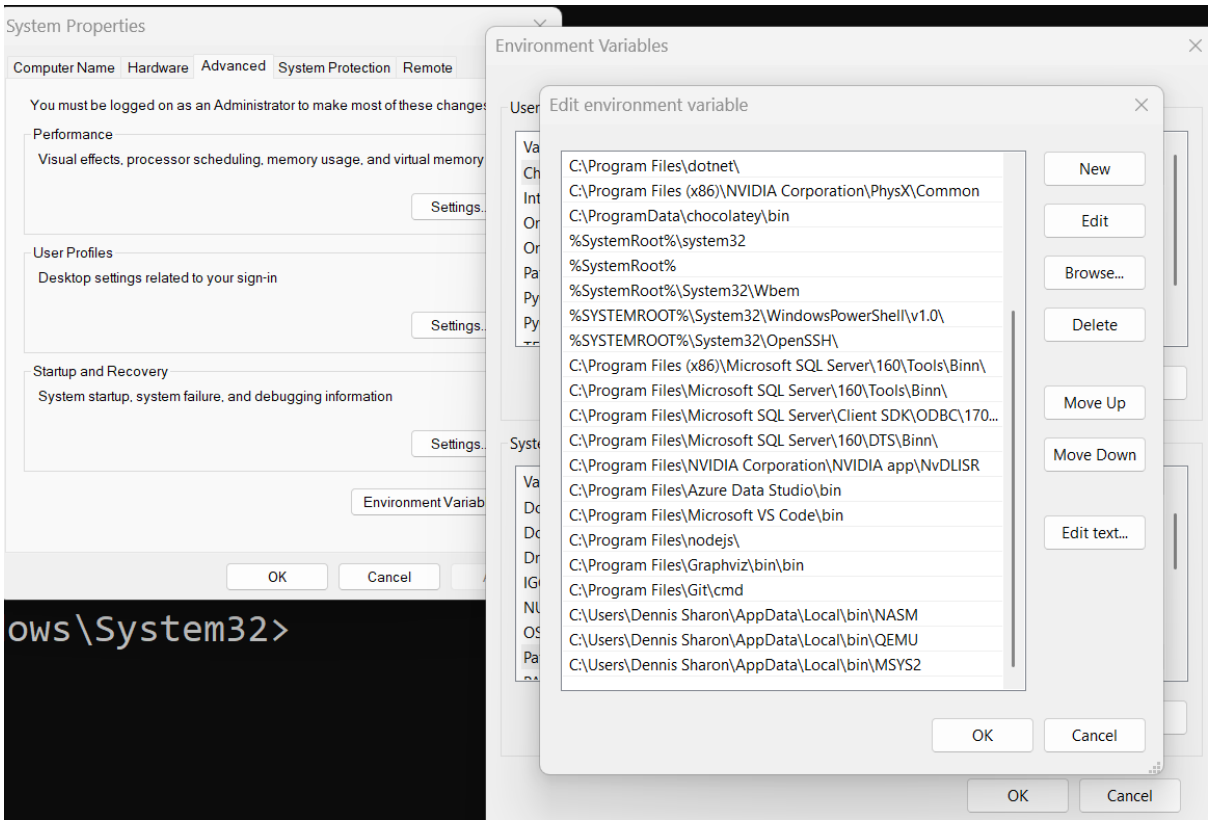
00-environment

```
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
```

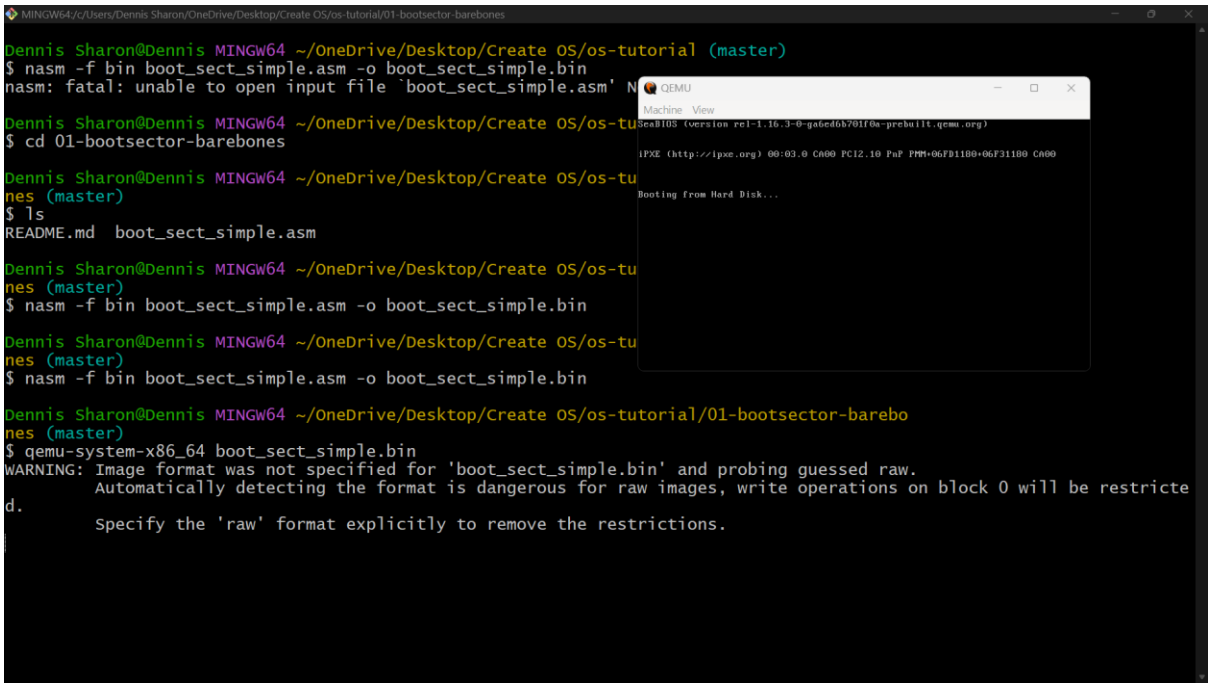
```
Select Administrator: Command Prompt
Microsoft Windows [Version 10.0.26200.7309]
(c) Microsoft Corporation. All rights reserved.

