

**SISTEM OPERASI**  
**Pengenalan Sistem Pengembangan OS Dengan PC Simulator**  
**“BOCHS”**



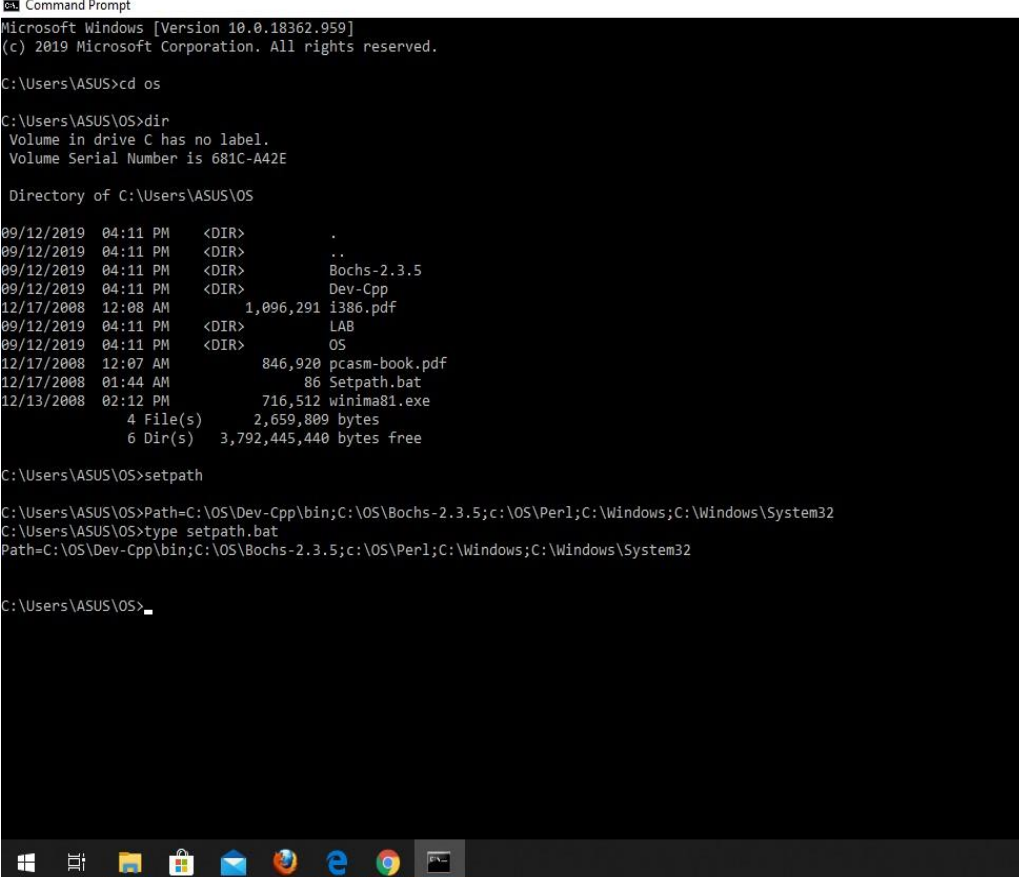
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**2020**

