

**PRAKTIKUM SISTEM OPERASI**



**DISUSUN OLEH:**

**ILHAM RIAN NOVANTO**

**L200200247**

**INFORMATIKA**

**FAKULTAS KOMUNIKASI DAN INFORMATIKA**

**UNIVERSITAS MUHAMMADIYAH SURAKARTA**

**2021**

## Modul 1 Pengenalan Sistem Pengembangan OS dengan PC Simulator 'Bochs'

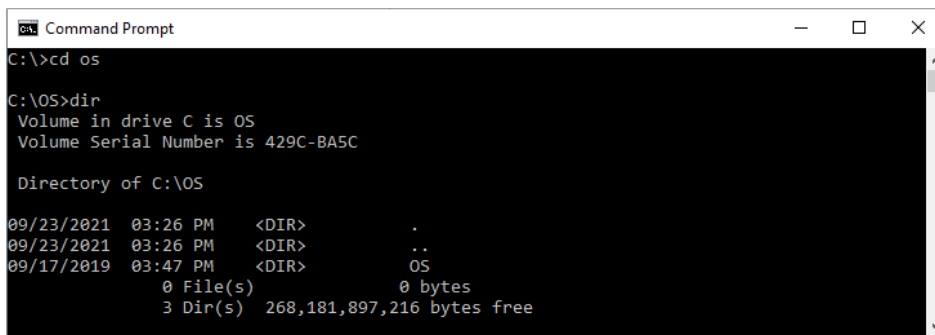
### Peralatan :

1. PC dengan sistem operasi Windows Xp
2. Program Simulator Boschs
3. Kompiler bahasa assembly 'nasm'
4. Kompiler bahasa C.
5. program bantu seperti 'make', 'debug', 'dd', dan 'tdump'
6. notepad

### Langkah Kerja

#### Menuju ke direktori kerja.

- a. Jalankan program command prompt atau cmd.
- b. Masuk ke direktori kerja 'C:\OS', dengan perintah 'cd os' .
- c. Masukkan perintah dir, untuk melihat isi direktori di dalam folder.

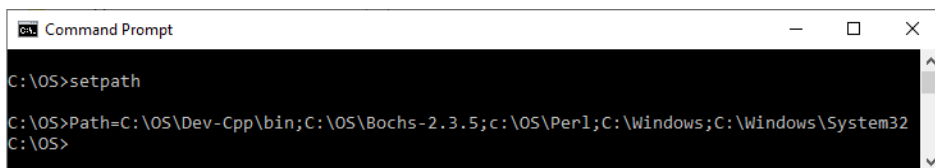


```
Command Prompt
C:\>cd os
C:\OS>dir
Volume in drive C is OS
Volume Serial Number is 429C-BA5C

Directory of C:\OS

09/23/2021  03:26 PM  <DIR>          .
09/23/2021  03:26 PM  <DIR>          ..
09/17/2019  03:47 PM  <DIR>          OS
               0 File(s)              0 bytes
               3 Dir(s) 268,181,897,216 bytes free
```

- d. Jalankan file setpath



```
Command Prompt
C:\OS>setpath
C:\OS>Path=C:\OS\Dev-Cpp\bin;C:\OS\Bochs-2.3.5;c:\OS\Perl;C:\Windows;C:\Windows\System32
C:\OS>
```

## Melihat isi direktori kerja

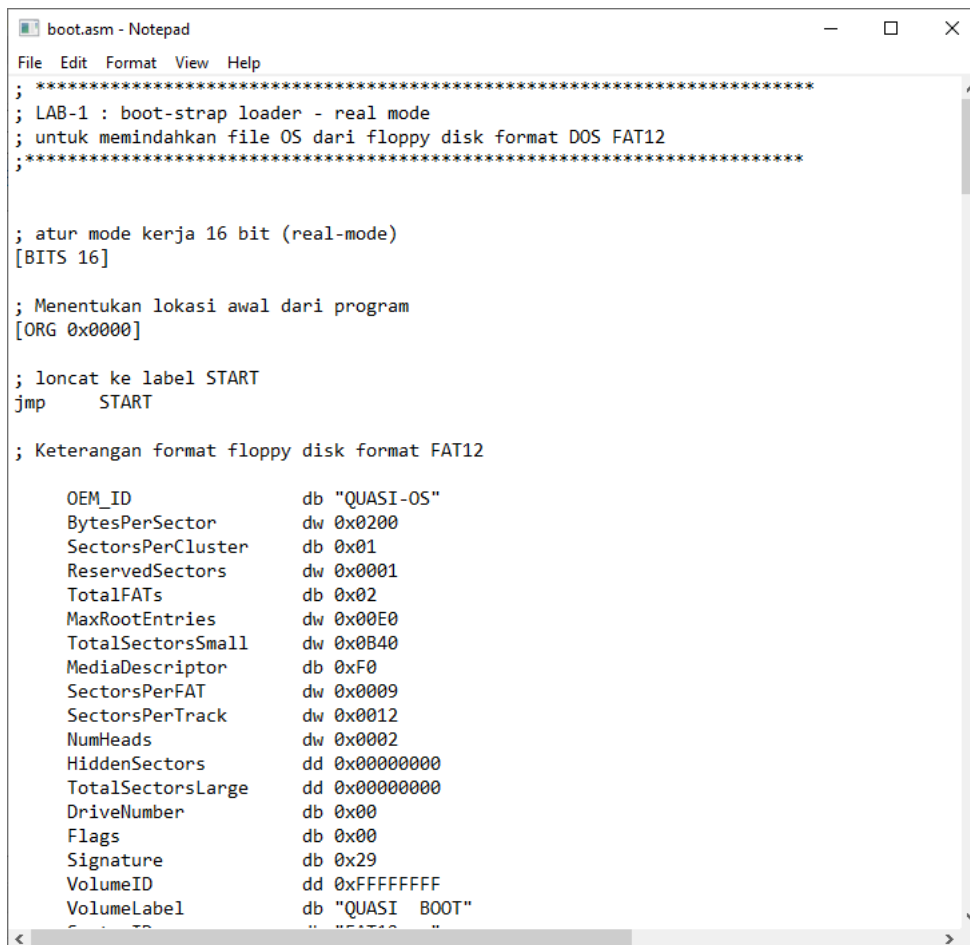
Untuk masuk di direktori kerja untuk modul ini pertama adalah:

- Jalankan command prompt
- Masuk ke direktori kerja pada 'C:\OS\LAB\LAB1'
- Cobalah untuk membuka file tersebut, dari 'COMMAND PROMPT',



```
Command Prompt
C:\OS>cd LAB
C:\OS\LAB>cd LAB1
C:\OS\LAB\LAB1>Notepad boot.asm
```

Maka secara otomatis akan masuk notepad yang berisi source code prototype



```
boot.asm - Notepad
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

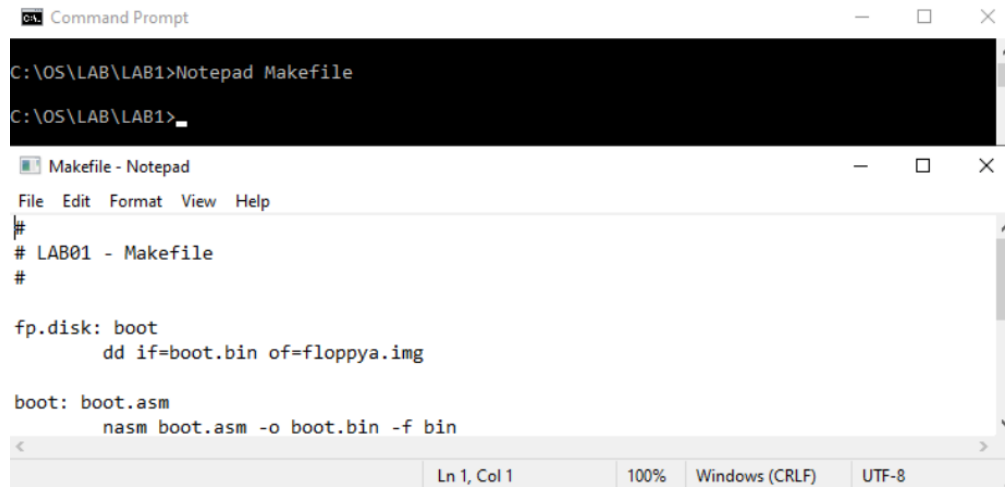
OEM_ID          db "QUASI-OS"
BytesPerSector   dw 0x0200
SectorsPerCluster db 0x01
ReservedSectors  dw 0x0001
TotalFATs        db 0x02
MaxRootEntries   dw 0x00E0
TotalSectorsSmall dw 0x0B40
MediaDescriptor  db 0xF0
SectorsPerFAT     dw 0x0009
SectorsPerTrack   dw 0x0012
NumHeads          dw 0x0002
HiddenSectors     dd 0x00000000
TotalSectorsLarge dd 0x00000000
DriveNumber       db 0x00
Flags             db 0x00
Signature        db 0x29
VolumeID          dd 0xFFFFFFFF
VolumeLabel       db "QUASI  BOOT"
```

- Selain kedua file source code ada sebuah file 'image floppy' dengan nama file 'floppya.img' file ini yang akan digunakan untuk menyimpan hasil kompilasi kedua source code, kemudian digunakan sebagai 'boot disk' pada PC-simulator 'Bochs'.

## Makefile

- a. Buka file 'Makefile', dari 'Command Prompt' untuk mengetahui script makefile:

setelah mengikuti langkah di modul, setelah menekan tab maka akan muncul teks Notepad Makefile dan otomatis membuka program notepad yang berisi source code seperti screenshot dibawah ini



```
Command Prompt
C:\OS\LAB\LAB1>Notepad Makefile
C:\OS\LAB\LAB1>

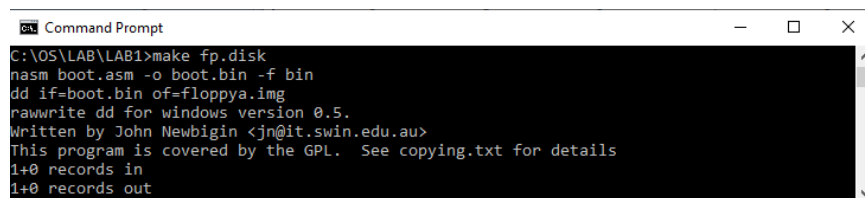
Makefile - Notepad
File Edit Format View Help
#
# LAB01 - Makefile
#

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

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

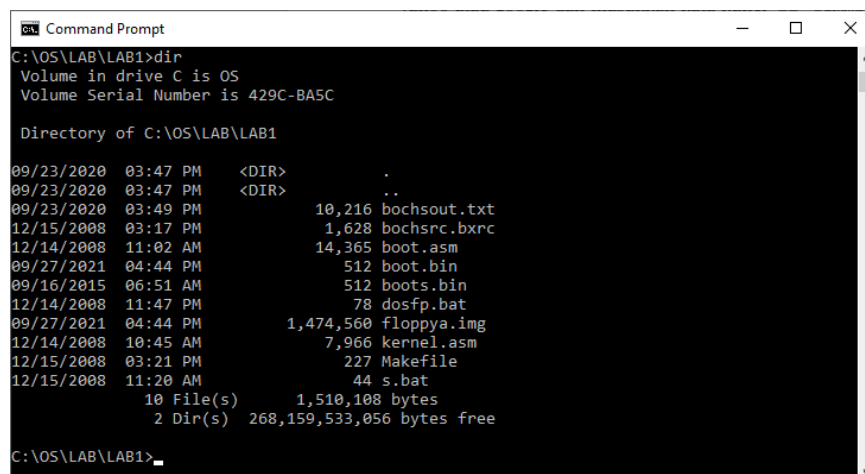
- b. buka 'Command Prompt' dan buka direktori kerja 'LAB1' ketik 'make fp.disk'

setelah melakukan langkah diatas, percobaan yang saya lakukan muncul tampilan seperti screenshot dibawah ini.