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:

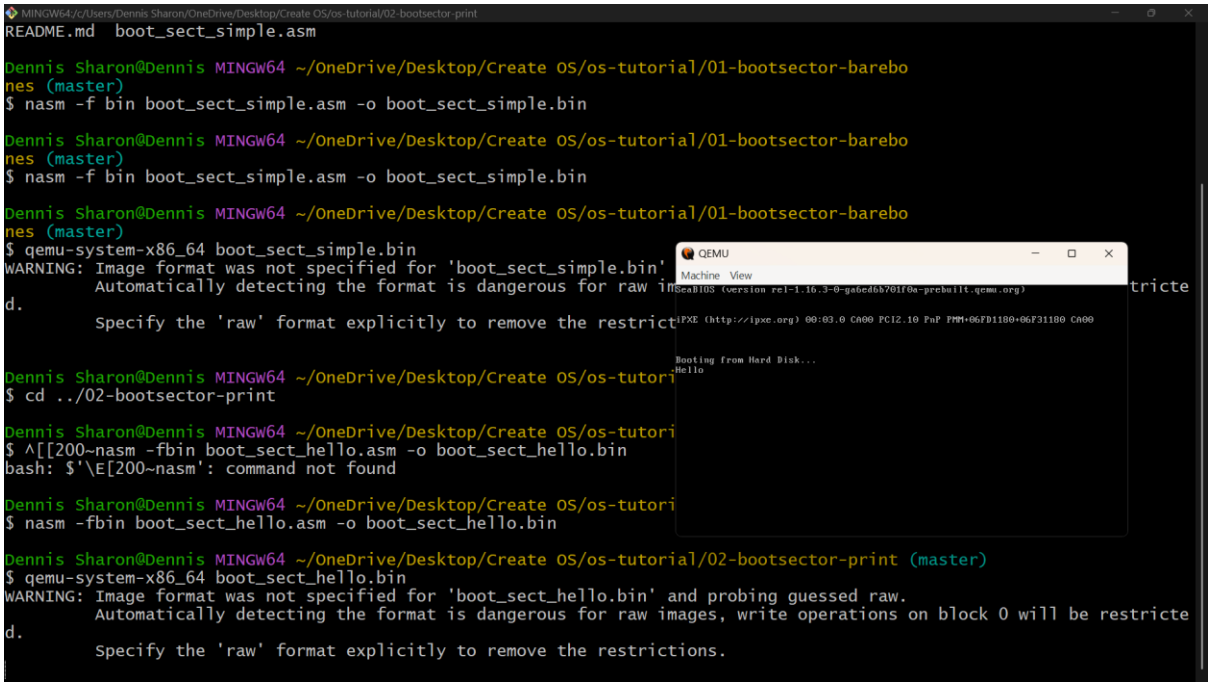
C:\Users\Dennis Sharon\AppData\Local\bin\NASAM
C:\Users\Dennis Sharon\AppData\Local\bin\QEMU
C:\Users\Dennis Sharon\AppData\Local\bin\MSYS2