## Menuju ke Direktori Kerja.

- Jalankan program command prompt atau cmd.
- Masuk ke direktori kerja 'C:\OS', dengan perintah 'cd os' <ENTER>.
- Masukan perintah dir, untuk melihat isi direktori di dalam folder tersebut. Akan muncul seperti di tampilan pada gambar
- Jalankan file setpath, untuk menjalankannya ketik 'setpath' tekan <ENTER>



```
Command Prompt
Microsoft Windows [Version 10.0.18362.959]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\ASUS>cd os

C:\Users\ASUS\OS>dir
Volume in drive C has no label.
Volume Serial Number is 681C-A42E

Directory of C:\Users\ASUS\OS

09/12/2019  04:11 PM  <DIR>          .
09/12/2019  04:11 PM  <DIR>          ..
09/12/2019  04:11 PM  <DIR>          Bochs-2.3.5
09/12/2019  04:11 PM  <DIR>          Dev-Cpp
12/17/2008  12:08 AM             1,096,291  i386.pdf
09/12/2019  04:11 PM  <DIR>          LAB
09/12/2019  04:11 PM  <DIR>          OS
12/17/2008  12:07 AM             846,920  pcam-book.pdf
12/17/2008  01:44 AM              86  Setpath.bat
12/13/2008  02:12 PM             716,512  winima81.exe
               4 File(s)      2,659,809 bytes
               6 Dir(s)      3,792,445,440 bytes free

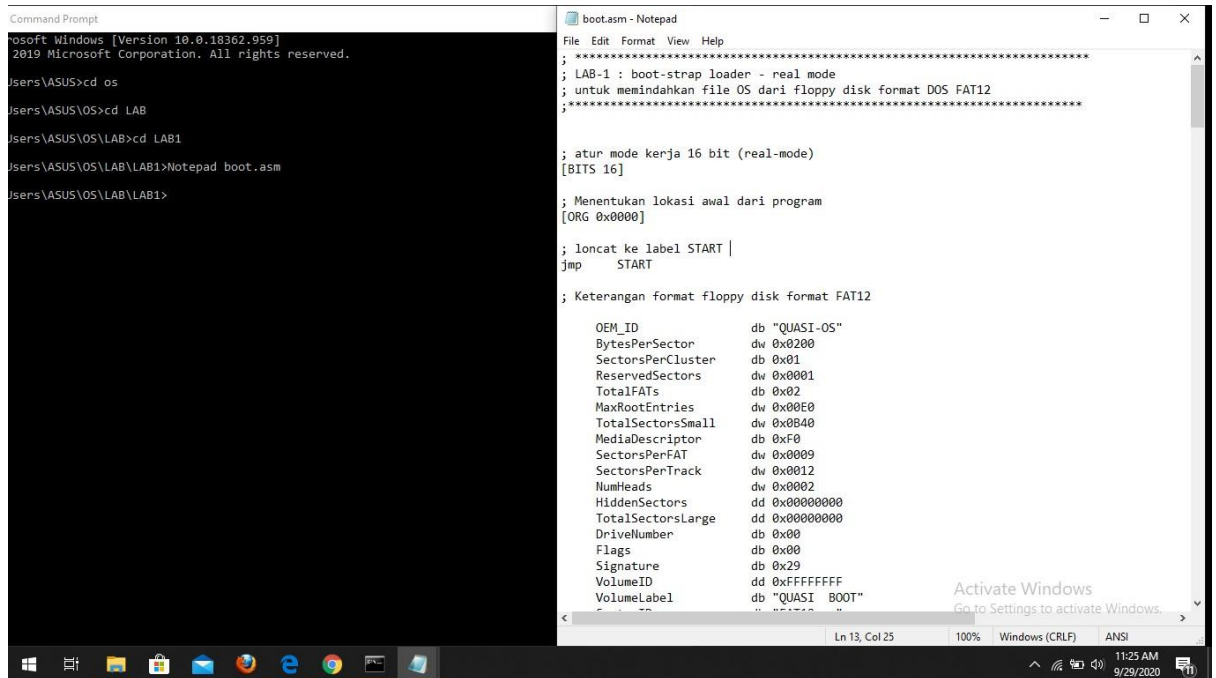
C:\Users\ASUS\OS>setpath

C:\Users\ASUS\OS>Path=C:\OS\Dev-Cpp\bin;C:\OS\Bochs-2.3.5;c:\OS\Perl;C:\Windows;C:\Windows\System32
C:\Users\ASUS\OS>type setpath.bat
Path=C:\OS\Dev-Cpp\bin;C:\OS\Bochs-2.3.5;c:\OS\Perl;C:\Windows;C:\Windows\System32

C:\Users\ASUS\OS>
```

## Melihat Isi Direktori Kerja

- Jalankan command prompt
- Masuk ke direktori kerja pada 'C:\OS\LAB\LAB1'.
- Cobalah untuk membuka file tersebut dengan perintah berikut, dari 'COMMAND PROMPT', ketikkan 'Notepad boot.asm' dan tekan <ENTER>.



The screenshot shows a Windows 10 desktop with two windows open. The Command Prompt window on the left displays the following commands and their outputs:

```
Microsoft Windows [Version 10.0.18362.959]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\ASUS>cd os
C:\Users\ASUS\OS>cd LAB
C:\Users\ASUS\OS\LAB>cd LAB1
C:\Users\ASUS\OS\LAB\LAB1>Notepad boot.asm
C:\Users\ASUS\OS\LAB\LAB1>
```

