Proj 11. Hacking Minesweeper with Ollydbg (15 pts + 30 pts extra

What You Need

A Windows machine, real or virtual. I used a Windows Server 2008 virtual machine.

Purpose

To hack MineSweeper at the binary level. This gives you practice using the Ollydbg debugger, Procdump, and Python.

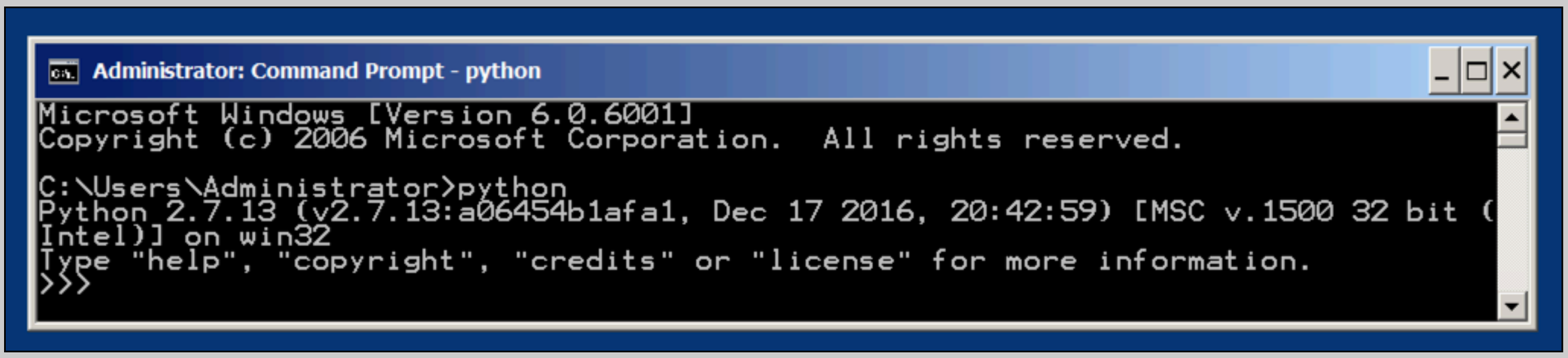
Getting Python

The Windows Server 2008 machine we have been using already has Python installed.

To see if you have it, open a Command Prompt and execute this command:

```
python
```

You should see a "Python 2.7" message, as shown below.



If you don't have Python 2.7 installed, follow these instructions:

https://samsclass.info/124/proj14/python2.7-win.htm

Getting Minesweeper

Download the minesweeper program from the link below.

minesam.exe.zip

Right-click the zipped file and click "**Extract All...**", **Extract**.

Double-click the **minesam.exe** file to launch Minesweeper.

The game launches. Click **Game**, **Beginner** to see the small gameboard shown below. as shown below.

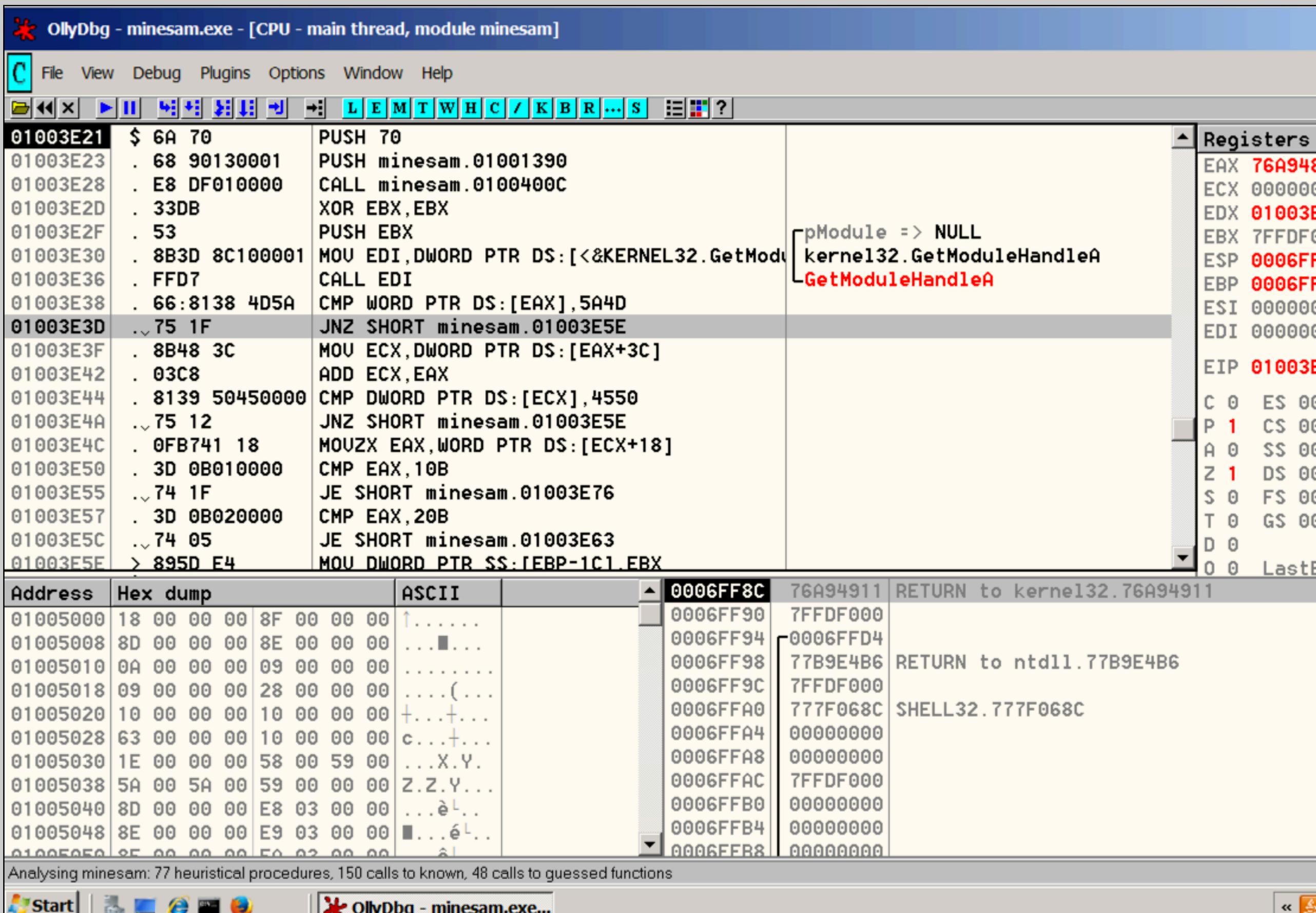
Click a cell. Some of the cells appear empty, and others are revealed with numbers in them, as shown below.