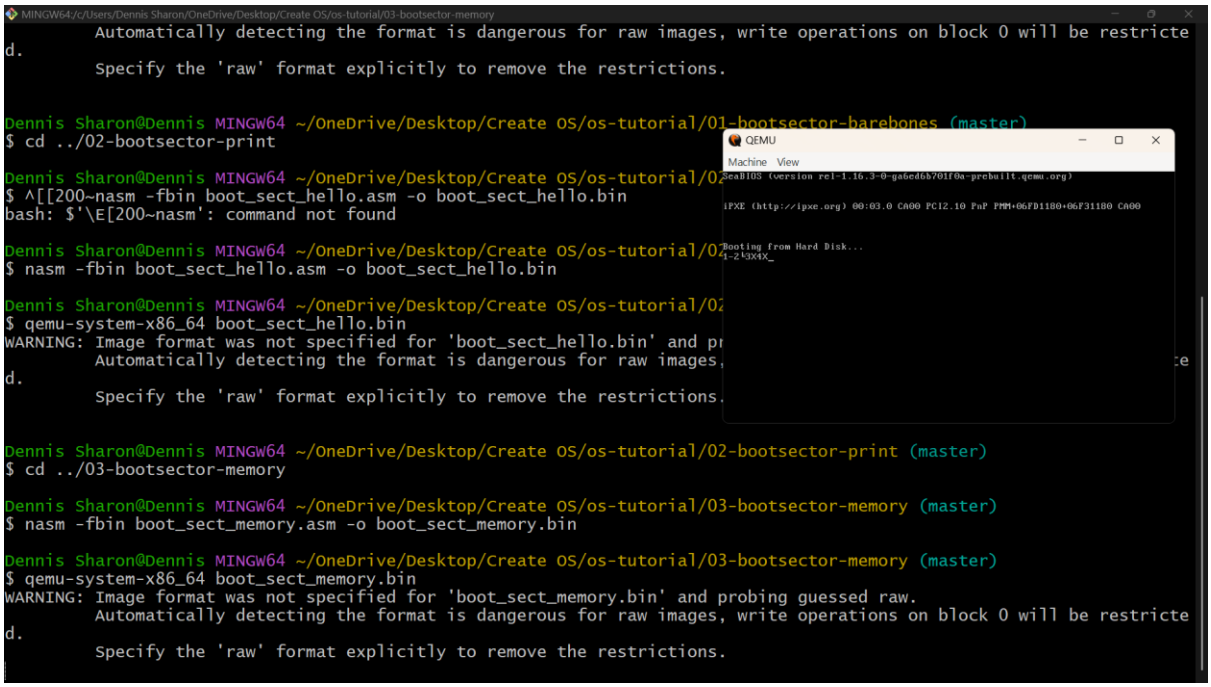
01-bootsector-barebones

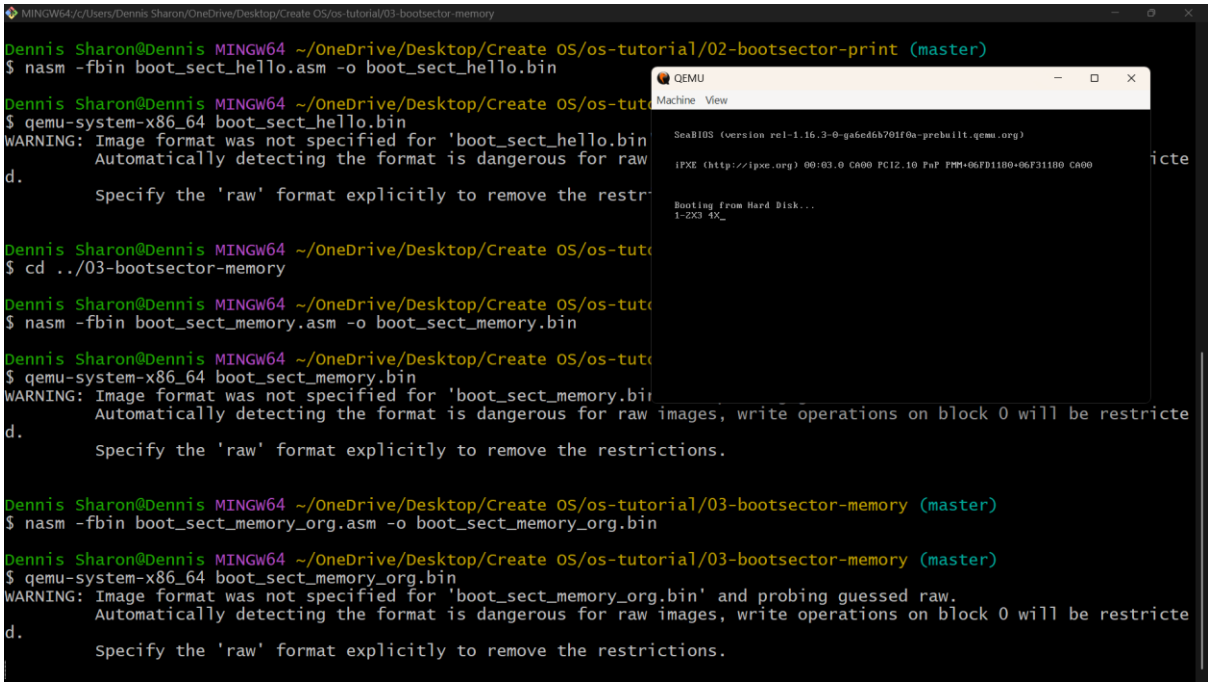


02-bootsector-print

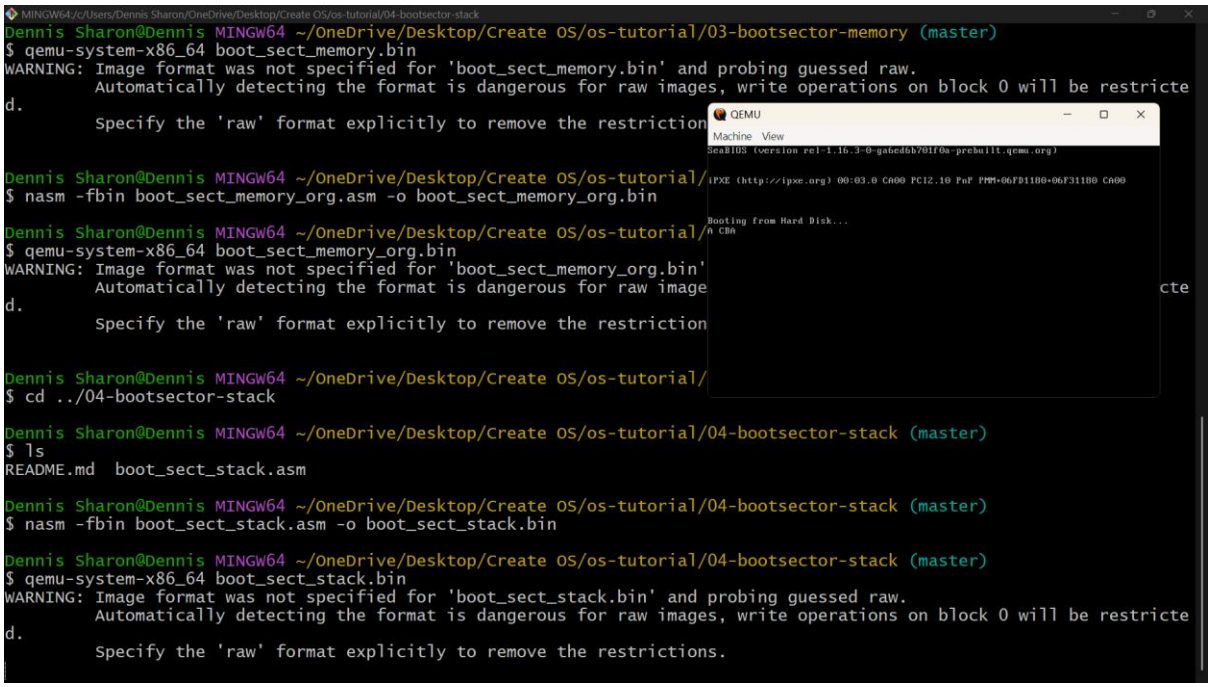


03-bootsector-memory