The Notepad window on the right, titled 'boot.asm - Notepad', shows the following assembly code:

```
File Edit Format View Help
; *****
; LAB-1 : boot-strap loader - real mode
; untuk memindahkan file OS dari floppy disk format DOS FAT12
; *****

; atur mode kerja 16 bit (real-mode)
[BITS 16]

; Menentukan lokasi awal dari program
[ORG 0x0000]

; loncat ke label START |
jmp     START

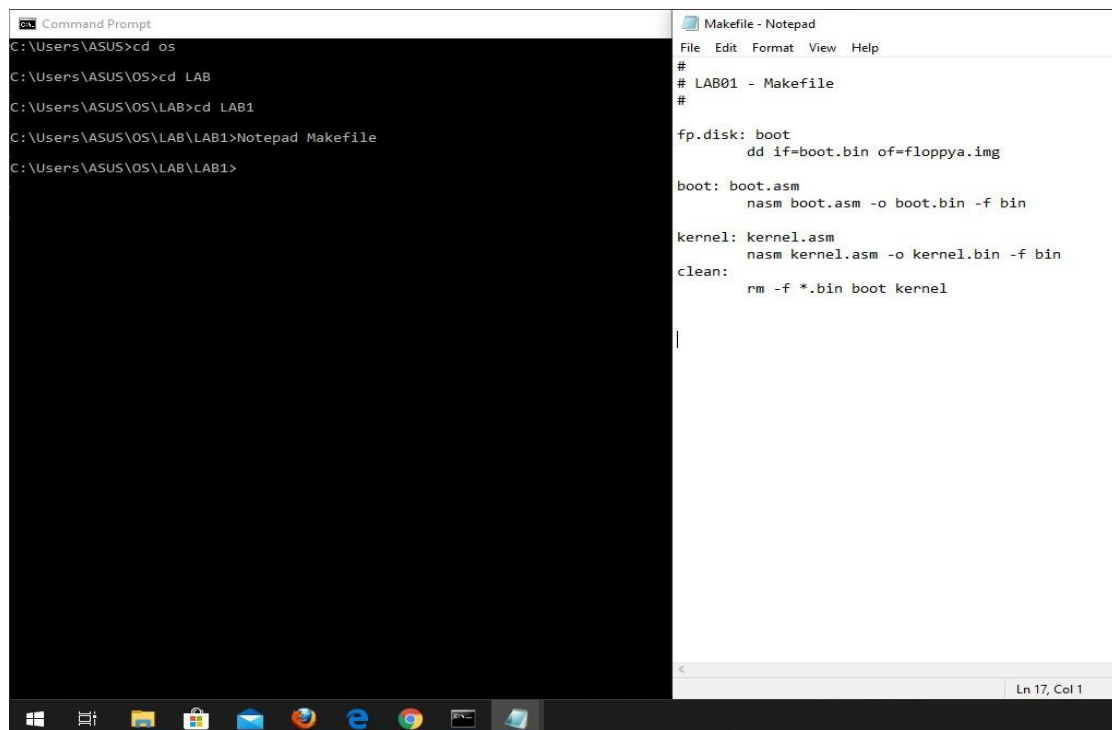
; Keterangan format floppy disk format FAT12

OEM_ID      db "QUASI-OS"
BytesPerSector dw 0x0200
SectorsPerCluster dw 0x01
ReservedSectors dw 0x0001
TotalFATS    dw 0x02
MaxRootEntries dw 0x00E0
TotalSectorsSmall dw 0x0040
MediaDescriptor db 0xF0
SectorsPerFAT dw 0x0009
SectorsPerTrack dw 0x0012
NumHeads      dw 0x0002
HiddenSectors dd 0x00000000
TotalSectorsLarge dd 0x00000000
Drivellumber  db 0x00
Flags         db 0x00
Signature     db 0x29
VolumeID      dd 0xFFFFFFFF
VolumeLabel   db "QUASI BOOT"
```

The status bar at the bottom of the Notepad window shows 'Ln 13, Col 25', '100%', 'Windows (CRLF)', and 'ANSI'. The system tray at the bottom right shows the time '11:25 AM' and date '9/29/2020'.

## Sekilas tentang Makefile

membuka direktori kerja 'C:\OS\LAB\LAB1' selanjutnya mengetik 'Notepad M' tekan tombol 'TAB' sehingga muncul 'Notepad Makefile' dan tekan <ENTER>



The screenshot shows a Windows 10 desktop with two windows open. The Command Prompt window on the left displays the following commands and their outputs:

```
C:\Users\ASUS>cd os
C:\Users\ASUS\OS>cd LAB
C:\Users\ASUS\OS\LAB>cd LAB1
C:\Users\ASUS\OS\LAB\LAB1>Notepad Makefile
C:\Users\ASUS\OS\LAB\LAB1>
```

The Notepad window on the right, titled 'Makefile - Notepad', shows the following Makefile content:

```
File Edit Format View Help
#
# LAB01 - Makefile
#

fp.disk: boot
dd if=boot.bin of=floppya.img

boot: boot.asm
nasm boot.asm -o boot.bin -f bin

kernel: kernel.asm
nasm kernel.asm -o kernel.bin -f bin

clean:
rm -f *.bin boot kernel
```

The status bar at the bottom of the Notepad window shows 'Ln 17, Col 1'. The system tray at the bottom right shows the time '11:25 AM' and date '9/29/2020'.