Viewing the Game in OllyDbg

Close Minesweeper.

Launch OllyDbg. Click **File**, **Open** and open **minesam.exe**.

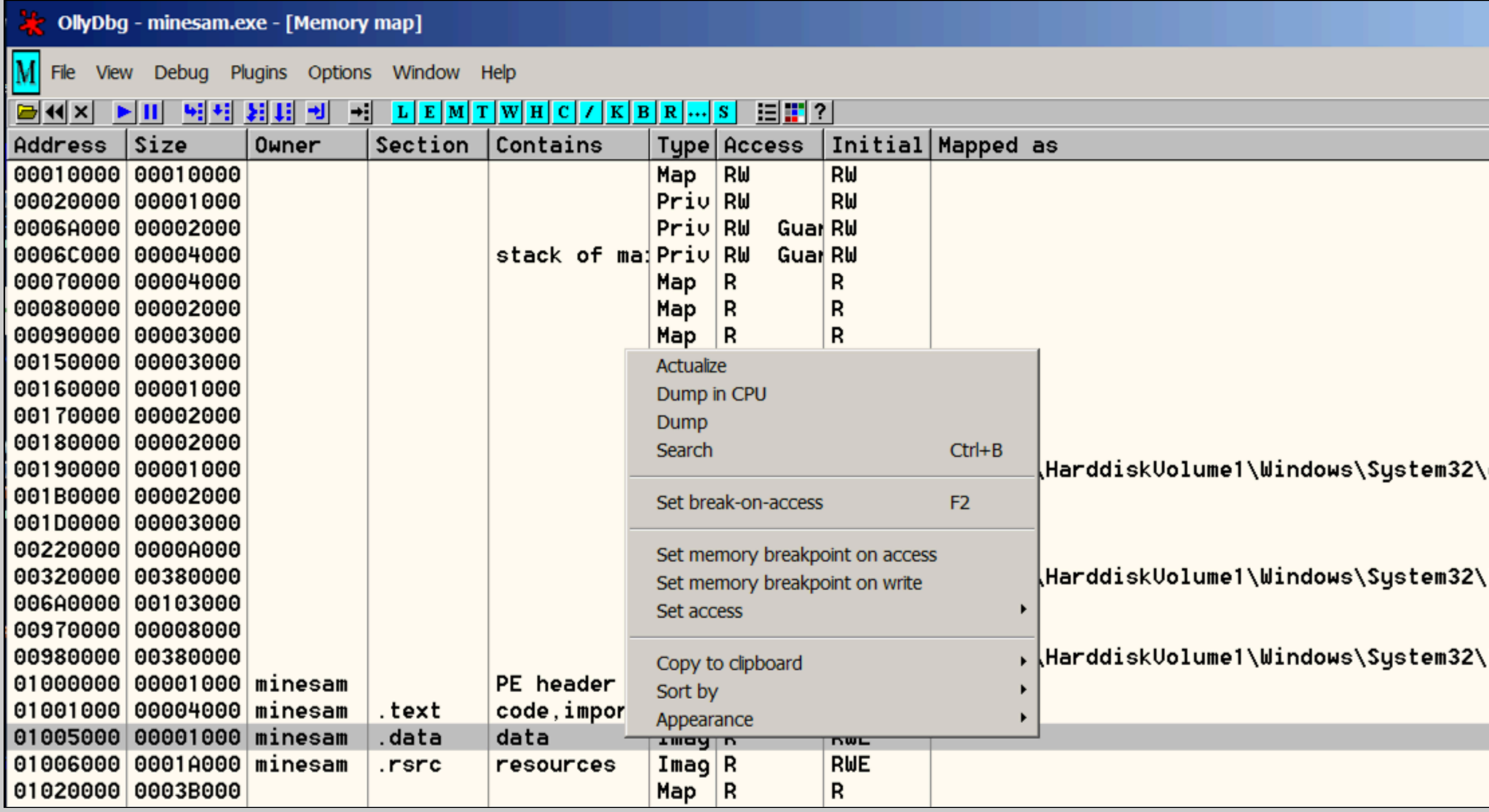
The program loads and pauses, as shown below.



From the OllyDbg menu bar, click **View**, **Memory**.

