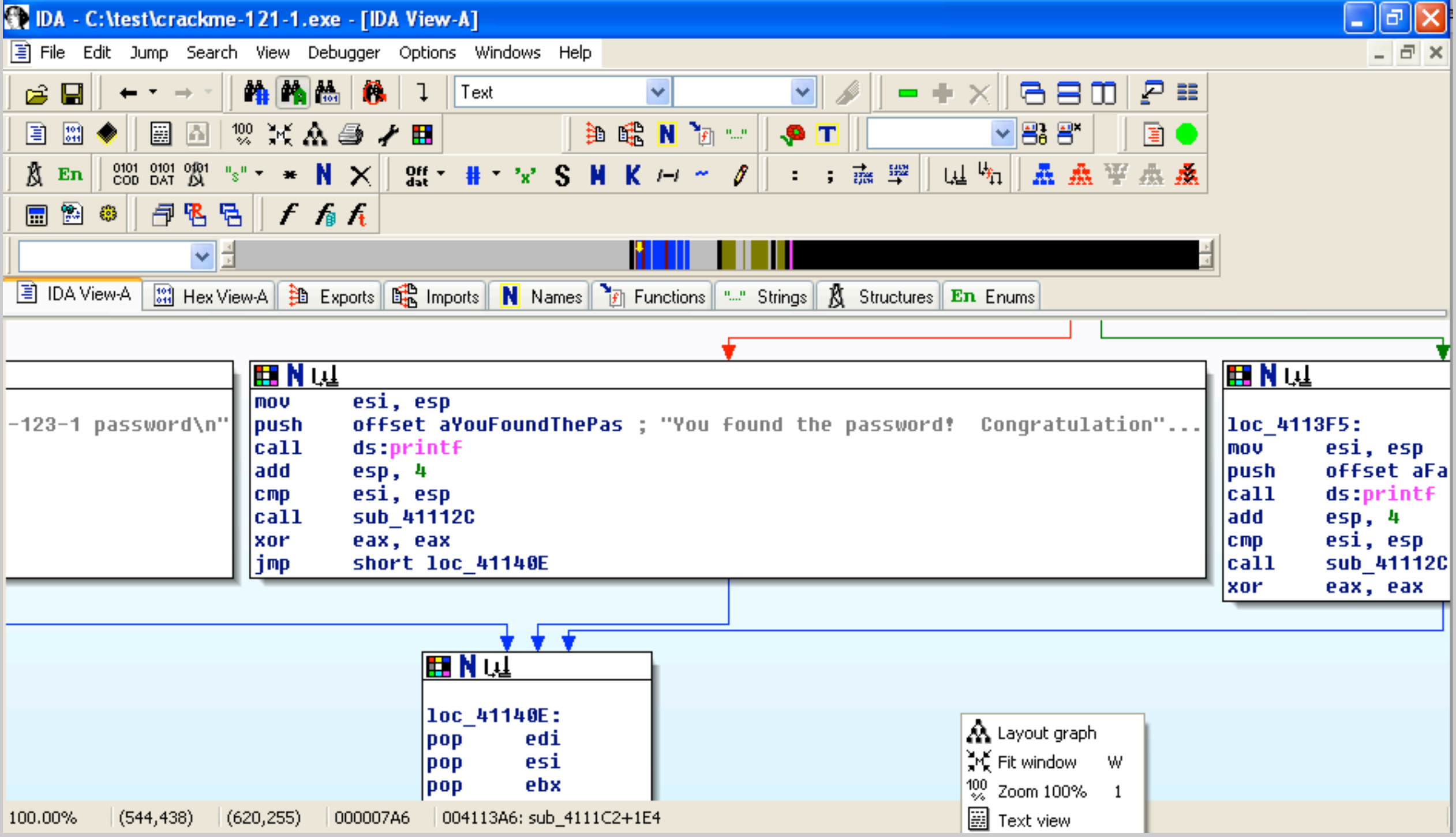
From the IDA menu bar, click **Search**, **Text**.

Search for **crackme** as shown below.