membuka 'Command Prompt' dan buka direktori kerja 'LAB1' selanjutnya ketik 'make fp.disk'

```
Command Prompt
C:\OS\LAB\LAB1>make fp.disk
nasm boot.asm -o boot.bin -f bin
dd if=boot.bin of=floppya.img
rawwrite dd for windows version 0.5.
Written by John Newbigin <jn@it.swin.edu.au>
This program is covered by the GPL. See copying.txt for details
1+0 records in
1+0 records out

C:\OS\LAB\LAB1>dir
Volume in drive C is Windows
Volume Serial Number is 7ECA-EB79

Directory of C:\OS\LAB\LAB1

28/09/2020  21:59      <DIR>          .
28/09/2020  21:59      <DIR>          ..
10/09/2019  10:19                10.235 bochsout.txt
15/12/2008  16:17                1.628 bochsrc.bxrc
14/12/2008  12:02               14.365 boot.asm
28/09/2020  23:07                512 boot.bin
16/09/2015  07:51                512 boots.bin
15/12/2008  00:47                78 dosfp.bat
28/09/2020  23:07             1.474.560 floppya.img
14/12/2008  11:45                7.966 kernel.asm
15/12/2008  10:21                227 Makefile
15/12/2008  12:20                44 s.bat
               10 File(s)              1.510.127 bytes
               2 Dir(s)              1.087.270.104 bytes free

C:\OS\LAB\LAB1>nasm boot.asm -o boot.bin -f bin
C:\OS\LAB\LAB1>dd if=boot.bin of=floppya.img
rawwrite dd for windows version 0.5.
Written by John Newbigin <jn@it.swin.edu.au>
This program is covered by the GPL. See copying.txt for details
1+0 records in
1+0 records out

C:\OS\LAB\LAB1>make clean
rm -f *.bin boot kernel

C:\OS\LAB\LAB1>boot.bin
'boot.bin' is not recognized as an internal or external command,
```

## Mengenal BOOT DISK

- menghapus file 'floppya.img' jika sudah ada pada direktori kerja anda, dari 'Command Prompt' (lakukan dari direktori kerja) ketik 'del floppya.img /P' lanjutkan dengan tekan 'Y' dan <ENTER>.
- memanggil 'bximage'
- selanjutnya ketikan 'fd' dan tekan <ENTER>
- Ada beberapa tipe (kapasitas) yang ditawarkan, pilih tipe yang paling banyak digunakan saat ini yaitu tipe floppy dengan kapasitas '1.44MB', ditunjukan oleh angka [1.44]. Selanjutnya tekan <ENTER>, untuk memilih tipe lain, masukan angka yang menunjukkan kapasitas yang anda inginkan (lihat gambar di atas) dan <ENTER>
- Terakhir anda diminta untuk memberikan nama file, ketikan 'floppya.img' dan <ENTER>

```
Command Prompt

C:\OS\LAB\LAB1>bximage
=====
                bximage
          Disk Image Creation Tool for Bochs
          $Id: bximage.c,v 1.32 2006/06/16 07:29:33 vruppert Exp $
=====

Do you want to create a floppy disk image or a hard disk image?
Please type hd or fd. [hd] fd

Choose the size of floppy disk image to create, in megabytes.
Please type 0.16, 0.18, 0.32, 0.36, 0.72, 1.2, 1.44, 1.68, 1.72, or 2.88.
[1.44]
I will create a floppy image with
  cyl=80
  heads=2
  sectors per track=18
  total sectors=2880
  total bytes=1474560

What should I name the image?
[a.img] floppy.img

The disk image 'floppy.img' already exists. Are you sure you want to replace it?
Please type yes or no. [no] yes

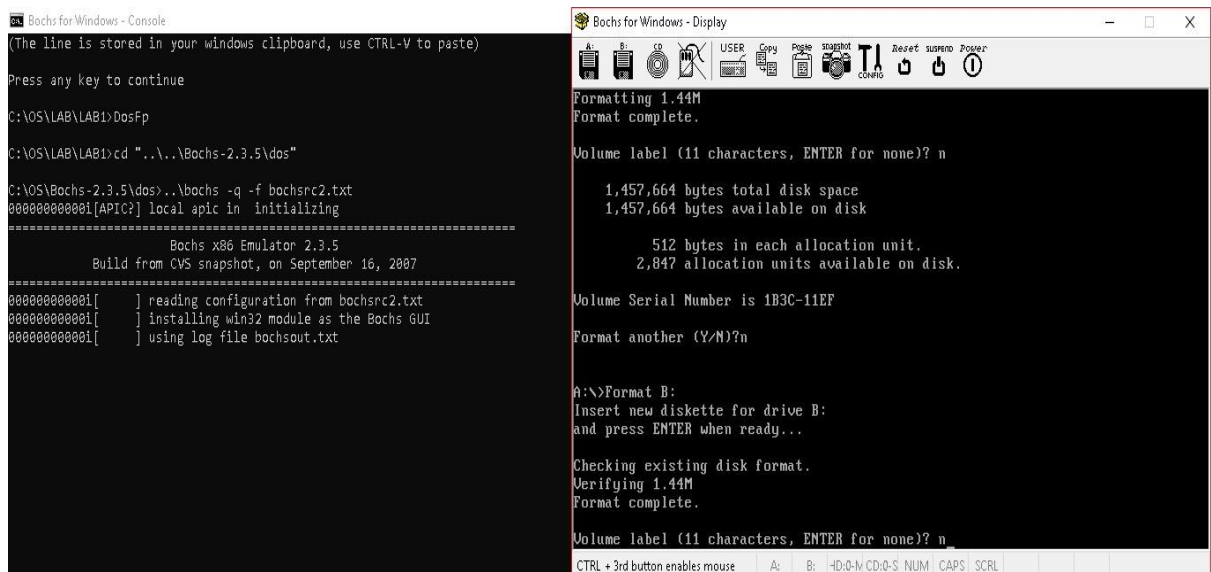
Writing: [] Done.

I wrote 1474560 bytes to floppy.img.

The following line should appear in your bochsrc:
  floppy: image="floppy.img", status=inserted
(The line is stored in your windows clipboard, use CTRL-V to paste)

Press any key to continue

C:\OS\LAB\LAB1>
```