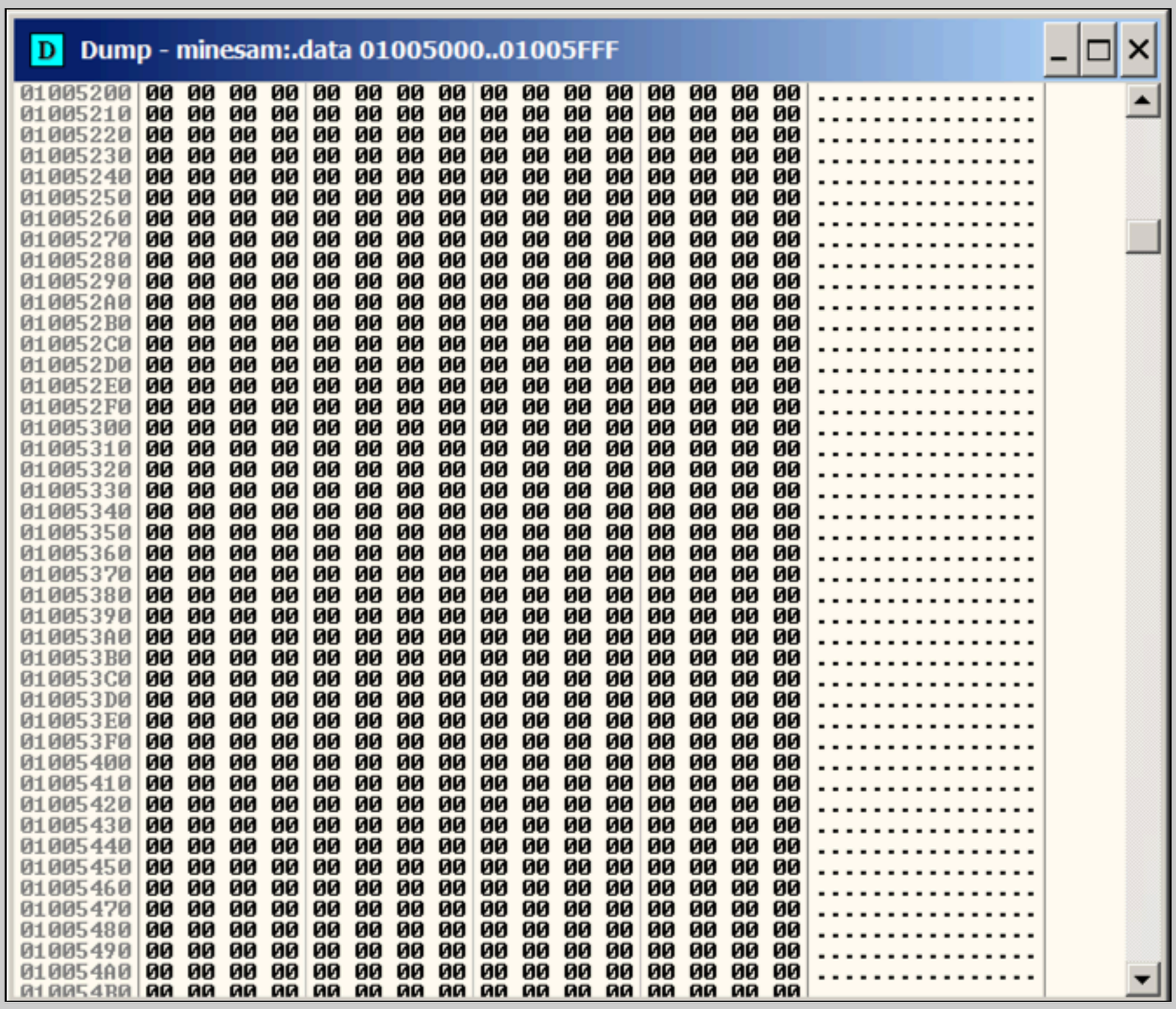
The memory segments are shown, as shown below.

Right-click the **minesam .data** line and click **Dump**, as shown below.



In the Dump window, scroll down to show memory near **01005340**.

This area contains only zeroes, as shown below.



From the OllyDbg menu bar, click **View**, **CPU**.

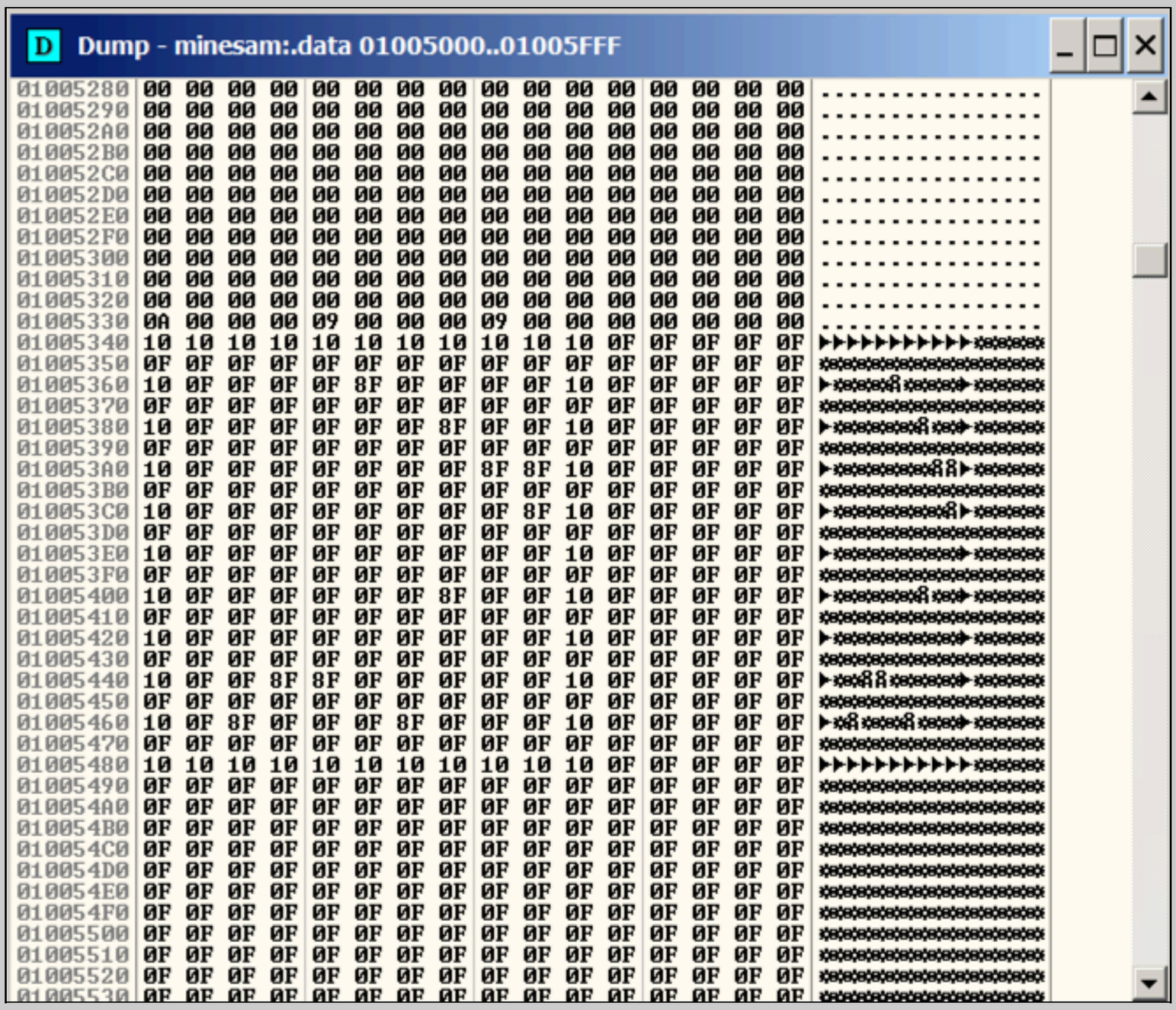
From the OllyDbg menu bar, click **Debug**, **Run**.