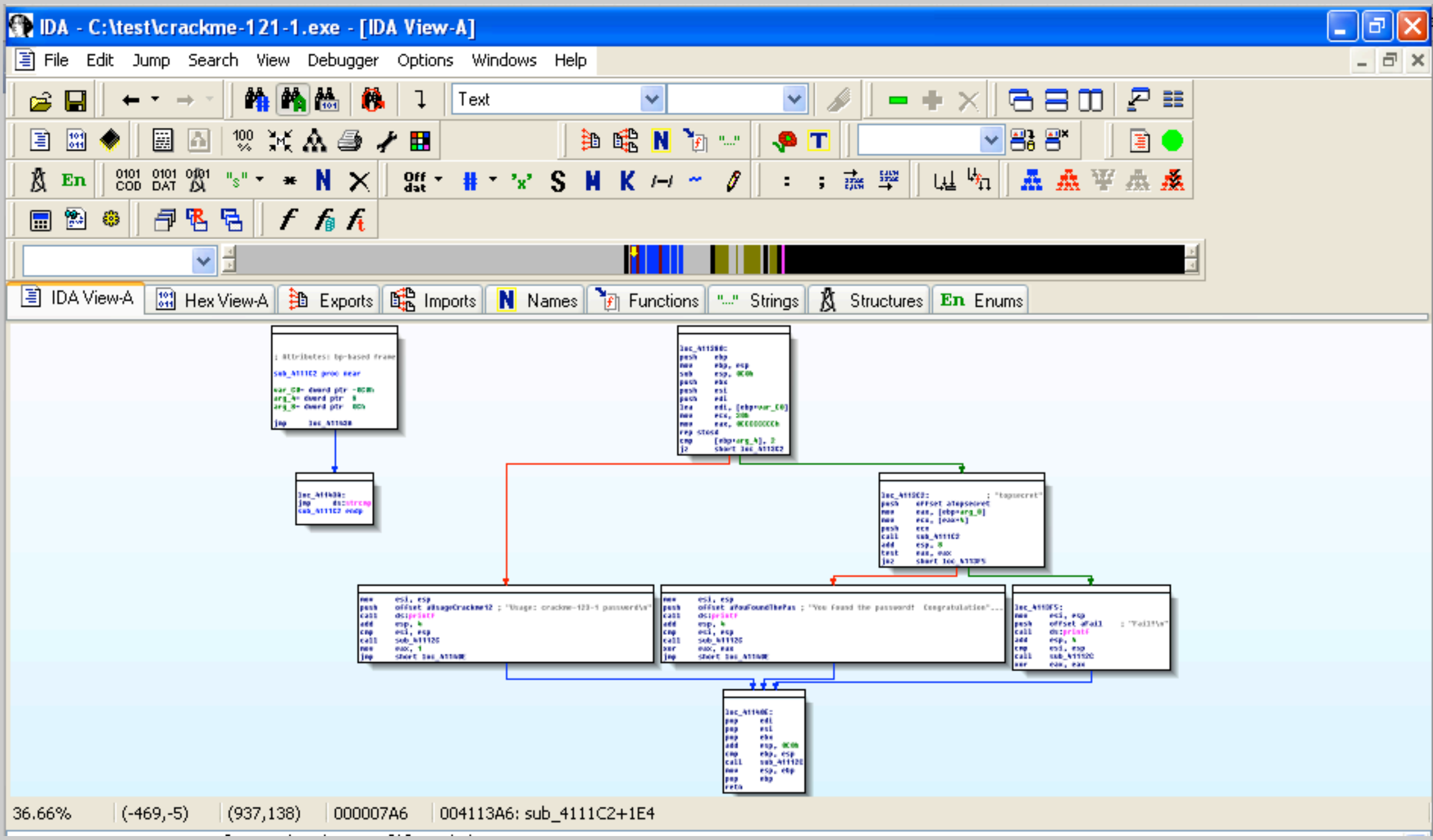
Click **OK**.