```
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
```

Dan setelah memeriksa hasil kompilasi dengan memasukan perintah 'dir',muncul tampilan seperti ini



```
Command Prompt
C:\OS\LAB\LAB1>dir
Volume in drive C is OS
Volume Serial Number is 429C-BA5C

Directory of C:\OS\LAB\LAB1

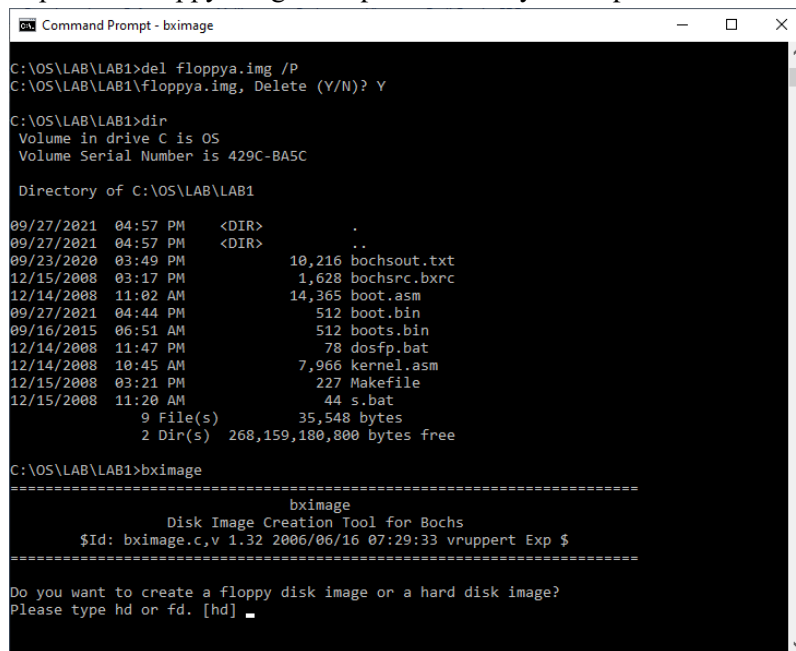
09/23/2020 03:47 PM <DIR> .
09/23/2020 03:47 PM <DIR> ..
09/23/2020 03:49 PM          10,216 bochsout.txt
12/15/2008 03:17 PM           1,628 bochsrc.bxrc
12/14/2008 11:02 AM          14,365 boot.asm
09/27/2021 04:44 PM             512 boot.bin
09/16/2015 06:51 AM             512 boots.bin
12/14/2008 11:47 PM              78 dosfp.bat
09/27/2021 04:44 PM        1,474,560 floppya.img
12/14/2008 10:45 AM           7,966 kernel.asm
12/15/2008 03:21 PM             227 Makefile
12/15/2008 11:20 AM              44 s.bat
                10 File(s)      1,510,108 bytes
                2 Dir(s)  268,159,533,056 bytes free

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

## Mengenal 'BOOT DISK'

Membuat file image floppy baru dengan menggunakan program aplikasi 'bxiimage.exe', dengan perintah berikut.

- a. Hapus file 'floppya.img' dan pastikan filenya terhapus



```
Command Prompt - bxiimage

C:\OS\LAB\LAB1>del floppya.img /P
C:\OS\LAB\LAB1>dir
Volume in drive C is OS
Volume Serial Number is 429C-BA5C

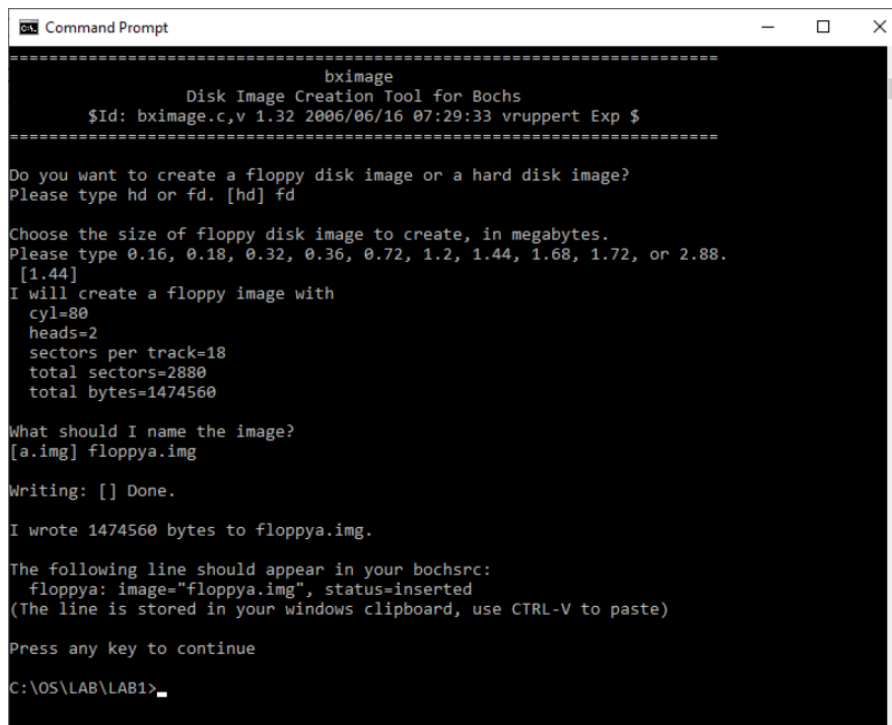
Directory of C:\OS\LAB\LAB1

09/27/2021  04:57 PM  <DIR>          .
09/27/2021  04:57 PM  <DIR>          ..
09/23/2020  03:49 PM             10,216 bochsout.txt
12/15/2008  03:17 PM             1,628 bochsrc.bxrc
12/14/2008  11:02 AM             14,365 boot.asm
09/27/2021  04:44 PM              512 boot.bin
09/16/2015  06:51 AM              512 boots.bin
12/14/2008  11:47 PM              78 dosfp.bat
12/14/2008  10:45 AM             7,966 kernel.asm
12/15/2008  03:21 PM              227 Makefile
12/15/2008  11:20 AM              44 s.bat
          9 File(s)            35,548 bytes
          2 Dir(s)        268,159,180 bytes free

C:\OS\LAB\LAB1>bxiimage
-----
                bxiimage
        Disk Image Creation Tool for Bochs
        $Id: bxiimage.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
```