A Minesweeper window opens, but does not come to the front. Click its button on the taskbar to bring it to the front, as shown below.

Viewing the Stored Gameboard

From the OllyDbg menu bar, click **Window**, **Dump**.

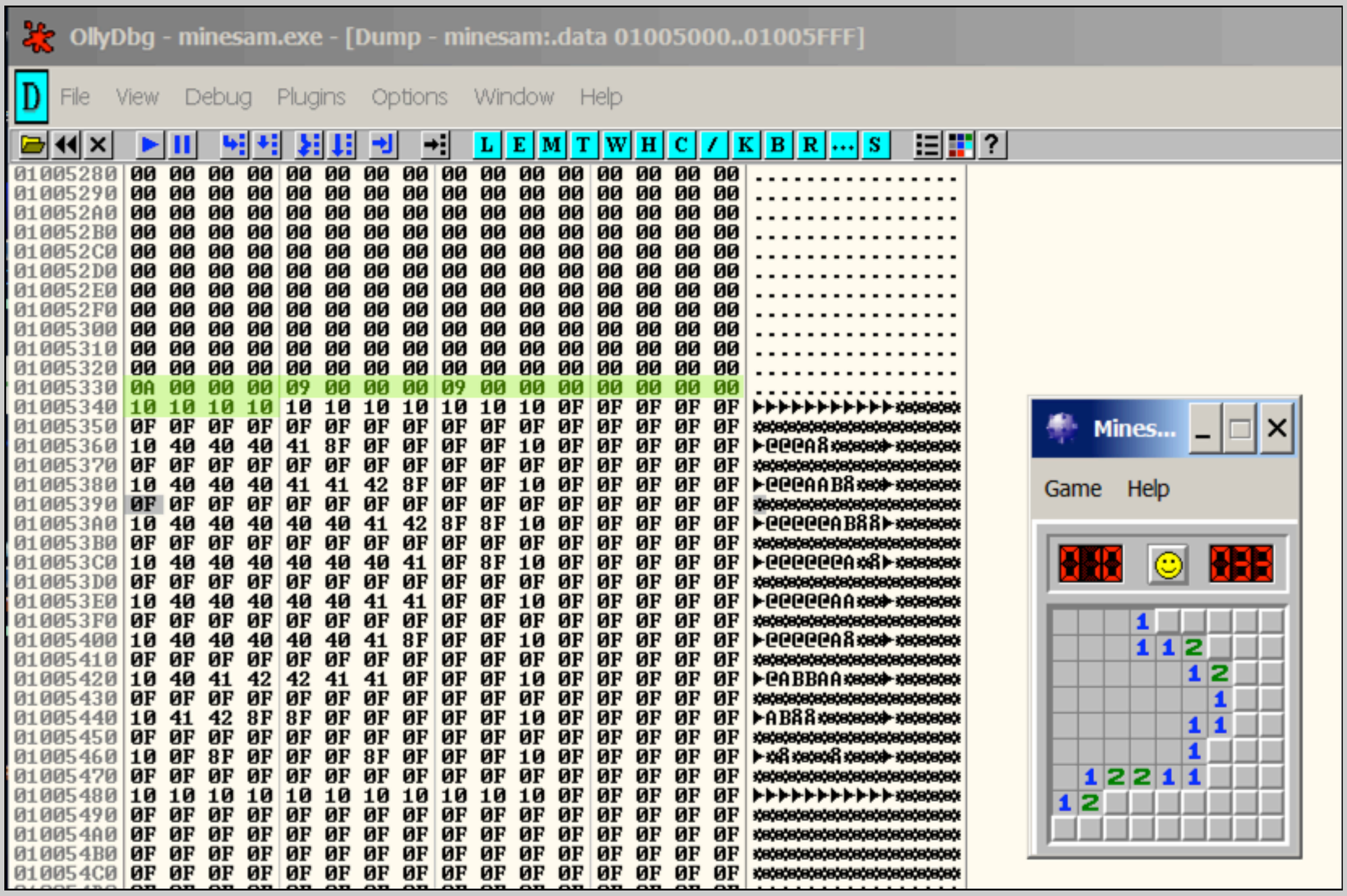
The memory after **01005340** now contains data, as shown below.



Click the **Minesweeper** button on the taskbar to bring it to the front. Click a cell to change the display.

Comare the Minesweeper gameboard with the Dump window. You can see that the gameboard is stored in RAM, using an "A" for "1", and a "B" for "2", as

shown below.



If we can read the RAM, we can cheat at the game.

Notice the green-highlighted region in the image above. If we can find this sequence of bytes in RAM, we can find the gameboard in a memory dump.

Getting Procdump

In a Web browser, go to

https://docs.microsoft.com/en-us/sysinternals/downloads/procdump

Download Procdump.zip, and put it in your Downloads folder.

Click **Start**, **Computer**. Navigate to your Download folder.

