

00-environment

```
C:\Windows\System32>nasm -v
NASM version 3.01 compiled on Oct 10 2025

C:\Windows\System32>qemu-system-x86_64 --version
QEMU emulator version 9.2.50 (v9.2.0-13622-g3429737367-dirty)
Copyright (c) 2003-2025 Fabrice Bellard and the QEMU Project developers
```

```

Select Administrator: Command Prompt
Microsoft Windows [Version 10.0.26200.7309]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\System32>gcc --version
gcc (Rev8, Built by MSYS2 project) 15.2.0
Copyright (C) 2025 Free Software Foundation, Inc.
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

C:\Windows\System32>make --version
GNU Make 4.4.1
Built for x86_64-w64-mingw32
Copyright (C) 1988-2023 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <https://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

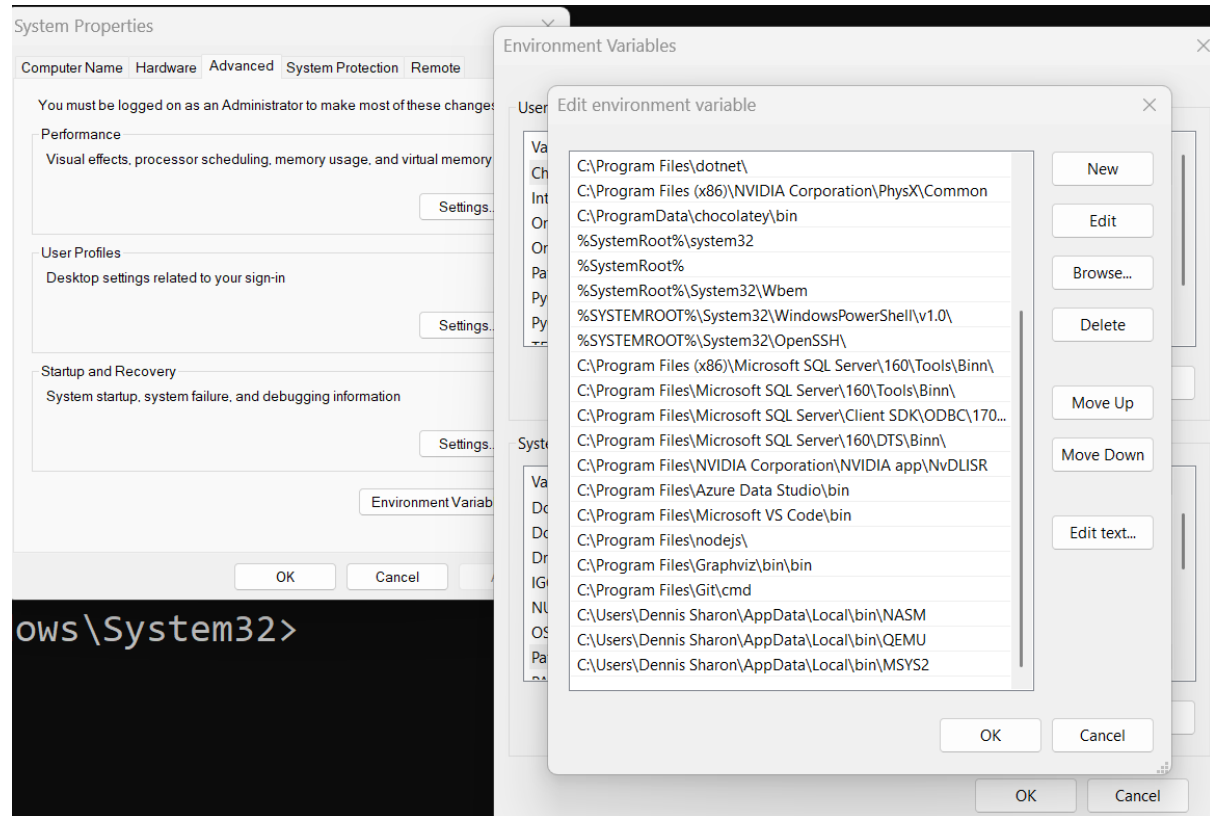
C:\Windows\System32>
```