- b. ada dua pilihan file image yaitu [hd] untuk membuat harddisk image atau [fd] untuk membuat floppy image. Lalu pilih fd



```
-----
                bxiimage
        Disk Image Creation Tool for Bochs
        $Id: bxiimage.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] floppya.img

Writing: [] Done.

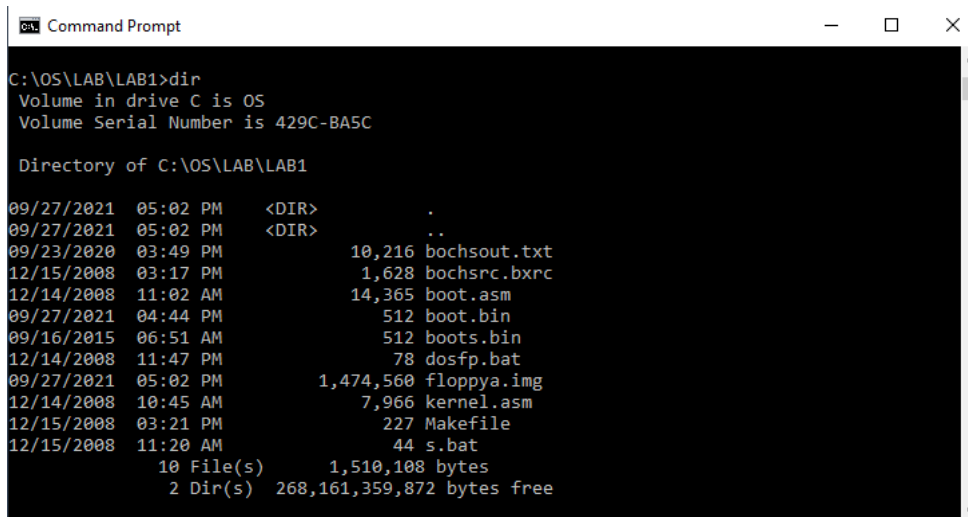
I wrote 1474560 bytes to floppya.img.

The following line should appear in your bochsrc:
floppya: image="floppya.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>
```

c. Setelah memberi nama 'floppya.img' dan cek keberadaan file image dengan perintah 'dir', dan filenya sudah ada tertera pada screenshot berikut ini:



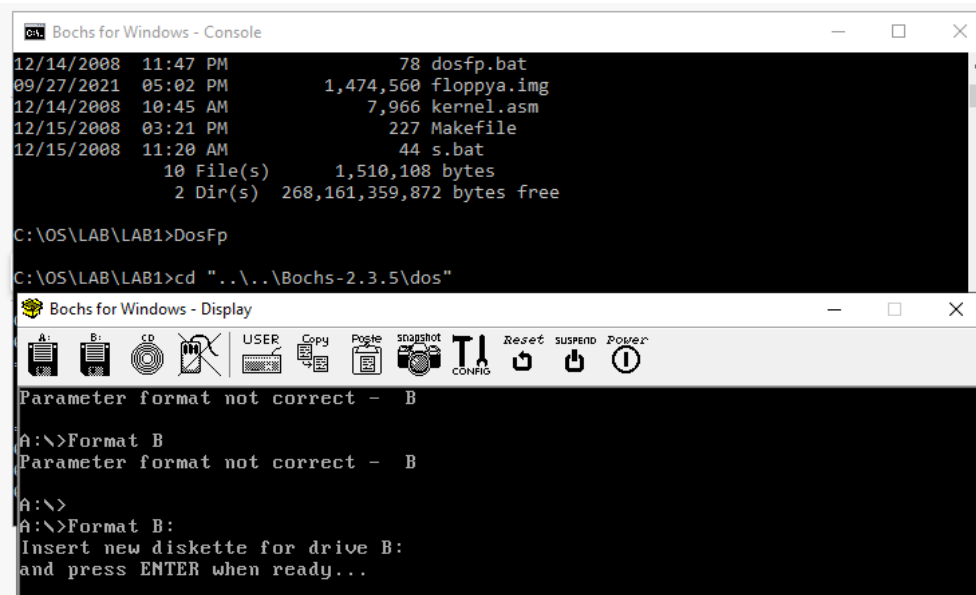
```
Command Prompt
C:\OS\LAB\LAB1>dir
Volume in drive C is OS
Volume Serial Number is 429C-BA5C

Directory of C:\OS\LAB\LAB1

09/27/2021  05:02 PM    <DIR>          .
09/27/2021  05:02 PM    <DIR>          ..
09/23/2020  03:49 PM        10,216 bochsout.txt
12/15/2008  03:17 PM         1,628 bochsrc.bxrc
12/14/2008  11:02 AM        14,365 boot.asm
09/27/2021  04:44 PM         512 boot.bin
09/16/2015  06:51 AM         512 boots.bin
12/14/2008  11:47 PM          78 dosfp.bat
09/27/2021  05:02 PM    1,474,560 floppya.img
12/14/2008  10:45 AM         7,966 kernel.asm
12/15/2008  03:21 PM         227 Makefile
12/15/2008  11:20 AM          44 s.bat
               10 File(s)      1,510,108 bytes
               2 Dir(s)  268,161,359,872 bytes free
```