Right-click **Procdump.zip** and click "**Extract All...**", **Extract**.

Capturing Process Memory

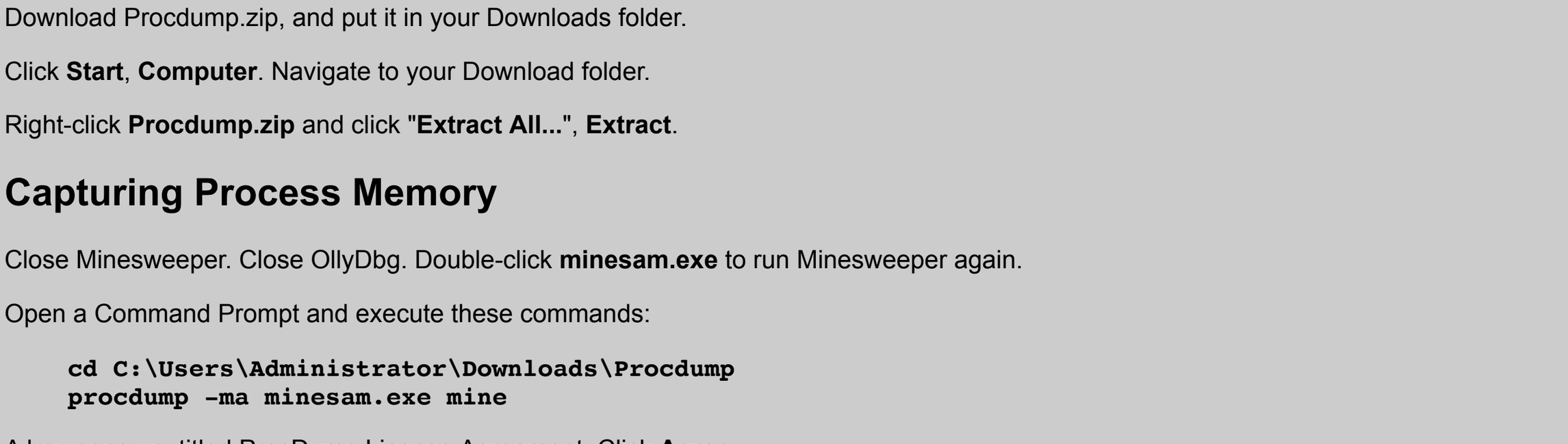
Close Minesweeper. Close OllyDbg. Double-click **minesam.exe** to run Minesweeper again.

Open a Command Prompt and execute these commands:

```
cd C:\Users\Administrator\Downloads\Procdump
procdump -ma minesam.exe mine
```

A box pops up, titled ProcDump License Agreement. Click **Agree**.

Procdump makes a dump file, as shown below.



Viewing the Memory with HxD

The Windows Server 2008 machine we have been using already has HxD installed.

If you don't have it, get it here:

https://mh-nexus.de/en/hxd/

Open HxD. From the HxD menu bar, click **File**, **Open**.

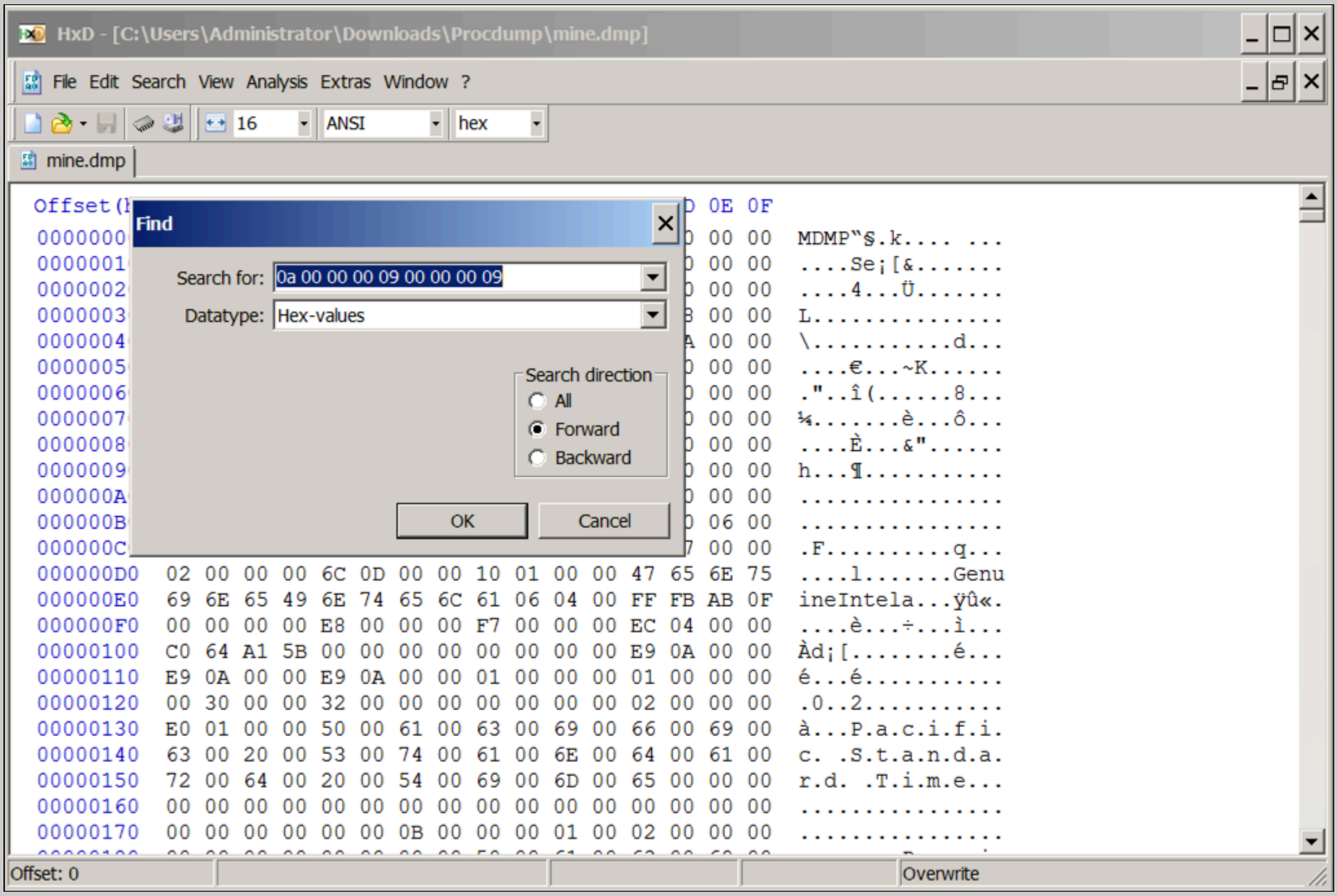
Navigate to your **Downloads** folder. Open the **Procdump** folder and double-click the **mine.dmp** file.