## Melihat Data dalam Boot Sector

- Meng-Copy 512 byte data bootsektor ke dalam sebuah file terpisah, caranya dari 'Command Prompt' ketik 'dd if=floppya.img of=boots.bin count=1' maksud dari perintah ini adalah menyalin byte data dari file 'floppya. img' ke dalam file 'boots.bin' sebanyak satu sektor mulai dari sektor 0.
- menjalankan 'Command Prompt' dan ketik 'debug boots. bin' dan <ENTER>
- Untuk melihat isi data file 'boots. bin' ketikkan perintah 'D CS:0100 02FF' dan tekan <ENTER>.

CA. Command Prompt

```
C:\OS\LAB\LAB1>debug boots.bin
'debug' is not recognized as an internal or external command,
operable program or batch file.

C:\OS\LAB\LAB1>tdump.exe
Turbo Dump Version 5.0.16.12 Copyright (c) 1988, 2000 Inprise Corporation
Syntax: TDUMP [options] [InputFile] [ListFile] [options]
-a      Display file in 8-bit ASCII -a7     Display file in 7-Bit ASCII
-b#     Start at offset #           -C      Dump OBJ, LIB COFF info
-d      Dump OBJ, LIB debug info    -e      Dump as EXE
-ed     No EXE debug info           -ee[=x] PE exports only (x=srch)
-eiID   EXE tbls:HDR,OBJ,FIX,NAM,ENT -el     No EXE line numbers
-em[=x] PE imports only (x=srch)    -em.[x] PE imp. modules (x=srch)
-ep     No EXE PE header display    -er     No EXE relocation records
-ea[:v] Dump Exports(:v sort on RVA) -ex     No New Executable dump
-h      Output in hex              -iID    Incl dbg tbl:[?/abc...rst]
-l      Dump as LIB (OMF)           -le[=x] Dump EXPDEF recs (x=srch)
-li[=x] Dump IMPDEF recs (x=srch)   -m      No C++ de-mangling
-o      Dump as OBJ (OMF)           -oc     Do OMF CRC check
-oiID   Include OMF rec (? for list) -oxID   Exclude OMF rec (? for list)
-q      Suppress copyright message -r      Raw dump of records
-R      Dump PE relocation table    -s[=x]  Dump strings (x=srch)
-su[=x] Dump unix style strings     -um     Unmangle file list of names
-v      Verbose dump of records     -xID    Excl dbg tbl:[?/abc...rst]
-?      Display a better help screen

C:\OS\LAB\LAB1>tdump boots.bin
Turbo Dump Version 5.0.16.12 Copyright (c) 1988, 2000 Inprise Corporation
Display of File BOOTS.BIN

000000: EB 3C 90 4D 53 57 49 4E 34 2E 31 00 02 01 01 00 <.MSWIN4.1....
000010: 02 E0 00 40 0B F0 09 00 12 00 02 00 00 00 00 00 ...@.....
000020: 00 00 00 00 00 00 29 E7 0F 15 2C 4E 4F 20 4E 41 .....)....NO NA
000030: 4D 45 20 20 20 20 46 41 54 31 32 20 20 20 33 C9 ME FAT12 3.
000040: 8E D1 BC FC 7B 16 07 BD 78 00 C5 76 00 1E 56 16 ....{...x.v..V.
000050: 55 BF 22 05 89 7E 00 89 4E 02 B1 0B FC F3 A4 06 U."...~.N.....
000060: 1F BD 00 7C C6 45 FE 0F 38 4E 24 7D 20 8B C1 99 ...|.E..8N$} ...
000070: E8 7E 01 83 EB 3A 66 A1 1C 7C 66 3B 07 8A 57 FC .~...:f...|f;..W.
000080: 75 06 80 CA 02 88 56 02 80 C3 10 73 ED 33 C9 FE u....V....s.3..
```

- d. Cara lain dapat digunakan program 'tdump.exe' milik borland, dari 'Command Prompt' ketikkan 'tdump boots. bin' <ENTER>