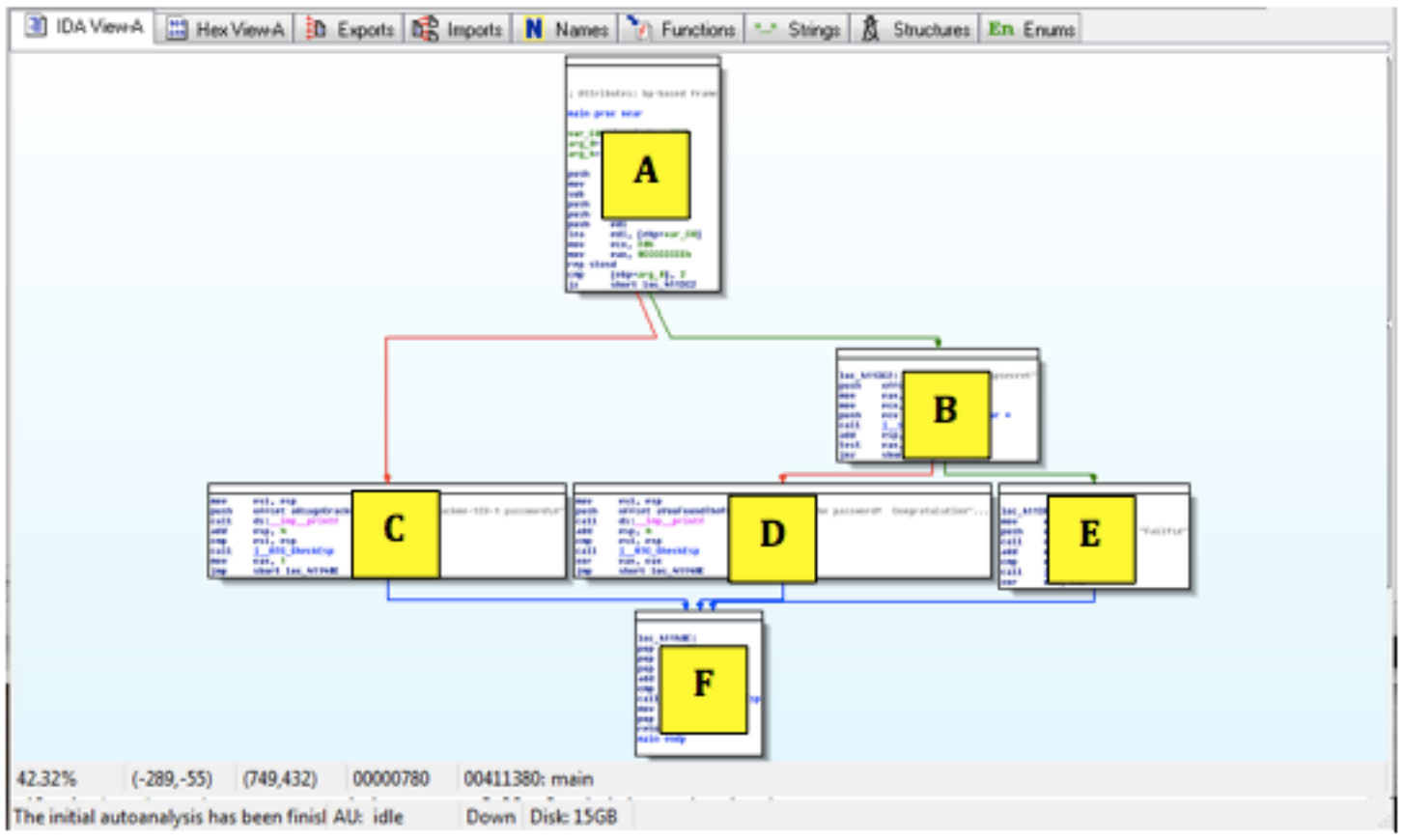
Right-click in the "View-A" box and click "**Fit window**", as shown below:



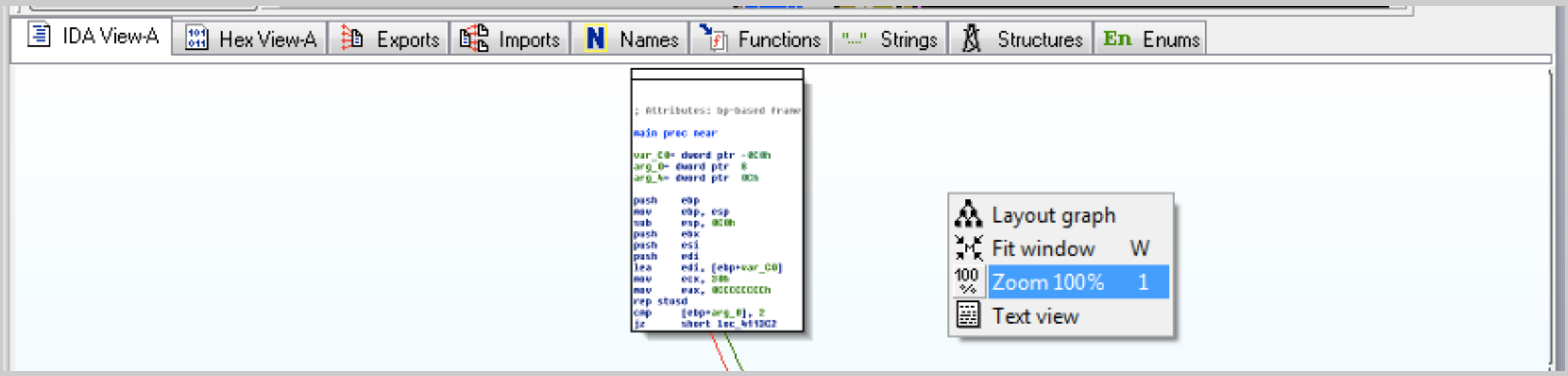
You should now see the entire program shown as six boxes connected by lines, as shown below. (Ignore the two extra boxes at the upper left):



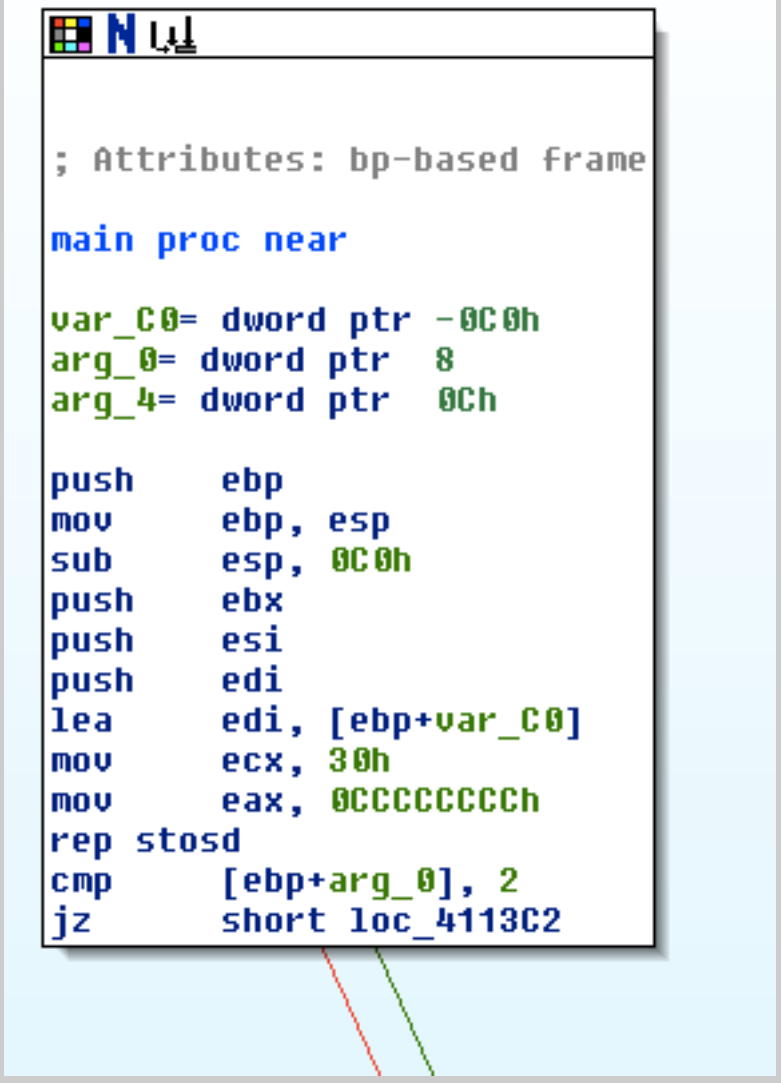
For this project, I have labelled the modules with letters as shown below:



Right-click in the "View-A" box and click "**Zoom 100%**", as shown below:



Click and drag the "View-A" display as needed to make module A visible, as shown below:



The assembly code is hard to read, but you don't need to understand it all. Focus on the last two instructions:

```
cmp     [ebp+arg_0], 2
jz      short loc_4113C2
```

This compares some number to 2 with the **cmp** (Compare) operation, and jumps to a different module if it is 2, using the **jz** (Jump if Zero) operation.

C Source Code

Here is the actual C source code for the file you are disassembling. Module A is the assembly code for the first "if" statement, labelled with the yellow "A" box below:

crackme-123-1.cpp

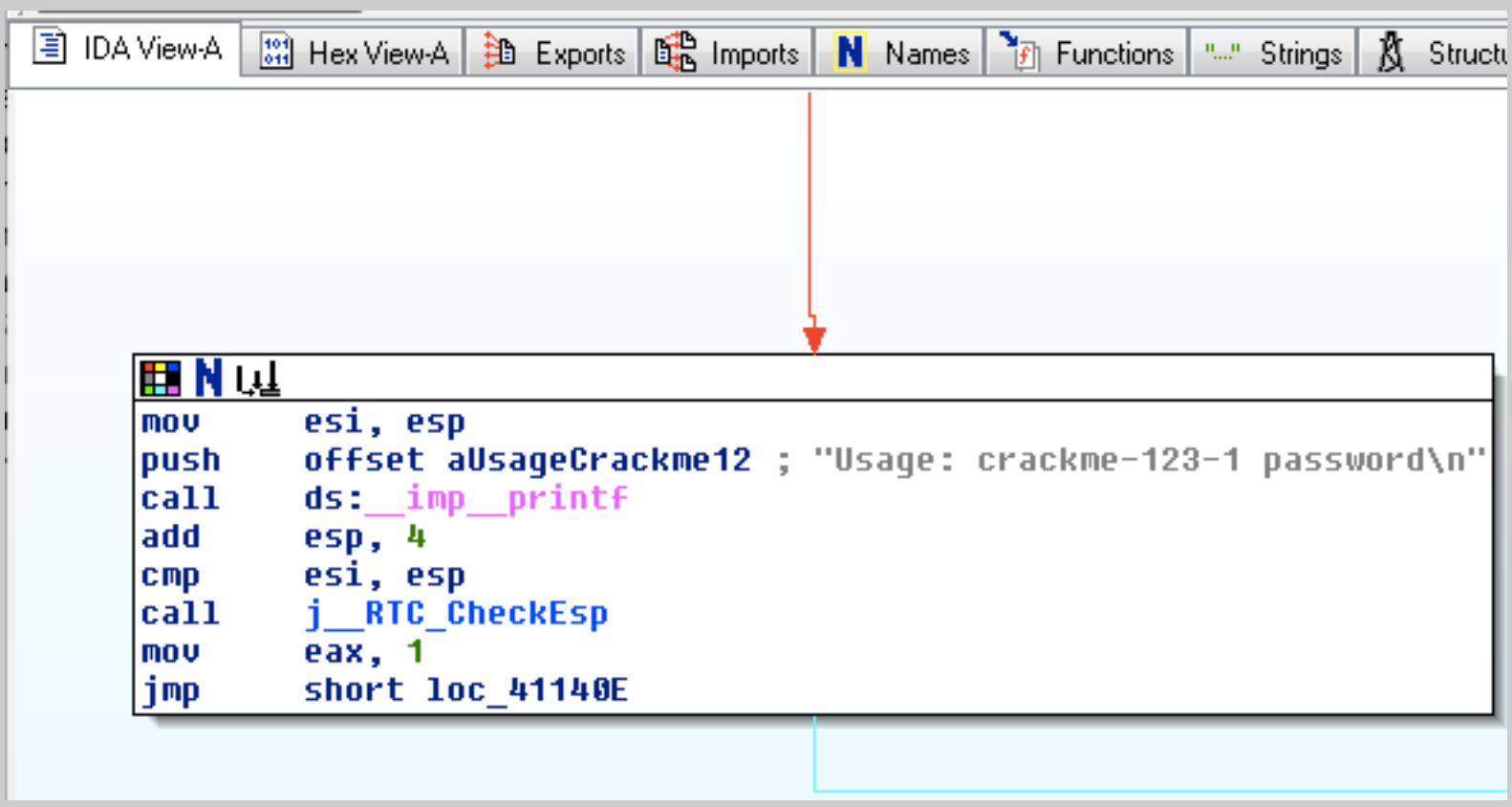
(Global Scope)

```
#include <iostream>
#include <string>
using namespace std;


int _tmain(int argc, _TCHAR* argv[])
{
    if (argc != 2)
    {
        printf("Usage: crackme-123-1 password\n");
        return 1;
    }
    if (strcmp(argv[1],"topsecret") == 0)
    {
        printf("You found the password!  Congratulations!\n");
        return 0;
    }

    printf("Fail!\n");
    return 0;
}
```