From the HxD menu bar, click **Search**, **Find**.

In the "Find" field, select a Datatype of **Hex-values**.

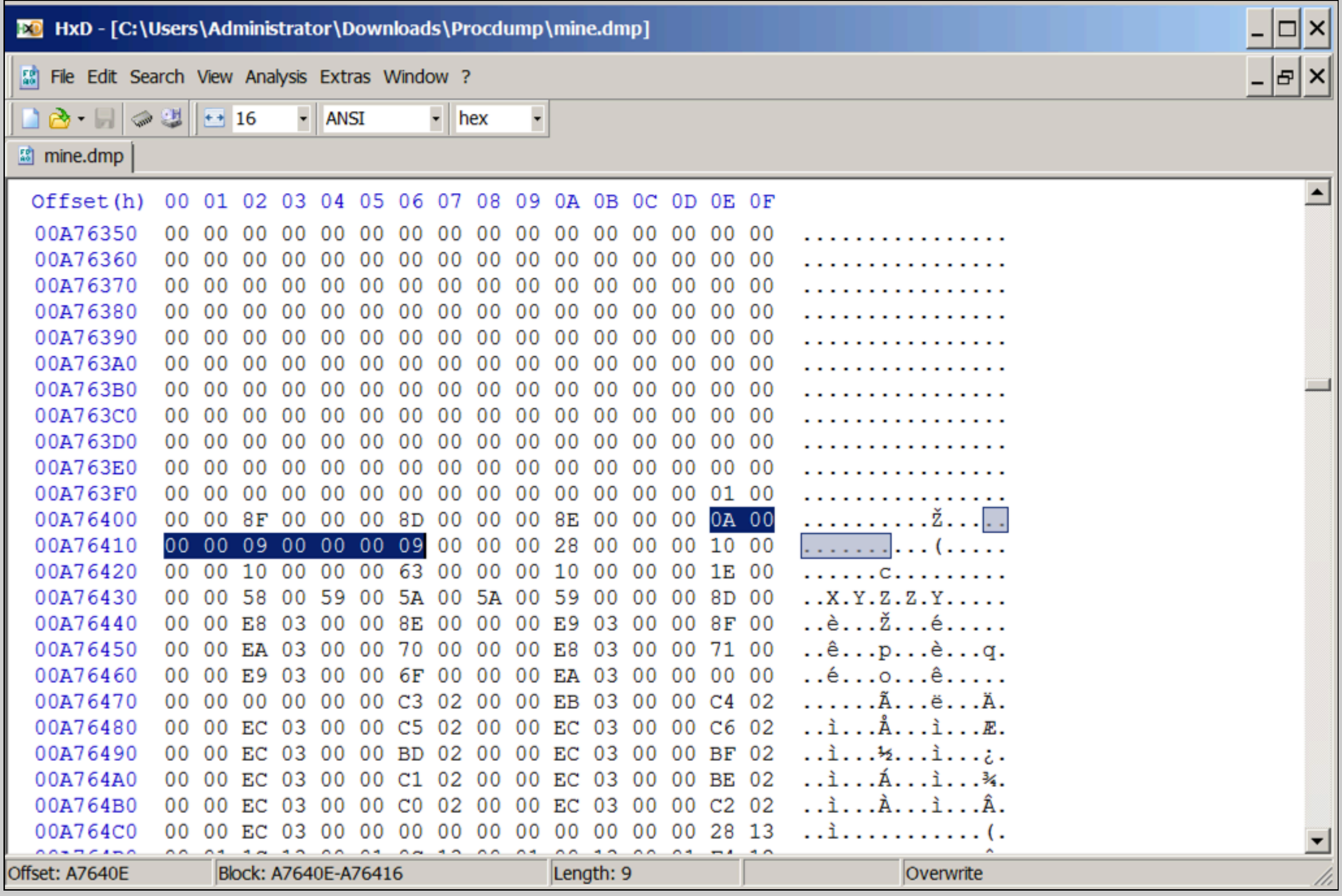
In the "Search for" field, enter this text, as shown below.

```
0a 00 00 00 09 00 00 00 09
```