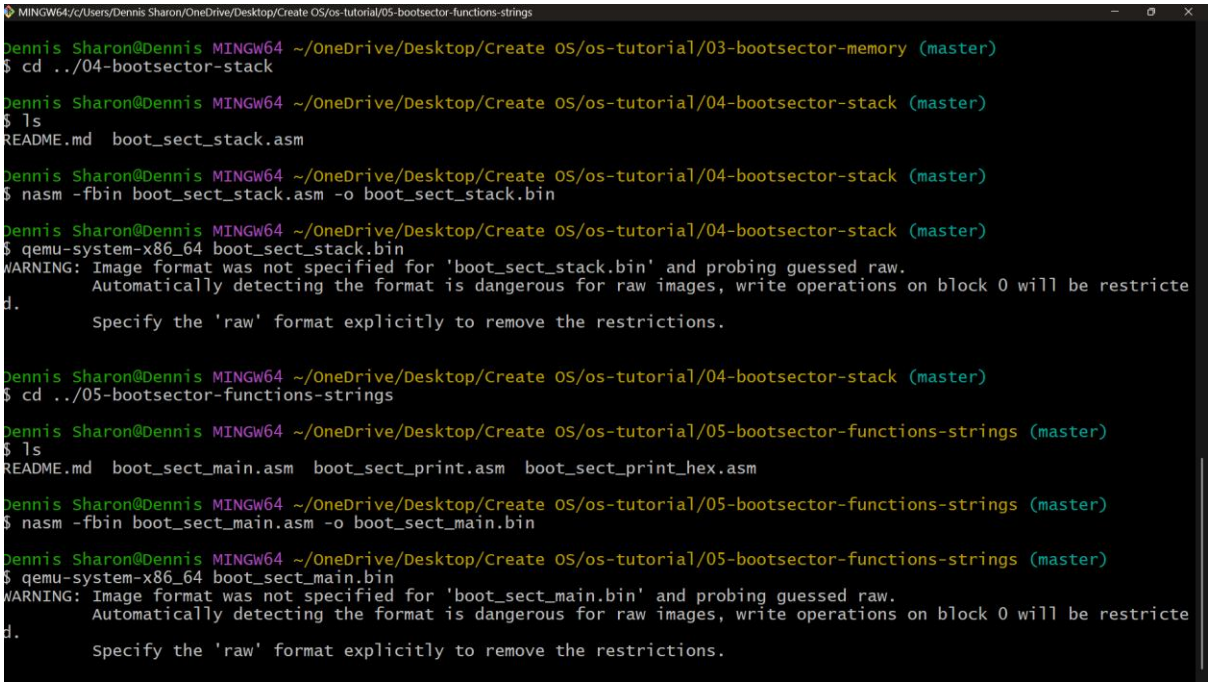


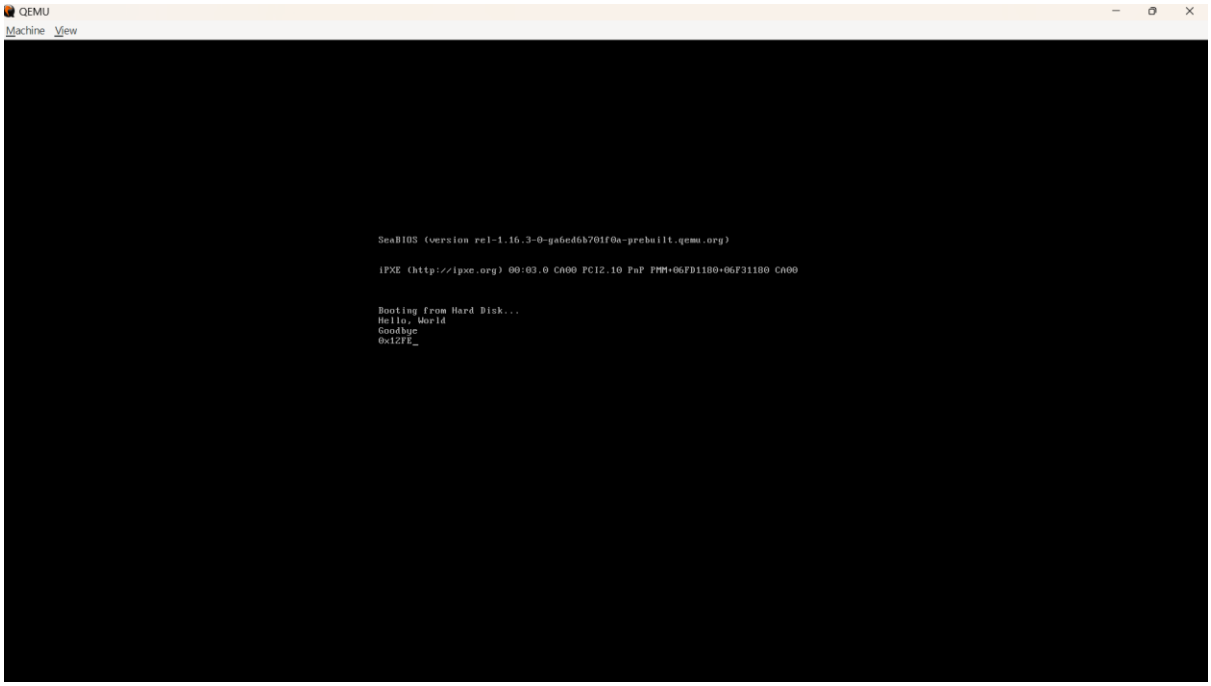


04-bootsector-stack

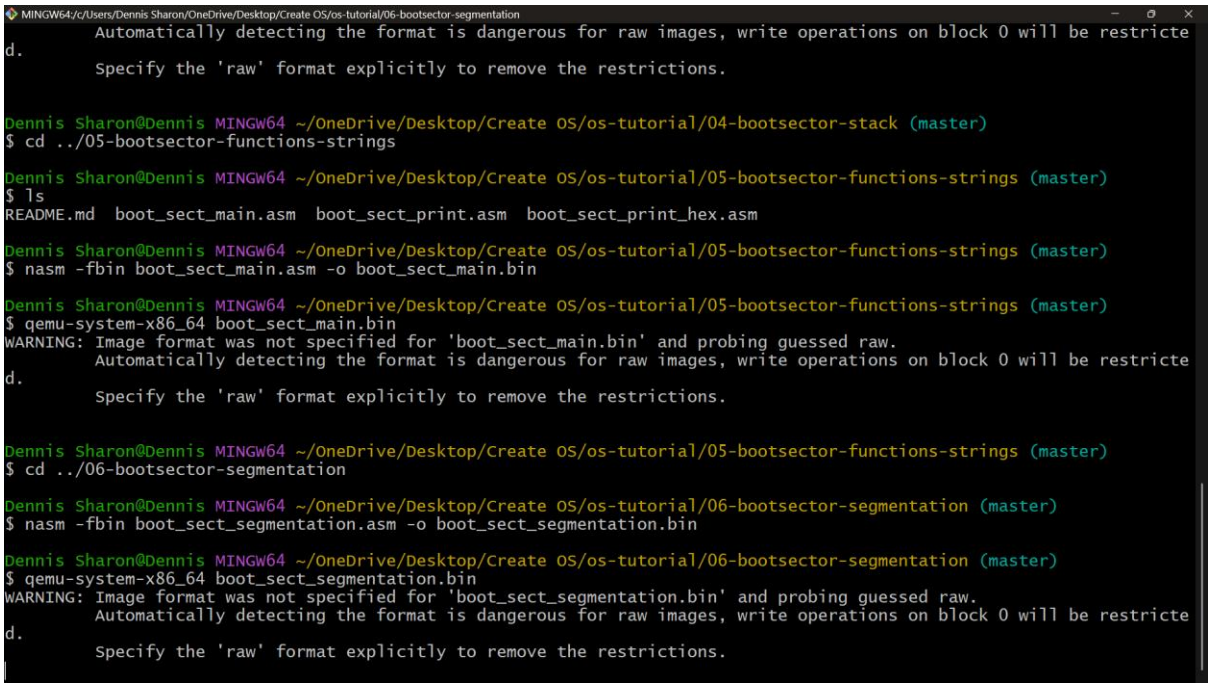


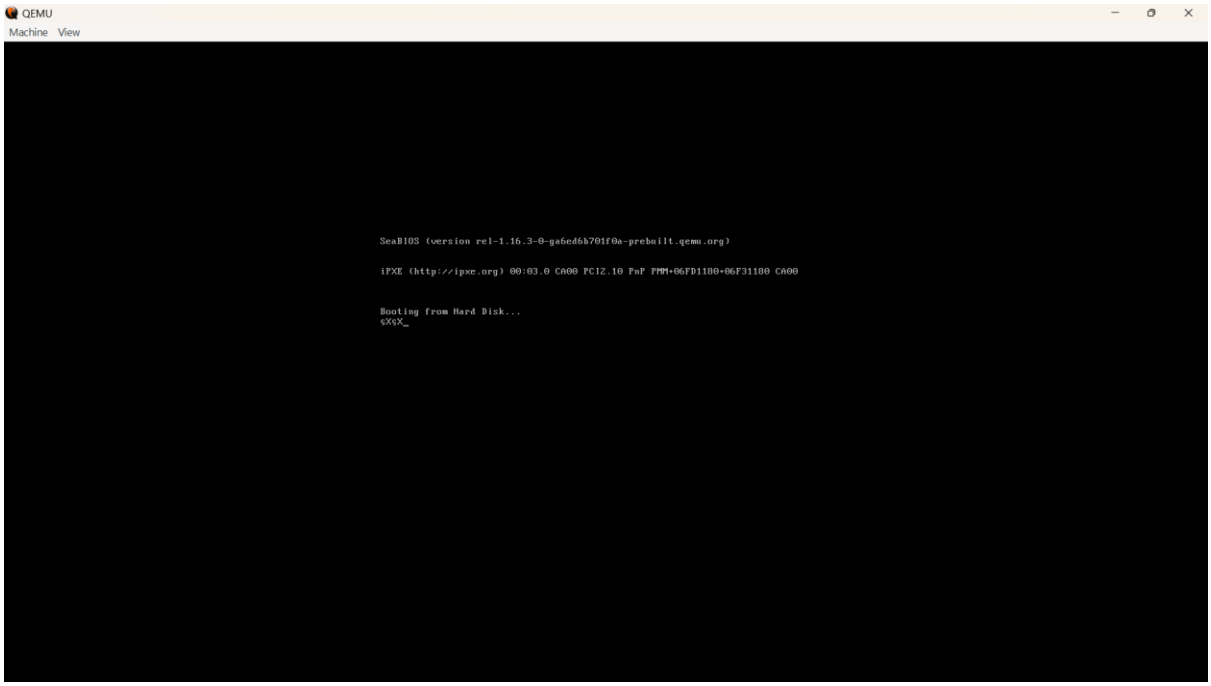
05-bootsector-functions-strings