PATH address:

C:\Users\Dennis Sharon\AppData\Local\bin\NASAM

C:\Users\Dennis Sharon\AppData\Local\bin\QEMU

C:\Users\Dennis Sharon\AppData\Local\bin\MSYS2



01-bootsector-barebones

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/01-bootsector-barebones
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial (master)
$ nasm -f bin boot_sect_simple.asm -o boot_sect_simple.bin
nasm: fatal: unable to open input file 'boot_sect_simple.asm' N

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial (master)
$ cd 01-bootsector-barebones

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial (master)
$ ls
README.md  boot_sect_simple.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial (master)
$ nasm -f bin boot_sect_simple.asm -o boot_sect_simple.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial (master)
$ nasm -f bin boot_sect_simple.asm -o boot_sect_simple.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/01-bootsector-barebones (master)
$ qemu-system-x86_64 boot_sect_simple.bin
WARNING: Image format was not specified for 'boot_sect_simple.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

QEMU
Machine: View
Seabios (version rel-1.16.3-0-g4ed6b701f0a-prebuilt.qemu.org)
iPXE (http://ipxe.org) 00:03.0 CA00 PCI2.10 PaP FMM+06F011B0+06F311B0 CA00
Booting from Hard Disk...
```

02-bootsector-print

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print
README.md  boot_sect_simple.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/01-bootsector-barebones (master)
$ nasm -f bin boot_sect_simple.asm -o boot_sect_simple.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/01-bootsector-barebones (master)
$ nasm -f bin boot_sect_simple.asm -o boot_sect_simple.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/01-bootsector-barebones (master)
$ qemu-system-x86_64 boot_sect_simple.bin
WARNING: Image format was not specified for 'boot_sect_simple.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ cd ../02-bootsector-print

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ ^[[200~nasm -fbin boot_sect_hello.asm -o boot_sect_hello.bin
bash: $'\E[200~nasm': command not found

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ nasm -fbin boot_sect_hello.asm -o boot_sect_hello.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ qemu-system-x86_64 boot_sect_hello.bin
WARNING: Image format was not specified for 'boot_sect_hello.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

QEMU
Machine: View
Seabios (version rel-1.16.3-0-g4ed6b701f0a-prebuilt.qemu.org)
iPXE (http://ipxe.org) 00:03.0 CA00 PCI2.10 PaP FMM+06F011B0+06F311B0 CA00
Booting from Hard Disk...
Hello
```

03-bootsector-memory

```
MINGW64~/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ cd ../02-bootsector-print

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ ^[[200~nasm -fbin boot_sect_hello.asm -o boot_sect_hello.bin
bash: $'\E[200~nasm': command not found

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ nasm -fbin boot_sect_hello.asm -o boot_sect_hello.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ qemu-system-x86_64 boot_sect_hello.bin
WARNING: Image format was not specified for 'boot_sect_hello.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ cd ../03-bootsector-memory

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ nasm -fbin boot_sect_memory.asm -o boot_sect_memory.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ qemu-system-x86_64 boot_sect_memory.bin
WARNING: Image format was not specified for 'boot_sect_memory.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```

```
MINGW64~/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ nasm -fbin boot_sect_hello.asm -o boot_sect_hello.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ qemu-system-x86_64 boot_sect_hello.bin
WARNING: Image format was not specified for 'boot_sect_hello.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/02-bootsector-print (master)
$ cd ../03-bootsector-memory

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ nasm -fbin boot_sect_memory.asm -o boot_sect_memory.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ qemu-system-x86_64 boot_sect_memory.bin
WARNING: Image format was not specified for 'boot_sect_memory.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ nasm -fbin boot_sect_memory_org.asm -o boot_sect_memory_org.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ qemu-system-x86_64 boot_sect_memory_org.bin
WARNING: Image format was not specified for 'boot_sect_memory_org.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```