CA. Command Prompt

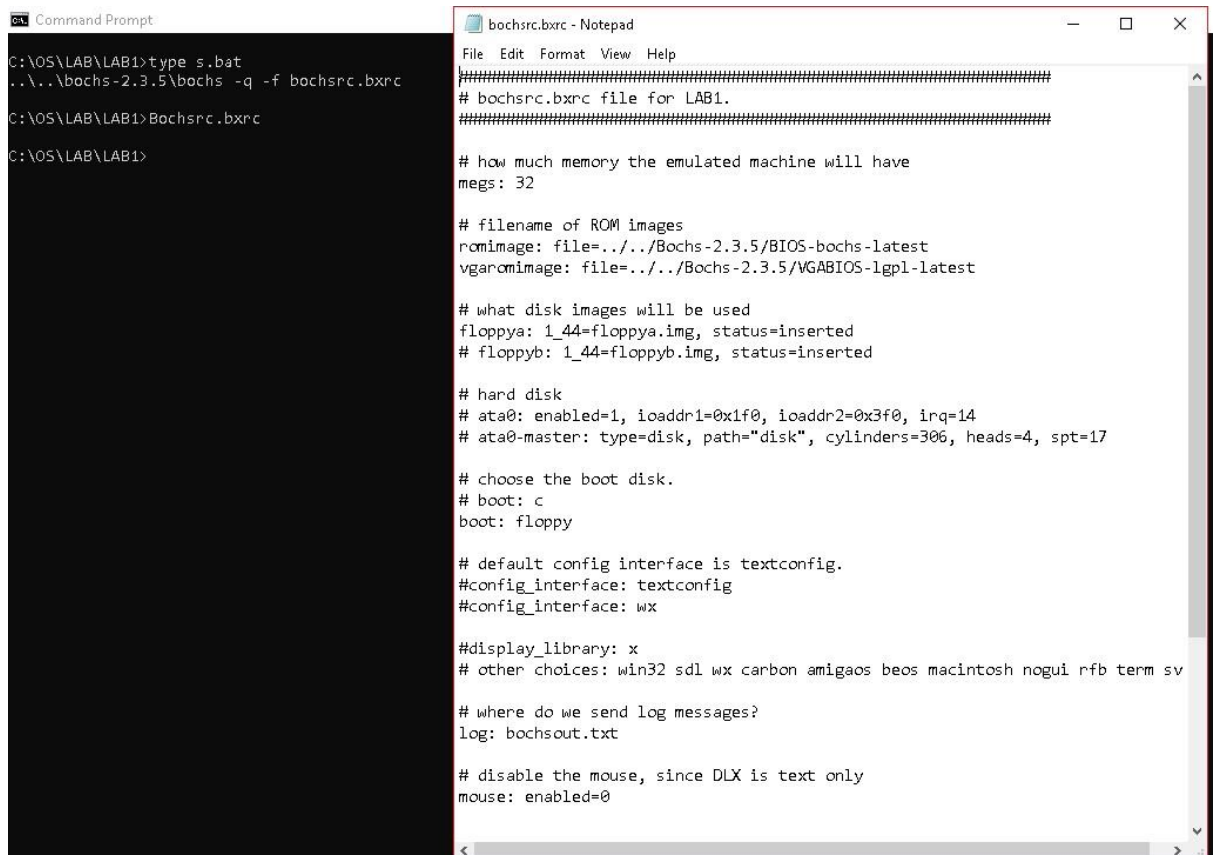
```
C:\OS\LAB\LAB1>tdump boots.bin
Turbo Dump Version 5.0.16.12 Copyright (c) 1988, 2000 Inprise Corporation
Display of File BOOTS.BIN

000000: EB 3C 90 4D 53 57 49 4E 34 2E 31 00 02 01 01 00 <.MSWIN4.1....
000010: 02 E0 00 40 0B F0 09 00 12 00 02 00 00 00 00 00 ...@.....
000020: 00 00 00 00 00 00 29 E7 0F 15 2C 4E 4F 20 4E 41 .....)....NO NA
000030: 4D 45 20 20 20 20 46 41 54 31 32 20 20 20 33 C9 ME FAT12 3.
000040: 8E D1 BC FC 7B 16 07 BD 78 00 C5 76 00 1E 56 16 ....{...x.v..V.
000050: 55 BF 22 05 89 7E 00 89 4E 02 B1 0B FC F3 A4 06 U."...~.N.....
000060: 1F BD 00 7C C6 45 FE 0F 38 4E 24 7D 20 8B C1 99 ...|.E..8N$} ...
000070: E8 7E 01 83 EB 3A 66 A1 1C 7C 66 3B 07 8A 57 FC .~...:f...|f;..W.
000080: 75 06 80 CA 02 88 56 02 80 C3 10 73 ED 33 C9 FE u....V....s.3..
000090: 06 D8 7D 8A 46 10 98 F7 66 16 03 46 1C 13 56 1E ..}.F...f..F..V.
0000A0: 03 46 0E 13 D1 8B 76 11 60 89 46 FC 89 56 FE B8 .F....v.`.F..V..
0000B0: 20 00 F7 E6 8B 5E 0B 03 C3 48 F7 F3 01 46 FC 11 ....^...H...F..
0000C0: 4E FE 61 BF 00 07 E8 28 01 72 3E 38 2D 74 17 60 N.a....(.r>8-t.`
0000D0: B1 0B BE D8 7D F3 A6 61 74 3D 4E 74 09 83 C7 20 .....}.at=Nt...
0000E0: 3B FB 72 E7 EB DD FE 0E D8 7D 7B A7 BE 7F 7D AC ;.r.....}{...}.
0000F0: 98 03 F0 AC 98 40 74 0C 48 74 13 B4 0E BB 07 00 .....@t.Ht.....
000100: CD 10 EB EF BE 82 7D EB E6 BE 80 7D EB E1 CD 16 .....}....}....
000110: 5E 1F 66 8F 04 CD 19 BE 81 7D 8B 7D 1A 8D 45 FE ^.f.....}.~.E.
000120: 8A 4E 0D F7 E1 03 46 FC 13 56 FE B1 04 E8 C2 00 .N....F..V.....
000130: 72 D7 EA 00 02 70 00 52 50 06 53 6A 01 6A 10 91 n....p.RP.Sj.j..
000140: 8B 46 18 A2 26 05 96 92 33 D2 F7 F6 91 F7 F6 42 .F..&...3.....B
000150: 87 CA F7 76 1A 8A F2 8A E8 C0 CC 02 0A CC B8 01 ...v.....
000160: 02 80 7E 02 0E 75 04 B4 42 8B F4 8A 56 24 CD 13 ..~...u...B...V$..
```