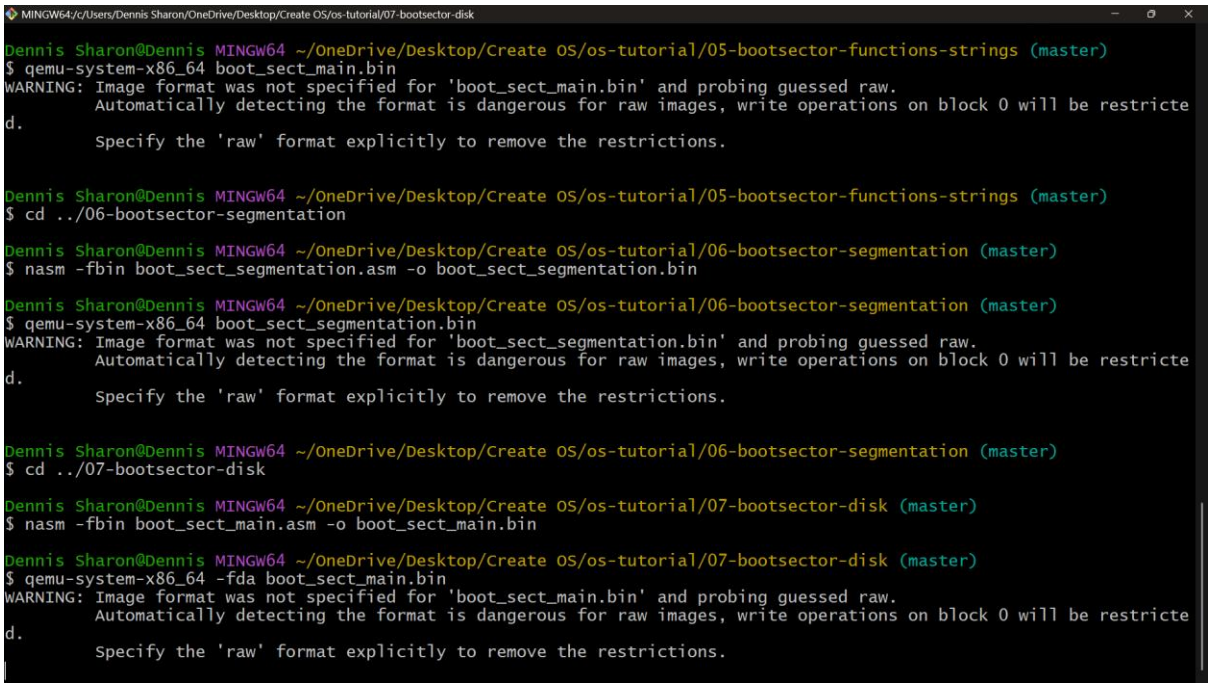


06-bootsector-segmentation

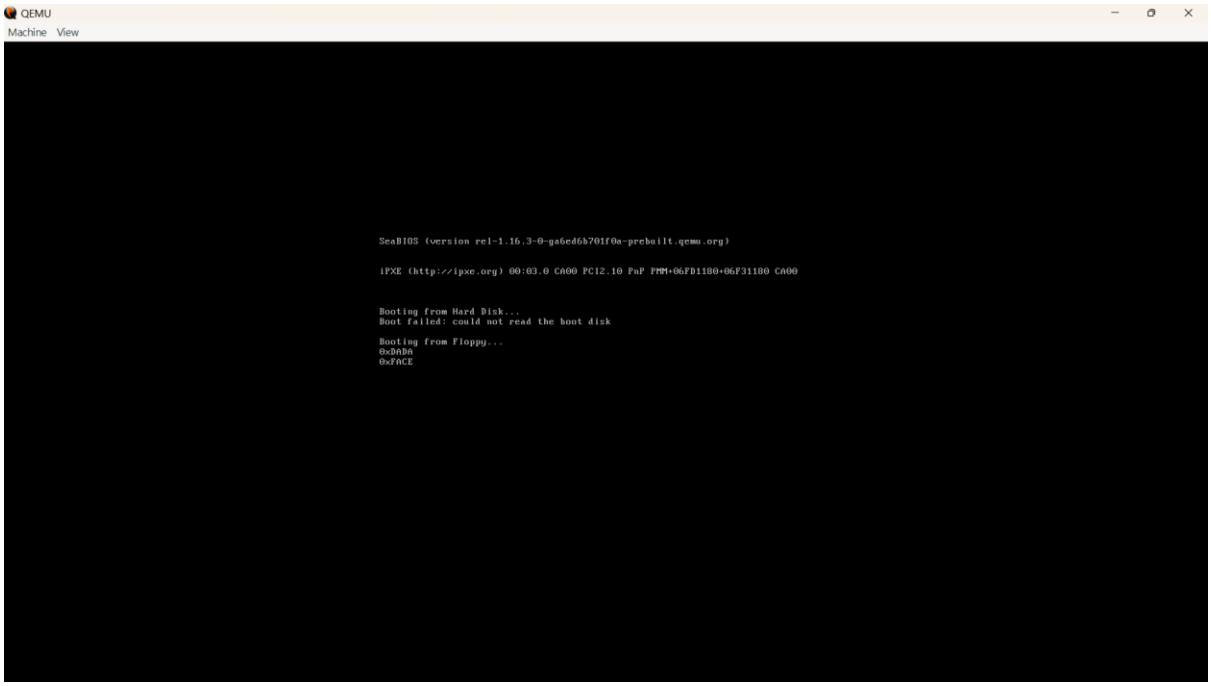




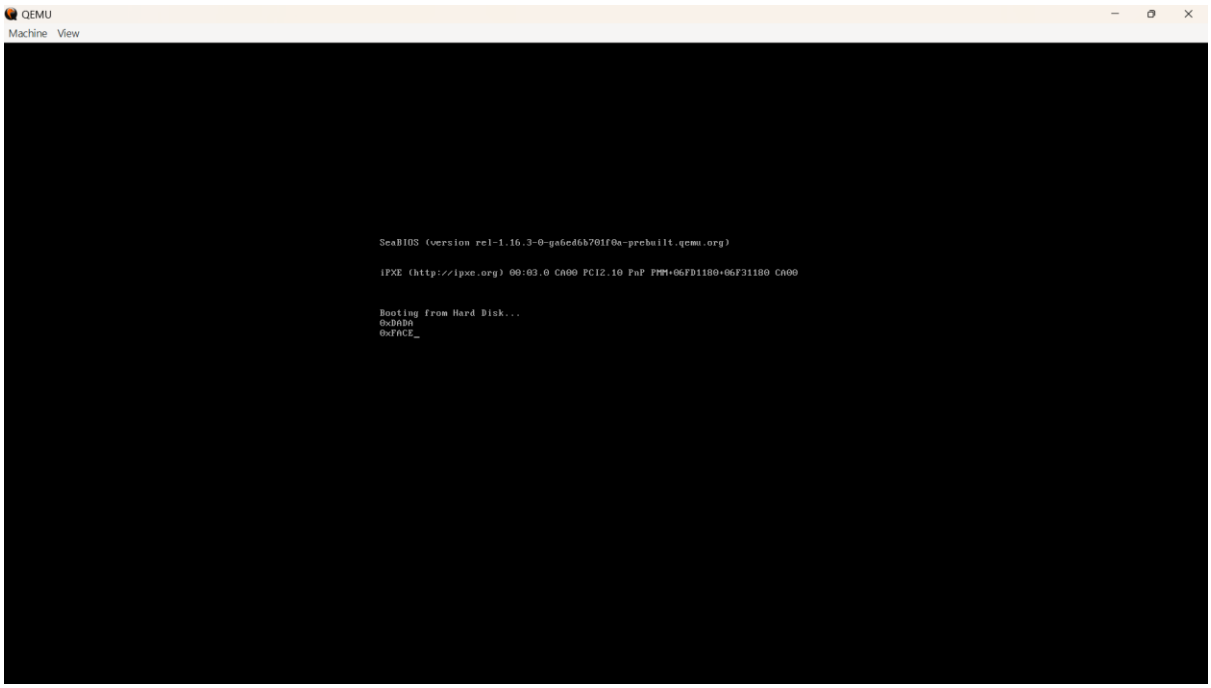
07-bootsector-disk



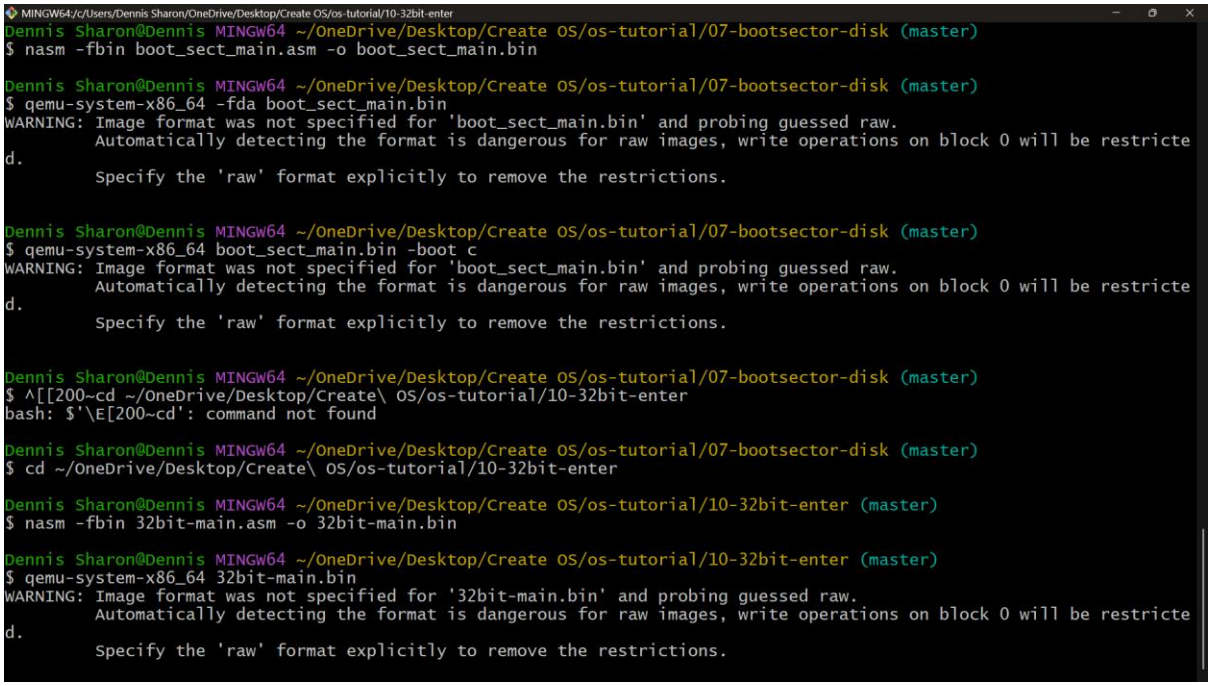