04-bootsector-stack

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ qemu-system-x86_64 boot_sect_memory.bin
WARNING: Image format was not specified for 'boot_sect_memory.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restriction.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ nasm -fbin boot_sect_memory.org.asm -o boot_sect_memory.org.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ qemu-system-x86_64 boot_sect_memory.org.bin
WARNING: Image format was not specified for 'boot_sect_memory.org.bin'
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restriction.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ cd ../04-bootsector-stack

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ ls
README.md boot_sect_stack.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ nasm -fbin boot_sect_stack.asm -o boot_sect_stack.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ qemu-system-x86_64 boot_sect_stack.bin
WARNING: Image format was not specified for 'boot_sect_stack.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```

05-bootsector-functions-strings

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/03-bootsector-memory (master)
$ cd ../04-bootsector-stack

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ ls
README.md boot_sect_stack.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ nasm -fbin boot_sect_stack.asm -o boot_sect_stack.bin

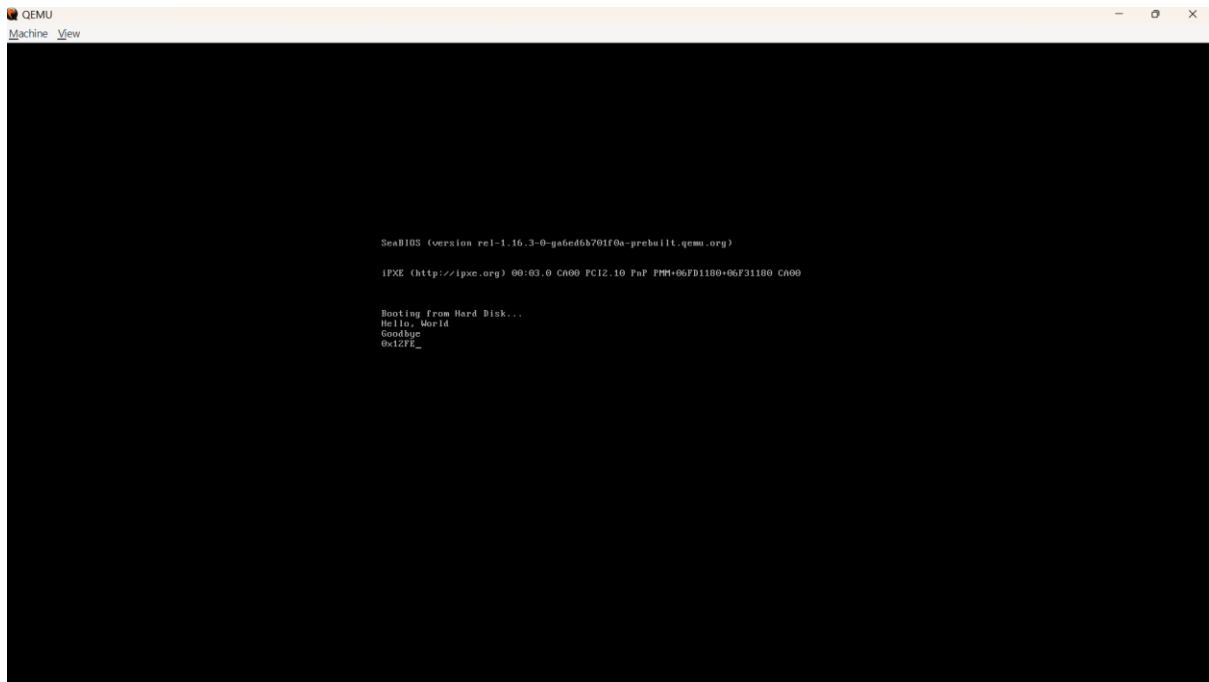
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ qemu-system-x86_64 boot_sect_stack.bin
WARNING: Image format was not specified for 'boot_sect_stack.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/04-bootsector-stack (master)
$ cd ../05-bootsector-functions-strings