'Boot' PC-Simulator dengan file image 'floppya.Img

- Melihat isi file 's.bat' dengan perintah 'type s.bat' <ENTER>
- Pada windows 'Bochs' masukan perintah 'A:>format B:/S ' <ENTER>
- Matikan PC-Simulator (klik tombol Power Off), sekarang kita coba untuk menggunakan 'floppya.img' sebagai 'boot disk' lagi, ketik 'S' <ENTER>



```
Command Prompt
C:\OS\LAB\LAB1>type s.bat
..\..\bochs-2.3.5\bochs -q -f bochsrc.bxrc
C:\OS\LAB\LAB1>Bochsrc.bxrc
C:\OS\LAB\LAB1>

bochsrc.bxrc - Notepad
File Edit Format View Help
=====
# bochsrc.bxrc file for LAB1.
=====

# how much memory the emulated machine will have
megs: 32

# filename of ROM images
romimage: file=../../Bochs-2.3.5/BIOS-bochs-latest
vgaromimage: file=../../Bochs-2.3.5/VGABIOS-lgpl-latest

# what disk images will be used
floppya: 1_44=floppya.img, status=inserted
# floppyb: 1_44=floppyb.img, status=inserted

# hard disk
# ata0: enabled=1, ioaddr1=0x1f0, ioaddr2=0x3f0, irq=14
# ata0-master: type=disk, path="disk", cylinders=306, heads=4, spt=17

# choose the boot disk.
# boot: c
boot: floppy

# default config interface is textconfig.
#config_interface: textconfig
#config_interface: wx

#display_library: x
# other choices: win32 sdl wx carbon amigaos beos macintosh nogui rfb term sv

# where do we send log messages?
log: bochsout.txt

# disable the mouse, since DLX is text only
mouse: enabled=0
```