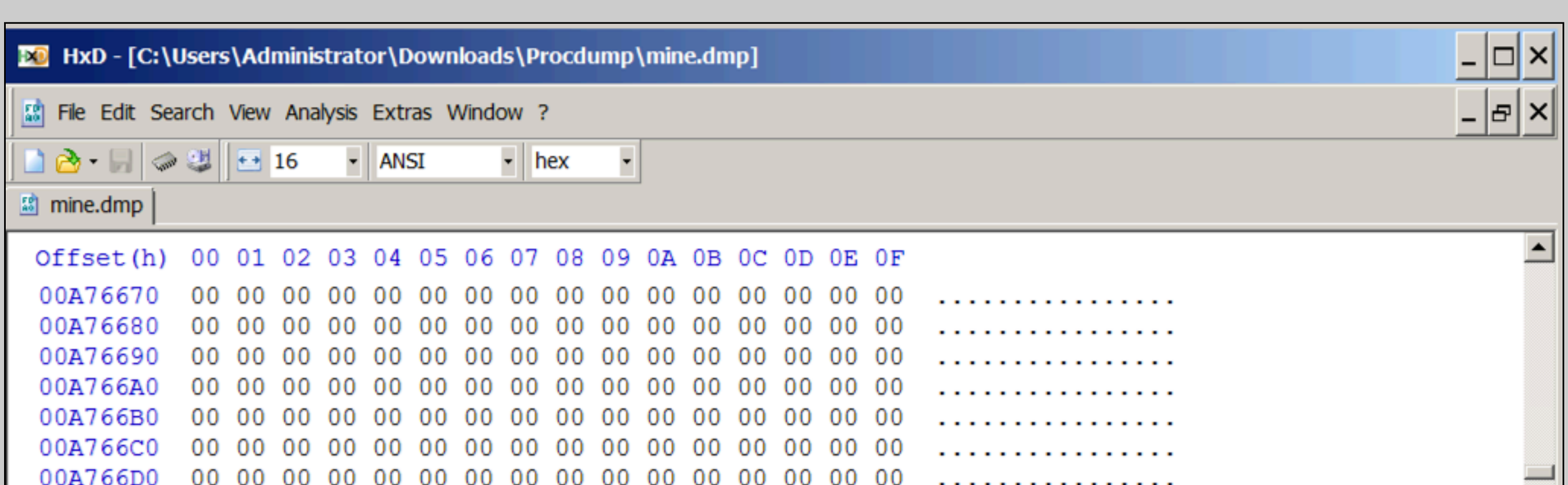
In the "Find" box, click **OK**.

The string is found, but it may not be the correct hit. The first one doesn't have the gameboard after it, as shown below.



From the HxD menu bar, click **Search**, "**Find again**".

This time it finds the gameboard data, as shown below.



Creating a Python Script

We can automate the process with Python. In a Command Prompt window, execute these commands:

```
cd C:\Users\Administrator\Downloads\Procdump
notepad cheat.py
```

A box pops up, saying "Do you want to create a ne file...?". Click **Yes**.

Paste in this code, as shown below.

```
import os

# Dump memory
cmd = "del mine.dmp"
os.system(cmd)
cmd = "procdump -ma minesam.exe mine"
os.system(cmd)

# Find gameboard

mark ='\x0A\x00\x00\x00\x09\x00\x00\x00\x09\x00\x00\x00\x00\x00\x00\x00\x10\x10\x10\x10'

nread = 20
boardfound = 0
gameboard = []

with open("mine.dmp", "rb") as f:
  line = f.read(20)

  while (boardfound == 0):
    c = f.read(1)
    if c == "":
      print "File ended, but gameboard not found!"
      exit()
    line = line[1:] + c
    nread += 1
    if nread % 0x100000 == 0:
      print "Looking at byte", hex(nread), nread
    if line == mark:
      print "Gameboard found at ", hex(nread)
      boardfound = 1
  for i in range(4):
    gameboard.append('\x10')
  for i in range(500):
    gameboard.append(f.read(1))

# Print Gameboard

l = len(gameboard)
m = 32 # items per line

for i in range(0, l-m, m):
  line = ""
  for j in range(m):
    g = gameboard[i+j]
    # print i, j, ord(g)
    if g == '\x10':
      c = "-"
    elif g == '\x0f':
      c = " "
    elif g == '\x8f':
      c = "*"
    elif g == '\x00':
      c = " "
    else:
      c = chr( ord(g) - 16 )
    line += c
  print line
```

cheat.py - Notepad

File Edit Format View Help

```
import os

# Dump memory
cmd = "del mine.dmp"
os.system(cmd)
cmd = "procdump -ma minesam.exe mine"
os.system(cmd)

# Find gameboard

mark ='\x0A\x00\x00\x00\x09\x00\x00\x00\x09\x00\x00\x00\x00\x00\x00\x00\x10\x10\x10\x10'

nread = 20
boardfound = 0
gameboard = []

with open("mine.dmp", "rb") as f:
  line = f.read(20)

while (boardfound == 0):
  c = f.read(1)
  if c == "":
    print "File ended, but gameboard not found!"
    exit()
  line = line[1:] + c
  nread += 1
```

In the Notepad window, click **File**, **Save**.

In the Command Prompt window, execute this command:

```
python cheat.py
```

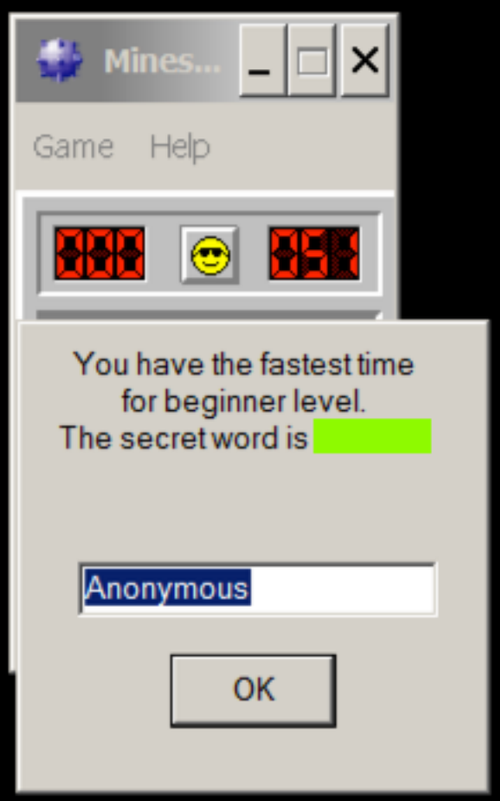
The program shows the location of the mines. With this information, you should easily be able to click all the squares without mines, as shown below.