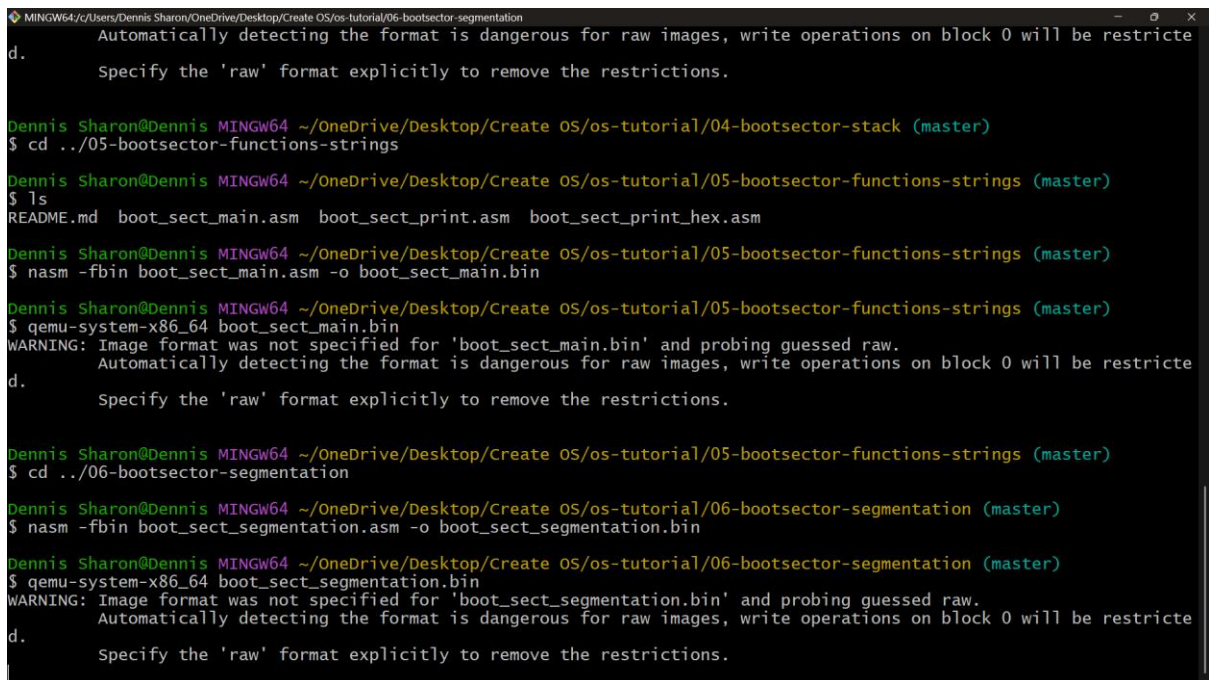
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings (master)
$ ls
README.md boot_sect_main.asm boot_sect_print.asm boot_sect_print_hex.asm

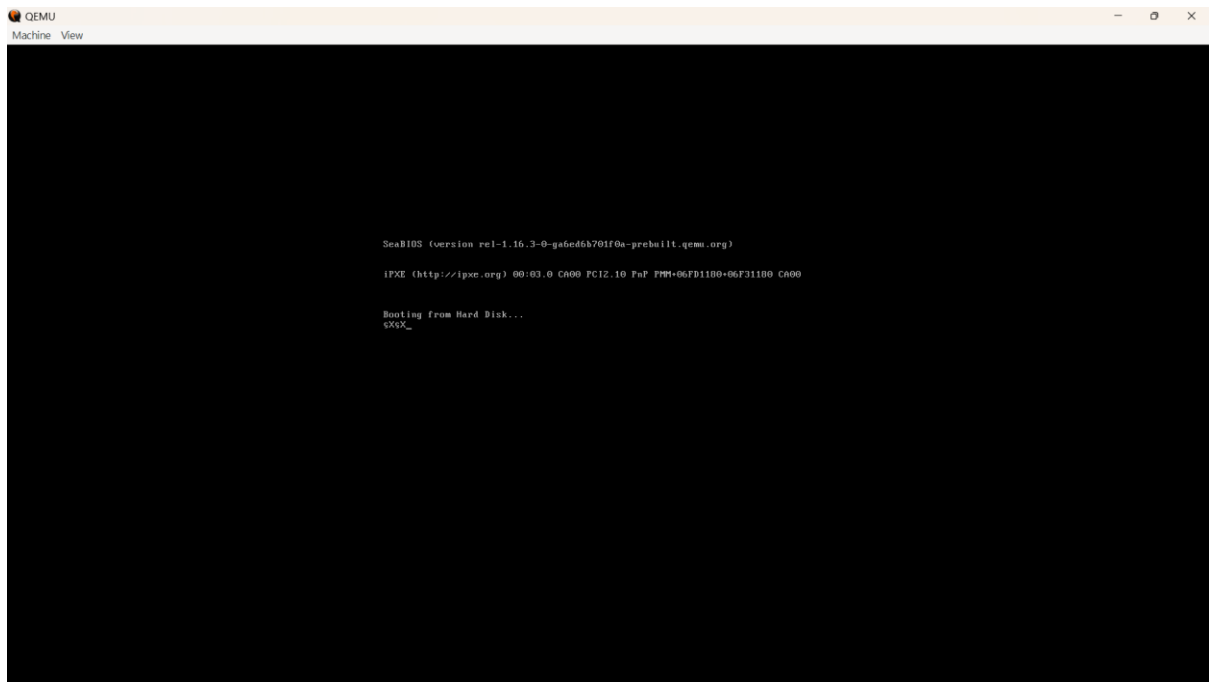
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings (master)
$ nasm -fbin boot_sect_main.asm -o boot_sect_main.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings (master)
$ qemu-system-x86_64 boot_sect_main.bin
WARNING: Image format was not specified for 'boot_sect_main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```