Error ()

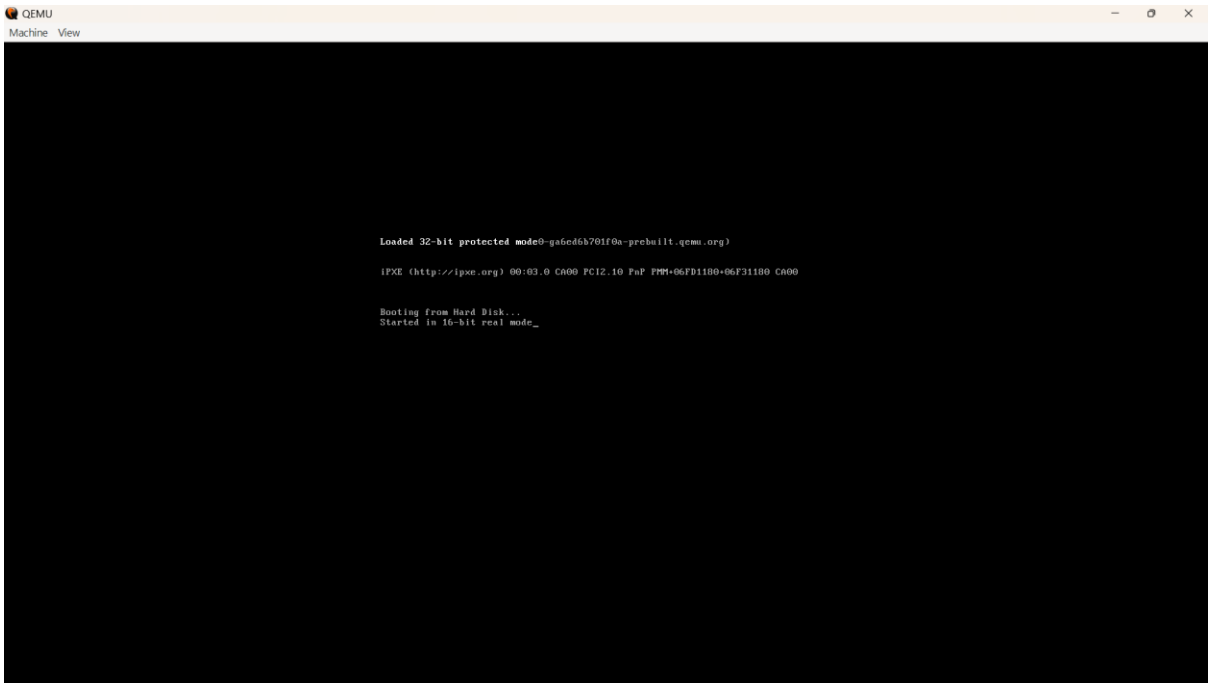


Resolved (qemu-system-x86_64 boot_sect_main.bin -boot c)



10-32bit-enter





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