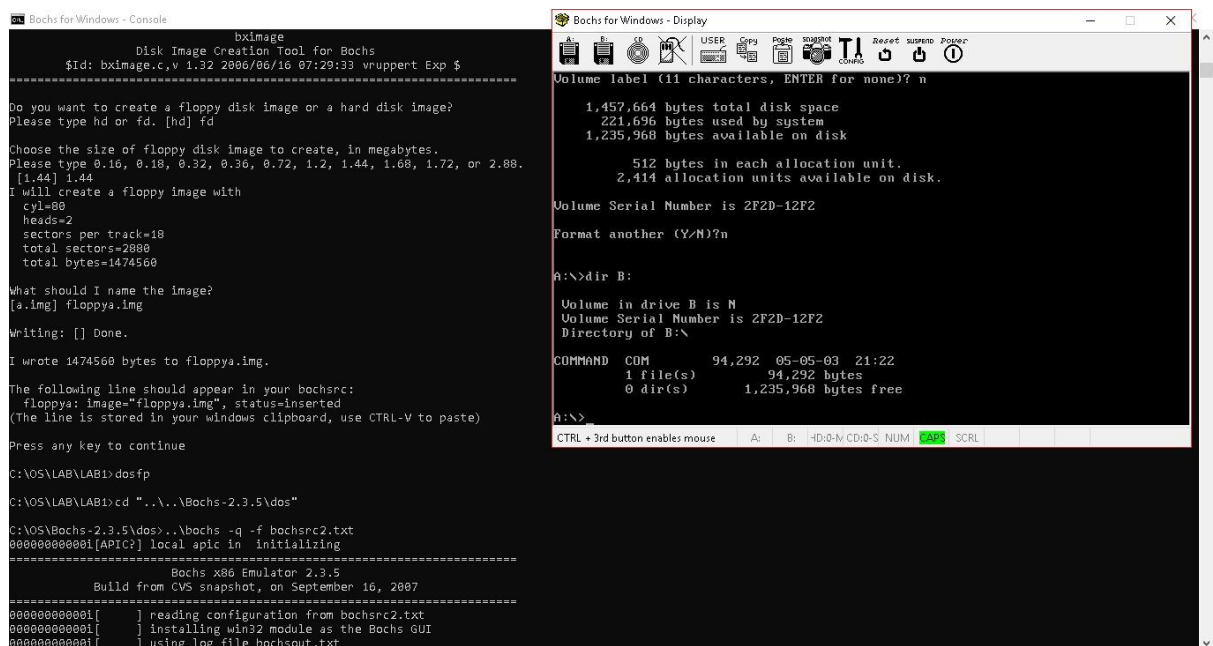
# Bochs for Windows - Console

```
C:\OS\LAB\LAB1>s

C:\OS\LAB\LAB1>..\..\bochs-2.3.5\bochs -q -f bochsrc.bxrc
000000000000i[APIC?] local apic in  initializing
=====
                        Bochs x86 Emulator 2.3.5
                        Build from CVS snapshot, on September 16, 2007
=====
000000000000i[      ] reading configuration from bochsrc.bxrc
000000000000i[      ] installing win32 module as the Bochs GUI
000000000000i[      ] using log file bochsout.txt
# In bx_win32_gui_c::exit(void)!
=====
Bochs is exiting with the following message:
[BIOS ] No bootable device.
=====

C:\OS\LAB\LAB1>del floppya.img
Could Not Find C:\OS\LAB\LAB1\floppya.img

C:\OS\LAB\LAB1>bximage
=====
                        bximage
                        Disk Image Creation Tool for Bochs
                        $Id: bximage.c,v 1.32 2006/06/16 07:29:33 wruppert Exp $
=====
```





Bochs for Windows - Console

```
Writing: [] Done.
I wrote 1474560 bytes to floppy.a.img.
The following line should appear in your bochsrc:
  floppy.a image="floppy.a.img", status=inserted
(The line is stored in your windows clipboard, use CTRL-V to paste)
Press any key to continue
```

```
C:\OS\LAB\LAB1>dosfp
```

```
C:\OS\LAB\LAB1>cd "..\..\Bochs-2.3.5\dos"
```

```
C:\OS\Bochs-2.3.5\dos>..\bochs -q -f bochsrc2.txt
```

```
000000000001[APIC?] local apic in  initializing
```

```
=====
Bochs X86 Emulator 2.3.5
Build from CVS snapshot, on September 16, 2007
```

```
000000000001[      ] reading configuration from bochsrc2.txt
000000000001[      ] installing win32 module as the Bochs GUI
000000000001[      ] using log file bochsout.txt
# In bx_win32_gui_c::exit(void)!
```

```
Bochs is exiting with the following message:
[!GUI ] POWER button turned off.
=====
```

```
C:\OS\Bochs-2.3.5\dos>cd "C:\os\lab\lab1"
```

```
C:\OS\LAB\LAB1>s
```

```
C:\OS\LAB\LAB1>..\..\bochs-2.3.5\bochs -q -f bochsrc.bxrc
```

```
000000000001[APIC?] local apic in  initializing
```

```
=====
Bochs X86 Emulator 2.3.5
Build from CVS snapshot, on September 16, 2007
```

```
000000000001[      ] reading configuration from bochsrc.bxrc
000000000001[      ] installing win32 module as the Bochs GUI
000000000001[      ] using log file bochsout.txt
```

Bochs for Windows - Display

Plex86/Bochs UGA Bios 0.6a 19 Aug 2006  
This UGA/UBE Bios is released under the GNU LGPL

Please visit :  
. <http://bochs.sourceforge.net>  
. <http://www.nongnu.org/vyabios>

Bochs UBE Display Adapter enabled

Bochs BIOS - build: 09/10/07  
\$Revision: 1.183 \$ \$Date: 2007/09/10 20:00:29 \$  
Options: apmbios pcibios eltorito rombios32

Booting from Floppy...  
Starting BootCD.....

Microsoft(R) MS-DOS 7.1  
(C)Copyright Microsoft Corp 1981-1999.

A:\>\_

CTRL + 3rd button enables mouse

Alt NUM CAPS SCRL