Administrator: Command Prompt

```
C:\Users\Administrator\Downloads\Procdump>python cheat.py

ProcDump v9.0 - Sysinternals process dump utility
Copyright (C) 2009-2017 Mark Russinovich and Andrew Richards
Sysinternals - www.sysinternals.com

[14:17:30] Dump 1 initiated: C:\Users\Administrator\Downloads\Procdump\mine.dmp
[14:17:30] Dump 1 writing: Estimated dump file size is 39 MB.
[14:17:30] Dump 1 complete: 39 MB written in 0.0 seconds
[14:17:31] Dump count reached.

Looking at byte 0x100000 1048576
Looking at byte 0x200000 2097152
Looking at byte 0x300000 3145728
Looking at byte 0x400000 4194304
Looking at byte 0x500000 5242880
Looking at byte 0x600000 6291456
Looking at byte 0x700000 7340032
Looking at byte 0x800000 8388608
Looking at byte 0x900000 9437184
Looking at byte 0xa00000 10485760
Gameboard found at  0xa99c06
----------
-          -
-    **    -
-          -
-          -
-*         -
-          -
-          -
-   *      -
-*         -
-****  *   -
----------
```


```
C:\Users\Administrator\Downloads\Procdump>
```

When you win the game, a secret word will appear, which is covered by a green box in the image below.



11.1 Beginner Level: Recording Your Score (15 pts)

Use the form below to record your score in Canvas.

Name or Email:

Secret Word:

CCSF Student

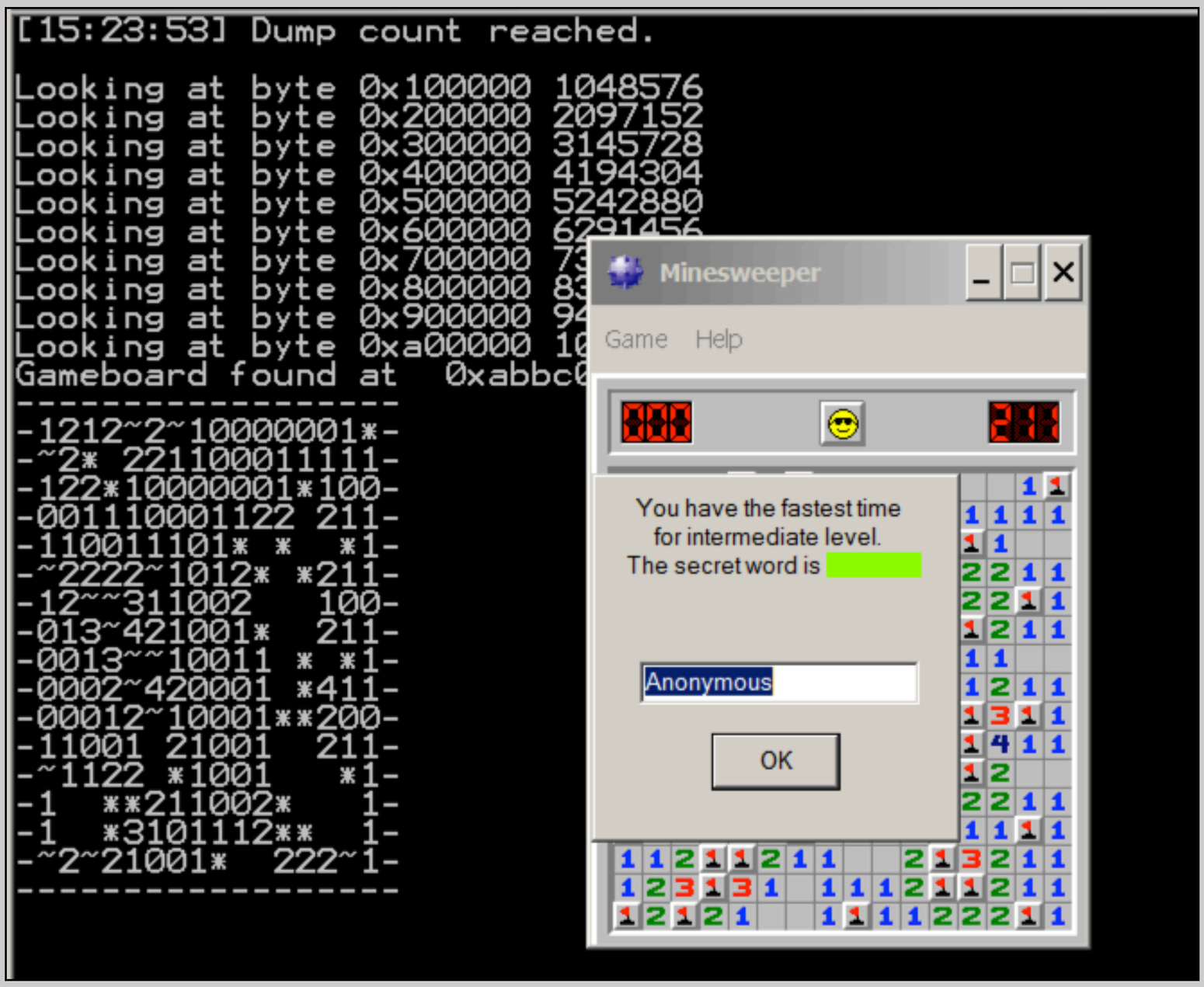
Non-CCSF Student

11.2 Intermediate Level (15 pts extra)

In Minesweeper, click **Game**, **Intermediate**.

Create a cheating tool that works for this level and win the game, as shown below.

*Hint: Search for **10 10 10 10** to find the gameboard.*



Use the form below to record your score in Canvas.

Name or Email:

Secret Word:

CCSF Student

Non-CCSF Student

11.3 Expert Level (15 pts extra)

In Minesweeper, click **Game**, **Expert**.

Find the secret word for the Expert level.

Hint: use a totally different technique; don't play the game.

Use the form below to record your score in Canvas.

Name or Email:

Secret Word:

CCSF Student

Non-CCSF Student

Sources

[Game Hacking: WinXP Minesweeper _MINIDUMP_TYPE Enumeration]

Posted 9-18-18