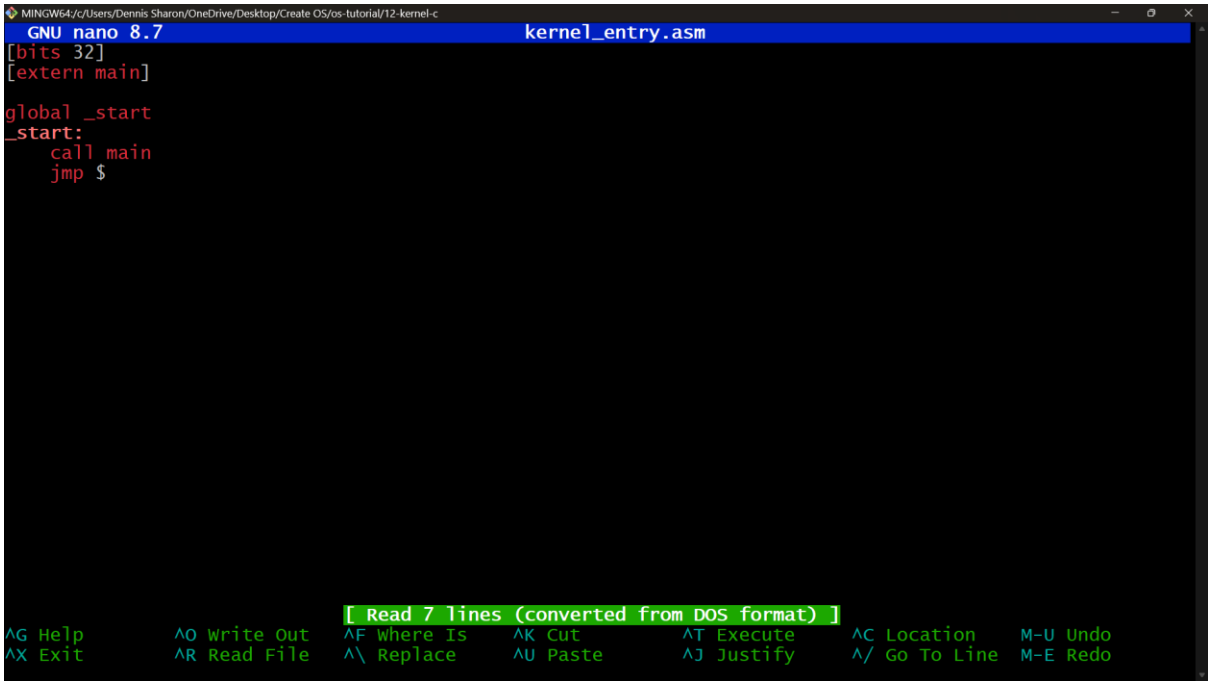
Required Packages

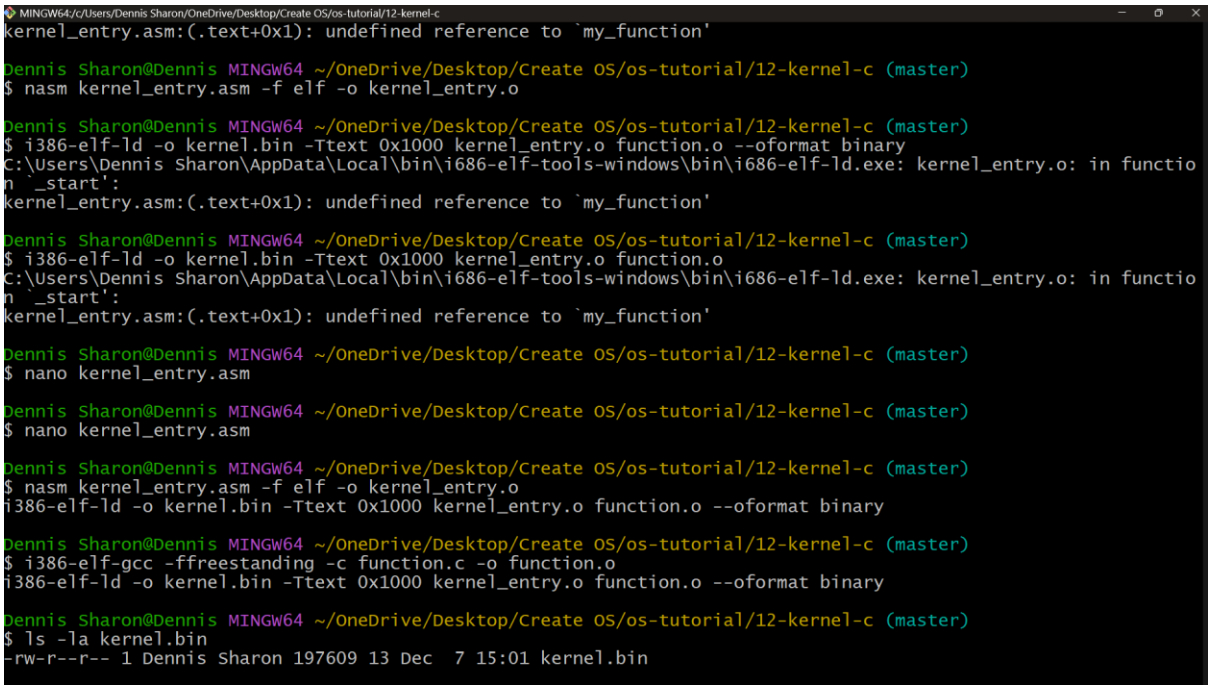
gmp, mpfr, libmpc, gcc

Platform Note

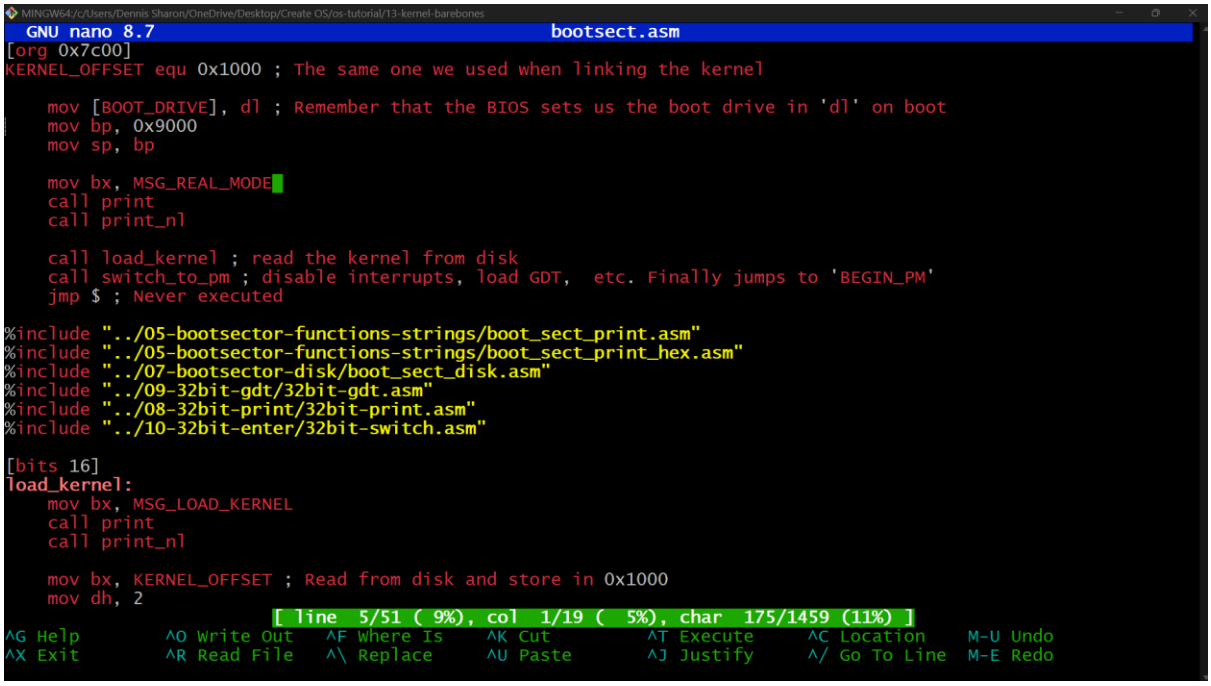
Windows 11 Limitation: This lesson targets