Langkah memformat 'floppya.img' agar floopnya.img dapat digunakan :

- jalankan PC-Simulator dari 'Command Prompt' dengan perintah 'DosFp',
- pada konfigurasi PC-Simulator file 'floppya.img' terpasang pada 'drive B:'. Selanjutnya dari prompt 'A:>' ketikan 'Format B:



```
Bochs for Windows - Console
12/14/2008  11:47 PM          78 dosfp.bat
09/27/2021  05:02 PM    1,474,560 floppya.img
12/14/2008  10:45 AM         7,966 kernel.asm
12/15/2008  03:21 PM         227 Makefile
12/15/2008  11:20 AM          44 s.bat
               10 File(s)      1,510,108 bytes
               2 Dir(s)  268,161,359,872 bytes free

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

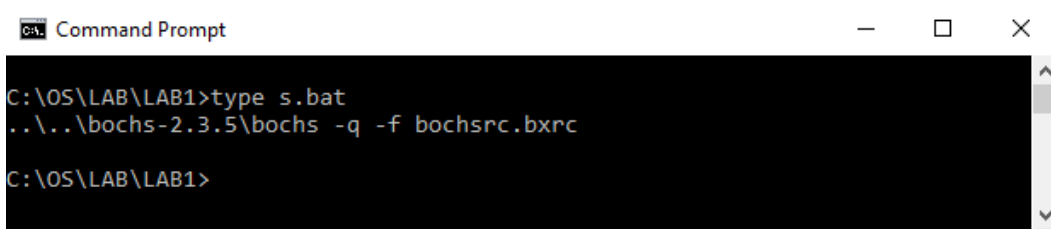
Bochs for Windows - Display
Parameter format not correct - B

A:\>Format B
Parameter format not correct - B

A:\>
A:\>Format B:
Insert new diskette for drive B:
and press ENTER when ready...
```

## ‘Boot’ PC-Simulator dengan file image ‘floppya.Img’

Lihat isi file ‘s.bat’ dengan perintah ‘type s.bat’ hasilnya tertera pada screenshot berikut:

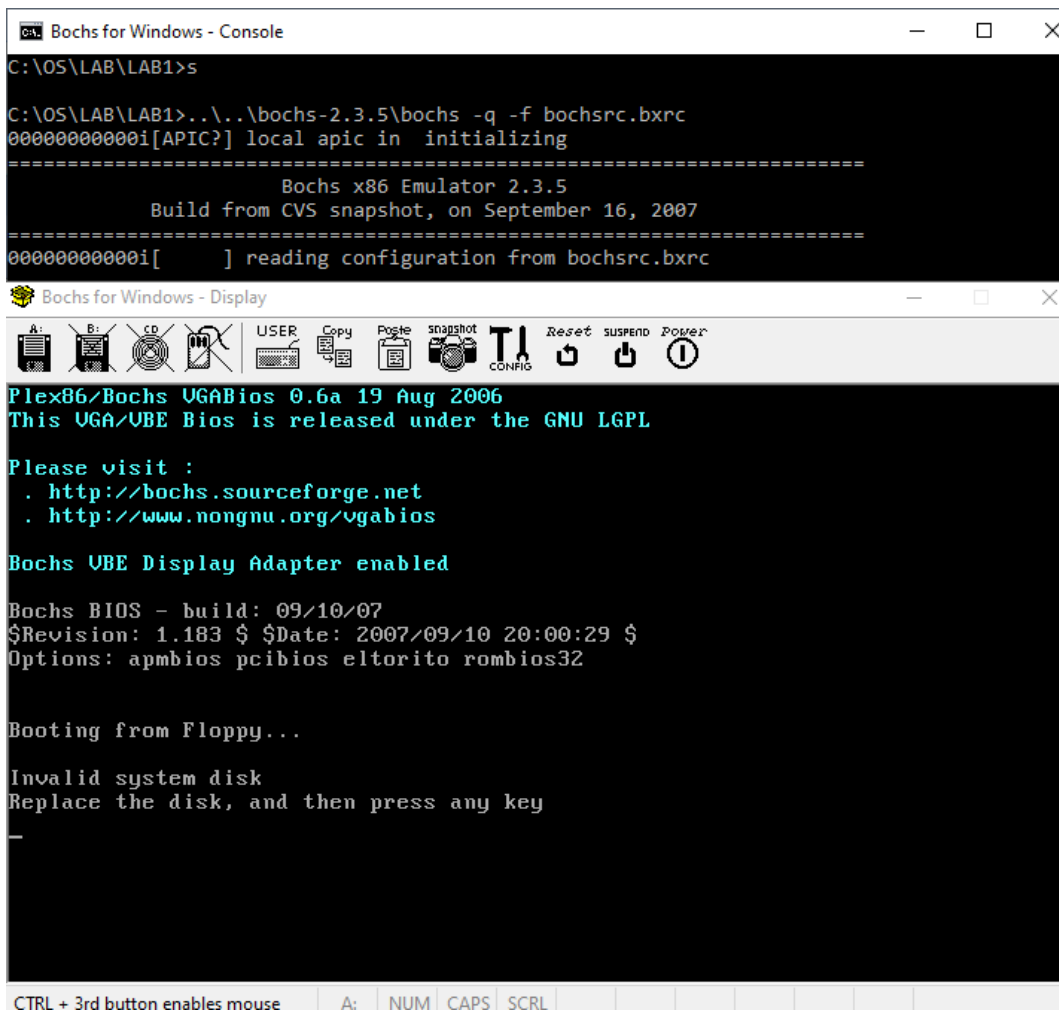


```
Command Prompt

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

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

Setelah ketik ‘s’ , akan ditampilkan windows ‘Bochs for windows – display’ yang sedang melakukan proses ‘booting’ namun tidak berhasil karena tidak menemukan diskboot, hasilnya pada screenshot berikut:



```
Bochs for Windows - Console

C:\OS\LAB\LAB1>s

C:\OS\LAB\LAB1>..\..\bochs-2.3.5\bochs -q -f bochsrc.bxrc
0000000000i[APIC?] local apic in  initializing
=====
                Bochs x86 Emulator 2.3.5
                Build from CVS snapshot, on September 16, 2007
=====
0000000000i[      ] reading configuration from bochsrc.bxrc

Bochs for Windows - Display

Plex86/Bochs VGABios 0.6a 19 Aug 2006
This VGA/VE Bios is released under the GNU LGPL

Please visit :
. http://bochs.sourceforge.net
. http://www.nongnu.org/vgabios

Bochs VBE Display Adapter enabled

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

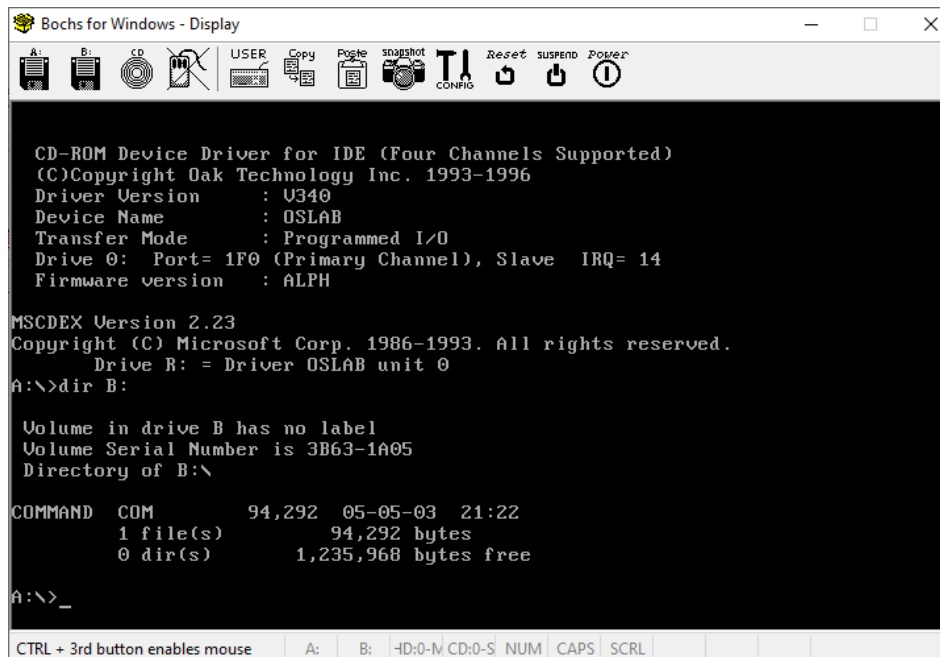
Booting from Floppy...

Invalid system disk
Replace the disk, and then press any key

CTRL + 3rd button enables mouse  A:  NUM  CAPS  SCRL
```

format 'floppya.img' dan tambahkan 'system file' ke dalamnya.

Panggil 'DosFp'. drive 'B:' terisi dengan 'system file', setelah diperiksa dengan perintah 'A:>dir B:', tidak ada kesalahan pada windows 'Bochs' berikut hasilnya:



```
Bochs for Windows - Display

A: B: CD USER Copy Paste snapshot T Reset SUSPEND Power
CONFIG

CD-ROM Device Driver for IDE (Four Channels Supported)
(C)Copyright Oak Technology Inc. 1993-1996
Driver Version      : U340
Device Name         : OSLAB
Transfer Mode       : Programmed I/O
Drive 0: Port= 1F0 (Primary Channel), Slave  IRQ= 14
Firmware version    : ALPH

MSCDEX Version 2.23
Copyright (C) Microsoft Corp. 1986-1993. All rights reserved.
Drive R: = Driver OSLAB unit 0
A:\>dir B:

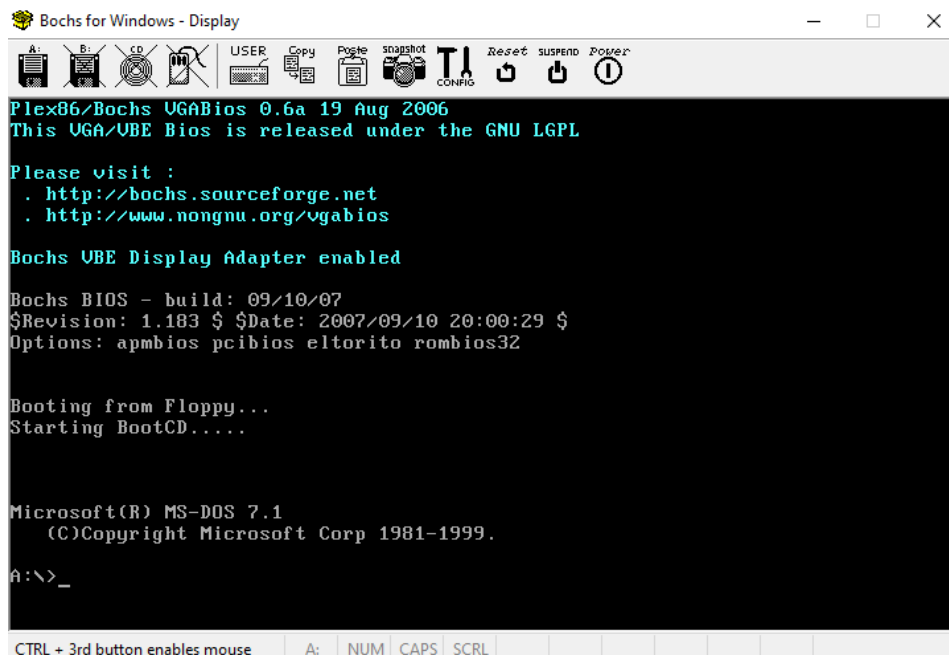
Volume in drive B has no label
Volume Serial Number is 3B63-1A05
Directory of B:\

COMMAND  COM      94,292  05-05-03  21:22
          1 file(s)      94,292  bytes
          0 dir(s)      1,235,968  bytes free

A:\>_

CTRL + 3rd button enables mouse  A:  B:  -D:0-M  CD:0-S  NUM  CAPS  SCRL
```

Percobaan menggunakan 'floppya.img' sebagai 'boot disk', dan hasilnya sesuai modul tidak ada kesalahan:



```
Bochs for Windows - Display

A: B: CD USER Copy Paste snapshot T Reset SUSPEND Power
CONFIG

Plex86/Bochs VGABios 0.6a 19 Aug 2006
This VGA/VE Bios is released under the GNU LGPL