06-bootsector-segmentation





07-bootsector-disk

```
MINGW64/c:/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings (master)
$ qemu-system-x86_64 boot_sect_main.bin
WARNING: Image format was not specified for 'boot_sect_main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/05-bootsector-functions-strings (master)
$ cd ../06-bootsector-segmentation

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/06-bootsector-segmentation (master)
$ nasm -fbin boot_sect_segmentation.asm -o boot_sect_segmentation.bin

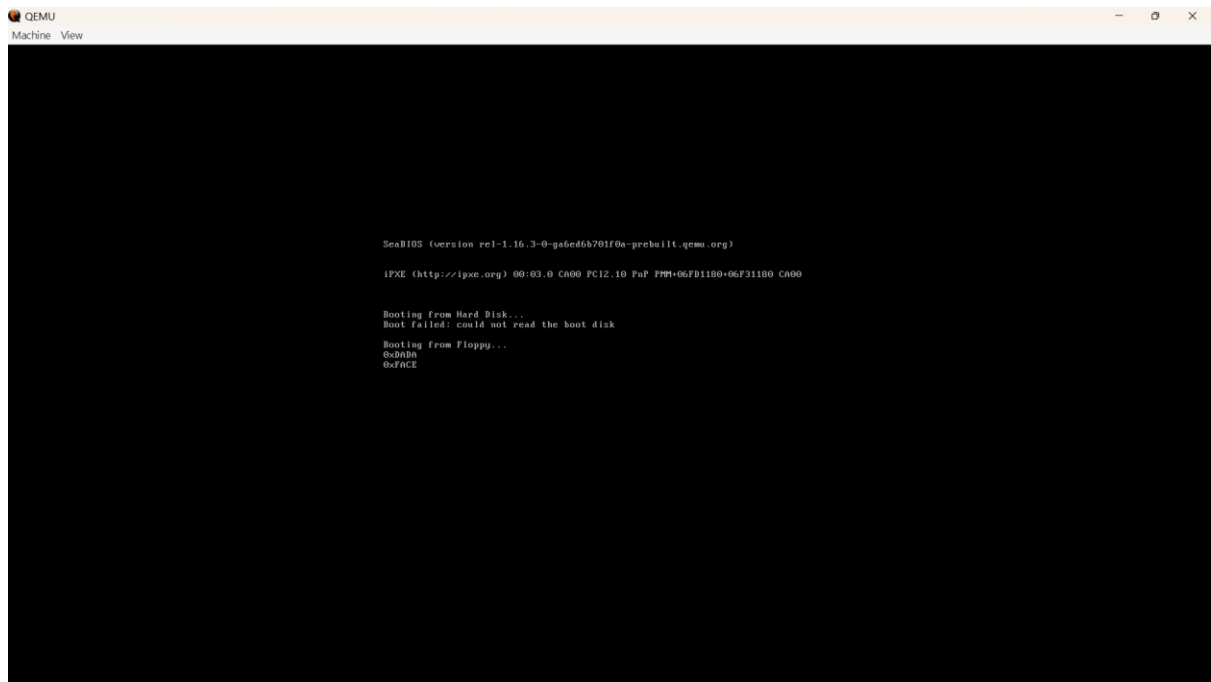
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/06-bootsector-segmentation (master)
$ qemu-system-x86_64 boot_sect_segmentation.bin
WARNING: Image format was not specified for 'boot_sect_segmentation.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/06-bootsector-segmentation (master)
$ cd ../07-bootsector-disk

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ nasm -fbin boot_sect_main.asm -o boot_sect_main.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ qemu-system-x86_64 -fda boot_sect_main.bin
WARNING: Image format was not specified for 'boot_sect_main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```

Error ()



Resolved (qemu-system-x86_64 boot_sect_main.bin -boot c)



10-32bit-enter

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/10-32bit-enter
Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ nasm -fbin boot_sect_main.asm -o boot_sect_main.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ qemu-system-x86_64 -fda boot_sect_main.bin
WARNING: Image format was not specified for 'boot_sect_main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ qemu-system-x86_64 boot_sect_main.bin -boot c
WARNING: Image format was not specified for 'boot_sect_main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ ^[[200~cd ~/OneDrive/Desktop/Create\ OS/os-tutorial/10-32bit-enter
bash: $'\E[200~cd': command not found

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/07-bootsector-disk (master)
$ cd ~/OneDrive/Desktop/Create\ OS/os-tutorial/10-32bit-enter

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/10-32bit-enter (master)
$ nasm -fbin 32bit-main.asm -o 32bit-main.bin

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/10-32bit-enter (master)
$ qemu-system-x86_64 32bit-main.bin
WARNING: Image format was not specified for '32bit-main.bin' and probing guessed raw.
Automatically detecting the format is dangerous for raw images, write operations on block 0 will be restricted.
Specify the 'raw' format explicitly to remove the restrictions.
```