A

100 %

Drag the "View-A" display to make Module C visible, as show below:



Notice the gray readable text on the right side, saying "Usage: crackme-121-1 password".

This module pushes those characters onto the stack with a **push** command, and then calls the printf function with the **call ds:_imp_printf** command.

The figure below shows the C statements that comple to the "C" module:

crackme-123-1.cpp

(Global Scope)

```
#include <iostream>
#include <string>
using namespace std;


int _tmain(int argc, _TCHAR* argv[])
{
    if (argc != 2)
    {
        printf("Usage: crackme-123-1 password\n");
        return 1;
    }
    if (strcmp(argv[1],"topsecret") == 0)
    {
        printf("You found the password!  Congratulations!\n");
        return 0;
    }

    printf("Fail!\n");
    return 0;
}
```

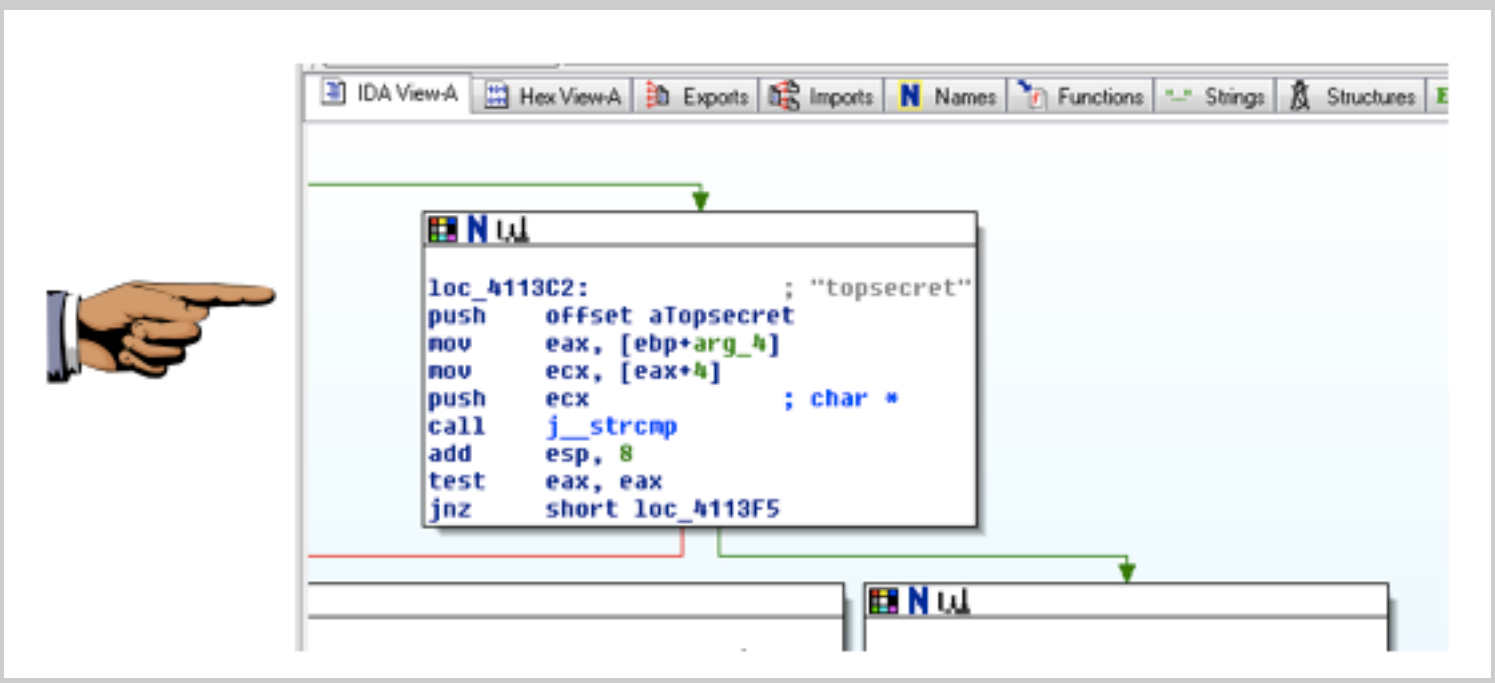
A B C D E F

100 %

Follow along in IDA Pro and make sure you see what each of the six modules do, and how they correspond to the C source code.

Saving the Image

Drag the "View-A" screen to show module "B", as shown below:



Make sure the gray "topsecret" text is visible.

Save this image with the filename **Proj 2xa from YOUR NAME**

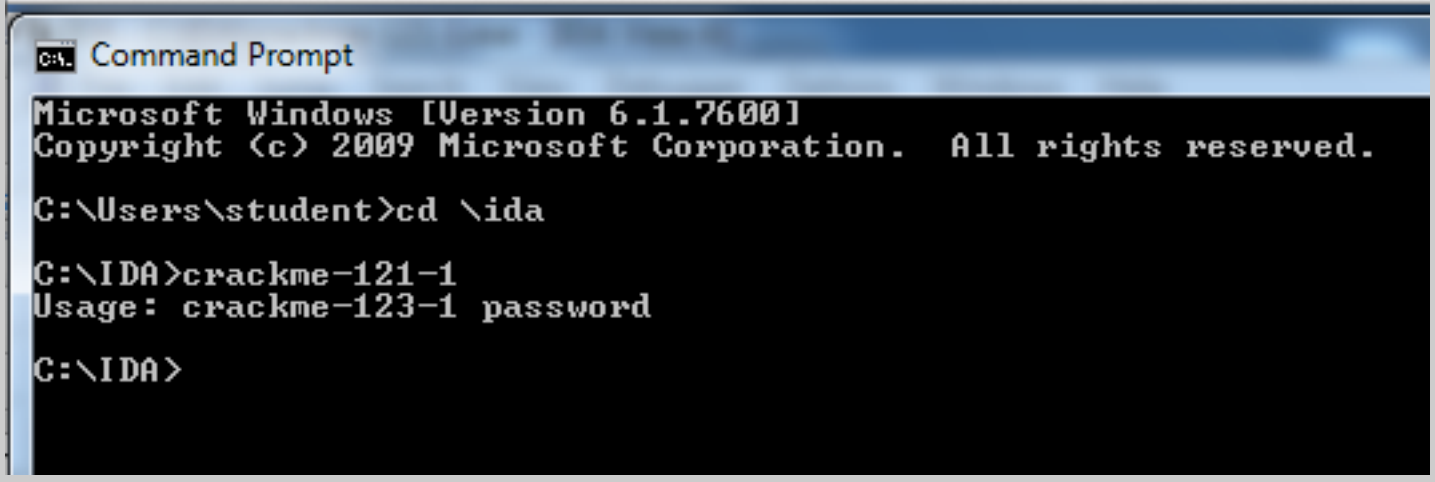
Running the Executable

Click **Start**, type in **CMD**, and press Enter to open a Command Prompt window.