Please visit :
. http://bochs.sourceforge.net
. http://www.nongnu.org/vgabios

Bochs VBE 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  A:  NUM  CAPS  SCRL
```



## Tugas

1. Apa yang dimaksud dengan kode 'ASCII', buatlah tabel kode ASCII lengkap cukup kode ASCII yang standar tidak perlu extended, tuliskan kode ASCII dalam format angka desimal, binary dan hexadecimal serta karakter dan simbol yang dikodekan.
2. Carilah daftar perintah bahasa assembly untuk mesin intel keluarga x86 lengkap (dari buku referensi atau internet). Daftar perintah ini dapat digunakan sebagai pedoman untuk memahami program 'boot.asm' dan 'kernel.asm'

## Jawaban

1. ASCII merupakan singkatan dari **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange. Ini adalah format paling umum untuk file teks di komputer dan di Internet, Kode ASCII adalah kode 7 bit karena dapat mewakili  $2^7 = 128$  karakter. Saat ini, total 95 karakter yang dapat dicetak diwakili oleh kode ini termasuk 26 huruf besar (A – Z), 26 huruf kecil (a – z), 10 angka (0 – 9), dan 33 karakter khusus yang termasuk matematika simbol, tanda baca dan karakter spasi.

| Kode ASCII<br>(Desimal) | Kode ASCII<br>(Binary) | Kode ASCII<br>(Hexadesimal) | Karakter |
|-------------------------|------------------------|-----------------------------|----------|
| 00                      | 0                      | 0                           | NULL     |
| 01                      | 1                      | 1                           | SOH      |
| 02                      | 10                     | 2                           | STX      |
| 03                      | 11                     | 3                           | ETX      |
| 04                      | 100                    | 4                           | EOT      |
| 05                      | 101                    | 5                           | ENQ      |
| 06                      | 110                    | 6                           | ACK      |
| 07                      | 111                    | 7                           | BEL      |
| 08                      | 1000                   | 8                           | BS       |
| 09                      | 1001                   | 9                           | HT       |
| 10                      | 1010                   | a                           | LF       |
| 11                      | 1011                   | b                           | VT       |
| 12                      | 1100                   | c                           | FF       |
| 13                      | 1101                   | d                           | CR       |
| 14                      | 1110                   | e                           | SO       |
| 15                      | 1111                   | f                           | SI       |
| 16                      | 10000                  | 10                          | DLE      |
| 17                      | 10001                  | 11                          | DC1      |
| 18                      | 10010                  | 12                          | DC2      |
| 19                      | 10011                  | 13                          | DC3      |

|     |         |    |       |
|-----|---------|----|-------|
| 20  | 10100   | 14 | DC4   |
| 21  | 10101   | 15 | NAK   |
| 22  | 10110   | 16 | SYN   |
| 23  | 10111   | 17 | ETB   |
| 24  | 11000   | 18 | CAN   |
| 25  | 11001   | 19 | EM    |
| 26  | 11010   | 1a | SUB   |
| 27  | 11011   | 1b | ESC   |
| 28  | 11100   | 1c | FS    |
| 29  | 11101   | 1d | GS    |
| 30  | 11110   | 1e | RS    |
| 31  | 11111   | 1f | US    |
| 127 | 1111111 | 7f | DEL   |
| 32  | 100000  | 20 | space |
| 33  | 100001  | 21 | !     |
| 34  | 100010  | 22 | "     |
| 35  | 100011  | 23 | #     |
| 36  | 100100  | 24 | \$    |
| 37  | 100101  | 25 | %     |
| 38  | 100110  | 26 | &     |
| 39  | 100111  | 27 | '     |
| 40  | 101000  | 28 | (     |
| 41  | 101001  | 29 | )     |
| 42  | 101010  | 2a | *     |
| 43  | 101011  | 2b | +     |
| 44  | 101100  | 2c | ,     |
| 45  | 101101  | 2d | -     |
| 46  | 101110  | 2e | .     |
| 47  | 101111  | 2f | /     |
| 48  | 110000  | 30 | 0     |
| 49  | 110001  | 31 | 1     |
| 50  | 110010  | 32 | 2     |
| 51  | 110011  | 33 | 3     |
| 52  | 110100  | 34 | 4     |
| 53  | 110101  | 35 | 5     |
| 54  | 110110  | 36 | 6     |
| 55  | 110111  | 37 | 7     |
| 56  | 111000  | 38 | 8     |

|    |         |    |   |
|----|---------|----|---|
| 57 | 111001  | 39 | 9 |
| 58 | 111010  | 3a | : |
| 59 | 111011  | 3b | ; |
| 60 | 111100  | 3c | < |
| 61 | 111101  | 3d | = |
| 62 | 111110  | 3e | > |
| 63 | 111111  | 3f | ? |
| 64 | 1000000 | 40 | @ |
| 65 | 1000001 | 41 | A |
| 66 | 1000010 | 42 | B |
| 67 | 1000011 | 43 | C |
| 68 | 1000100 | 44 | D |
| 69 | 1000101 | 45 | E |
| 70 | 1000110 | 46 | F |
| 71 | 1000111 | 47 | G |
| 72 | 1001000 | 48 | H |
| 73 | 1001001 | 49 | I |
| 74 | 1001010 | 4a | J |
| 75 | 1001011 | 4b | K |
| 76 | 1001100 | 4c | L |
| 77 | 1001101 | 4d | M |
| 78 | 1001110 | 4e | N |
| 79 | 1001111 | 4f | O |
| 80 | 1010000 | 50 | P |
| 81 | 1010001 | 51 | Q |
| 82 | 1010010 | 52 | R |
| 83 | 1010011 | 53 | S |
| 84 | 1010100 | 54 | T |
| 85 | 1010101 | 55 | U |
| 86 | 1010110 | 56 | V |
| 87 | 1010111 | 57 | W |
| 88 | 1011000 | 58 | X |
| 89 | 1011001 | 59 | Y |
| 90 | 1011010 | 5a | Z |
| 91 | 1011011 | 5b | [ |
| 92 | 1011100 | 5c | \ |
| 93 | 1011101 | 5d | ] |
| 94 | 1011110 | 5e | ^ |

|     |         |    |   |
|-----|---------|----|---|
| 95  | 1011111 | 5f | _ |
| 96  | 1100000 | 60 | ` |
| 97  | 1100001 | 61 | a |
| 98  | 1100010 | 62 | b |
| 99  | 1100011 | 63 | c |
| 100 | 1100100 | 64 | d |
| 101 | 1100101 | 65 | e |
| 102 | 1100110 | 66 | f |
| 103 | 1100111 | 67 | g |
| 104 | 1101000 | 68 | h |
| 105 | 1101001 | 69 | i |
| 106 | 1101010 | 6a | j |
| 107 | 1101011 | 6b | k |
| 108 | 1101100 | 6c | l |
| 109 | 1101101 | 6d | m |
| 110 | 1101110 | 6e | n |
| 111 | 1101111 | 6f | o |
| 112 | 1110000 | 70 | p |
| 113 | 1110001 | 71 | q |
| 114 | 1110010 | 72 | r |
| 115 | 1110011 | 73 | s |
| 116 | 1110100 | 74 | t |
| 117 | 1110101 | 75 | u |
| 118 | 1110110 | 76 | v |
| 119 | 1110111 | 77 | w |
| 120 | 1111000 | 78 | x |
| 121 | 1111001 | 79 | y |
| 122 | 1111010 | 7a | z |
| 123 | 1111011 | 7b | { |
| 124 | 1111100 | 7c |   |
| 125 | 1111101 | 7d | } |
| 126 | 1111110 | 7e | ~ |

2.berikut ini daftar perintah bahasa assembly:

|       |                                   |
|-------|-----------------------------------|
| ACALL | Absolute Call                     |
| ADD   | Add                               |
| ADDC  | Add with Carry                    |
| AJMP  | Absolute Jump                     |
| ANL   | AND Logic                         |
| CJNE  | Compare and Jump if Not<br>Equal  |
| CLR   | Clear                             |
| CPL   | Complement                        |
| DA    | Decimal Adjust                    |
| DEC   | Decrement                         |
| DIV   | Divide                            |
| DJNZ  | Decrement and Jump if Not<br>Zero |
| INC   | Increment                         |
| JB    | Jump if Bit Set                   |
| JBC   | Jump if Bit Set and Clear Bit     |
| JC    | Jump if Carry Set                 |
| JMP   | Jump to Address                   |
| JNB   | Jump if Not Bit Set               |
| JNC   | Jump if Carry Not Set             |
| JNZ   | Jump if Accumulator Not Zero      |
| JZ    | Jump if Accumulator Zero          |
| LCALL | Long Call                         |
| LJMP  | Long Jump                         |

|      |                            |
|------|----------------------------|
| MOV  | Move from Memory           |
| MOVC | Move from Code Memory      |
| MOVX | Move from Extended Memory  |
| MUL  | Multiply                   |
| NOP  | No Operation               |
| ORL  | OR Logic                   |
| POP  | Pop Value From Stack       |
| PUSH | Push Value Onto Stack      |
| RET  | Return From Subroutine     |
| RETI | Return From Interrupt      |
| RL   | Rotate Left                |
| RLC  | Rotate Left through Carry  |
| RR   | Rotate Right               |
| RRC  | Rotate Right through Carry |
| SETB | Set Bit                    |
| SJMP | Short Jump                 |
| SUBB | Subtract With Borrow       |
| SWAP | Swap Nibbles               |
| XCH  | Exchange Bytes             |
| XCHD | Exchange Digits            |
| XRL  | Exclusive OR Logic         |