The Issue

The 32-bit message is probably being written to the **top-left corner** of the VGA display (position 0,0), while the BIOS messages scrolled the screen down. So both messages exist, just in different locations on screen!

11-kernel-crosscompiler

Overview

Establishes a development environment with a cross-compiler toolchain to build C kernel code for i386-elf architecture.

Key Concepts

- **Cross-Compiler:** A specialized GCC that compiles code for i386-elf target instead of the host system
- **Required Tools:** Binutils (assembler/linker) and GCC configured for OS development
- **Installation Path:** /usr/local/i386elfgcc with i386-elf- prefix to avoid conflicts

Required Packages

gmp, mpfr, libmpc, gcc

Platform Note

Windows 11 Limitation: This lesson targets Mac/Linux environments. Windows 11 users require alternative approaches: WSL2 (Windows Subsystem for Linux), Docker containers, or pre-built cross-compiler binaries.

12-kernel-c

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c
GNU nano 8.7 kernel_entry.asm
[bits 32]
[extern main]

global _start
_start:
    call main
    jmp $

[ Read 7 lines (converted from DOS format) ]
^G Help      ^O Write Out  ^F Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^_ Go To Line M-E Redo
```

```
MINGW64/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c
kernel_entry.asm:(.text+0x1): undefined reference to `my_function'

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ nasm kernel_entry.asm -f elf -o kernel_entry.o

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ i386-elf-ld -o kernel.bin -Ttext 0x1000 kernel_entry.o function.o --oformat binary
C:\Users\Dennis Sharon\AppData\Local\bin\i686-elf-tools-windows\bin\i686-elf-ld.exe: kernel_entry.o: in function
_start':
kernel_entry.asm:(.text+0x1): undefined reference to `my_function'