In the Command Prompt window, execute these commands:

```
cd \IDA

crackme-121-1
```

You should see the message "Usage: crackme-121-1 password", as shown below:



If you see a message saying "This application has failed to start because MSVCR100D.dll was not found", download that file here, and put it in the same folder as the .exe file:

msvcr100d.dll

This message is telling you that you need to add a password after the "crackme-121-1".

In the Command Prompt window, execute this command:

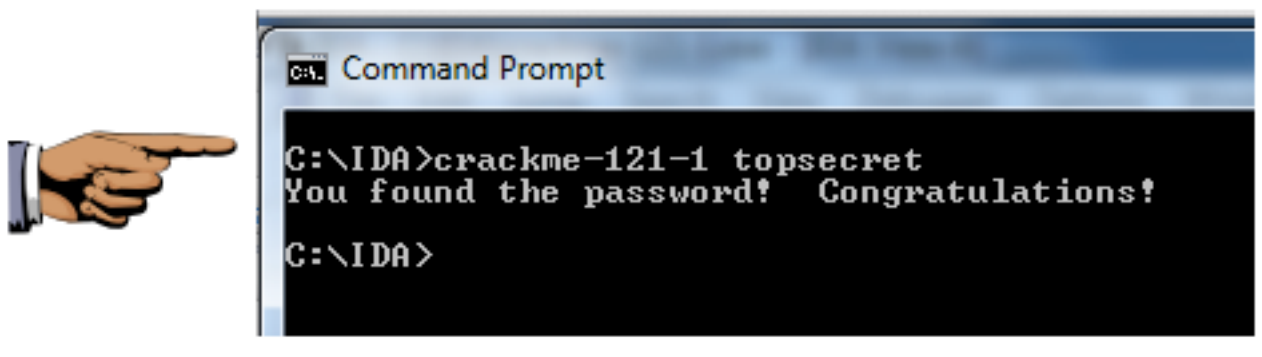
```
crackme-121-1 wrongpassword
```

You should see the message "Fail!".

In the Command Prompt window, execute this command:

```
crackme-121-1 topsecret
```

You should see the message "You found the password!", as shown below:



Saving the Image

Make sure the "You found the password!" text is visible.

Save this image with the filename **Proj 2xb from YOUR NAME**

Point Value

Those two images are worth a total of ten points. You can now earn more points by using the same technique to crack more files, as explained below.

crackme-121-2 (10 points)

Download this file:

crackme-121-2.exe

It is very similar to crackme-121-1. Perform these steps:

1. Load the executable in IDA Pro
2. Find the module containing the password, and save a screen capture of it
3. Run the program at a command prompt and save an image of it congratulating you for finding the password.

crackme-121-3 (10 points)

This one is a little more complicated, with two passwords instead of just one.

Download this file:

crackme-121-3.exe

Perform these steps:

1. Load the executable in IDA Pro
2. Find the modules containing the passwords, and save a screen capture of them
3. Run the program at a command prompt and save an image of it congratulating you for finding the passwords.

crackme-121-4 (10 points)

This one is a little more complicated--you need to do more than just provide a password.

Download this file:

crackme-121-4.exe

Perform these steps:

1. Load the executable in IDA Pro
2. Find the modules that perform string comparisons (strcmp) and try to guess what they are referring to.
3. Run the program at a command prompt and save an image of it congratulating you for solving the puzzle.

Turning in your Project

Email the images to cnit.126sam@gmail.com with the subject line: **Proj 2x from YOUR NAME**

Credits

This is based on a class I took at the HoneyNet conference, from Felix Leder.

Last modified 7-22-14