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ i386-elf-ld -o kernel.bin -Ttext 0x1000 kernel_entry.o function.o
C:\Users\Dennis Sharon\AppData\Local\bin\i686-elf-tools-windows\bin\i686-elf-ld.exe: kernel_entry.o: in function
_start':
kernel_entry.asm:(.text+0x1): undefined reference to `my_function'

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ nano kernel_entry.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ nano kernel_entry.asm

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ nasm kernel_entry.asm -f elf -o kernel_entry.o
i386-elf-ld -o kernel.bin -Ttext 0x1000 kernel_entry.o function.o --oformat binary

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ i386-elf-gcc -ffreestanding -c function.c -o function.o
i386-elf-ld -o kernel.bin -Ttext 0x1000 kernel_entry.o function.o --oformat binary

Dennis Sharon@Dennis MINGW64 ~/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c (master)
$ ls -la kernel.bin
-rw-r--r-- 1 Dennis Sharon 197609 13 Dec  7 15:01 kernel.bin
```

13-kernel-barebones

```
GNU nano 8.7 bootsect.asm
[org 0x7c00]
KERNEL_OFFSET equ 0x1000 ; The same one we used when linking the kernel

    mov [BOOT_DRIVE], dl ; Remember that the BIOS sets us the boot drive in 'dl' on boot
    mov bp, 0x9000
    mov sp, bp

    mov bx, MSG_REAL_MODE
    call print
    call print_nl

    call load_kernel ; read the kernel from disk
    call switch_to_pm ; disable interrupts, load GDT, etc. Finally jumps to 'BEGIN_PM'
    jmp $ ; Never executed

%include "../05-bootsector-functions-strings/boot_sect_print.asm"
%include "../05-bootsector-functions-strings/boot_sect_print_hex.asm"
%include "../07-bootsector-disk/boot_sect_disk.asm"
%include "../09-32bit-gdt/32bit-gdt.asm"
%include "../08-32bit-print/32bit-print.asm"
%include "../10-32bit-enter/32bit-switch.asm"

[bits 16]
load_kernel:
    mov bx, MSG_LOAD_KERNEL
    call print
    call print_nl

    mov bx, KERNEL_OFFSET ; Read from disk and store in 0x1000
    mov dh, 2
    [ line 5/51 ( 9%), col 1/19 ( 5%), char 175/1459 (11%) ]
AG Help      AO Write Out  AF Where Is  AK Cut       AT Execute   AC Location   M-U Undo
AX Exit      AR Read File  AL Replace   AU Paste     AJ Justify   AL Go To Line M-E Redo
```

```
GNU nano 8.7 bootsect.asm

[bits 16]
load_kernel:
    mov bx, MSG_LOAD_KERNEL
    call print
    call print_nl

    mov bx, KERNEL_OFFSET ; Read from disk and store in 0x1000
    mov dh, 2
    mov dl, [BOOT_DRIVE]
    call disk_load
    ret

[bits 32]
BEGIN_PM:
    mov ebx, MSG_PROT_MODE
    call print_string_pm
    call KERNEL_OFFSET ; Give control to the kernel
    jmp $ ; Stay here when the kernel returns control to us (if ever)

BOOT_DRIVE db 0 ; It is a good idea to store it in memory because 'dl' may get overwritten
MSG_REAL_MODE db "Started in 16-bit Real Mode", 0
MSG_PROT_MODE db "Landed in 32-bit Protected Mode", 0
MSG_LOAD_KERNEL db "Loading kernel into memory", 0

; padding
times 510 - ($-$$) db 0
dw 0xaa55

AG Help      AO Write Out  AF Where Is  AK Cut       AT Execute   AC Location   M-U Undo
AX Exit      AR Read File  AL Replace   AU Paste     AJ Justify   AL Go To Line M-E Redo
```

```
Xended in 32-bit Protected Mode(a6d6b701f0a-prebuilt.qemu.org)

IPXE (http://ipxe.org) 00:03:0 CA00 FC12:10 FaP PMM+06FD11B0+06F311B0 CA00

Booting from Hard Disk...
Boot failed: could not read the boot disk

Booting from Floppy...
Started in 16-bit Real Mode
Loading kernel into memory
```