Mac/Linux environments. Windows 11 users require alternative approaches: WSL2 (Windows Subsystem for Linux), Docker containers, or pre-built cross-compiler binaries.

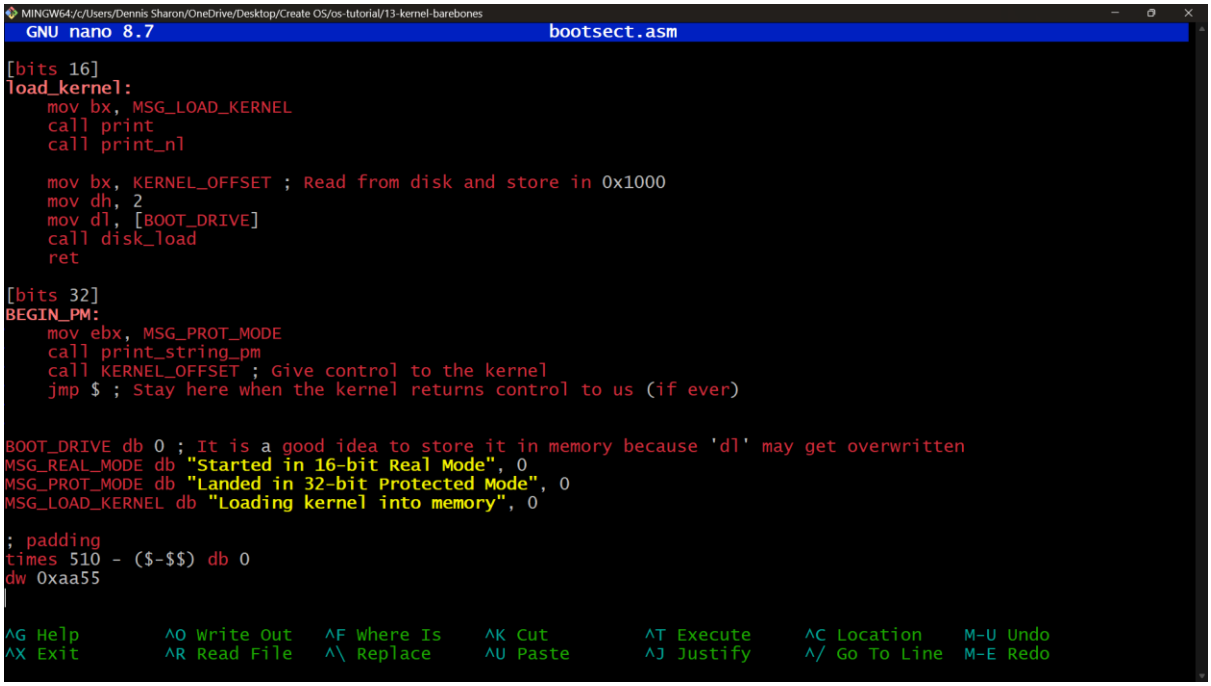
12-kernel-c

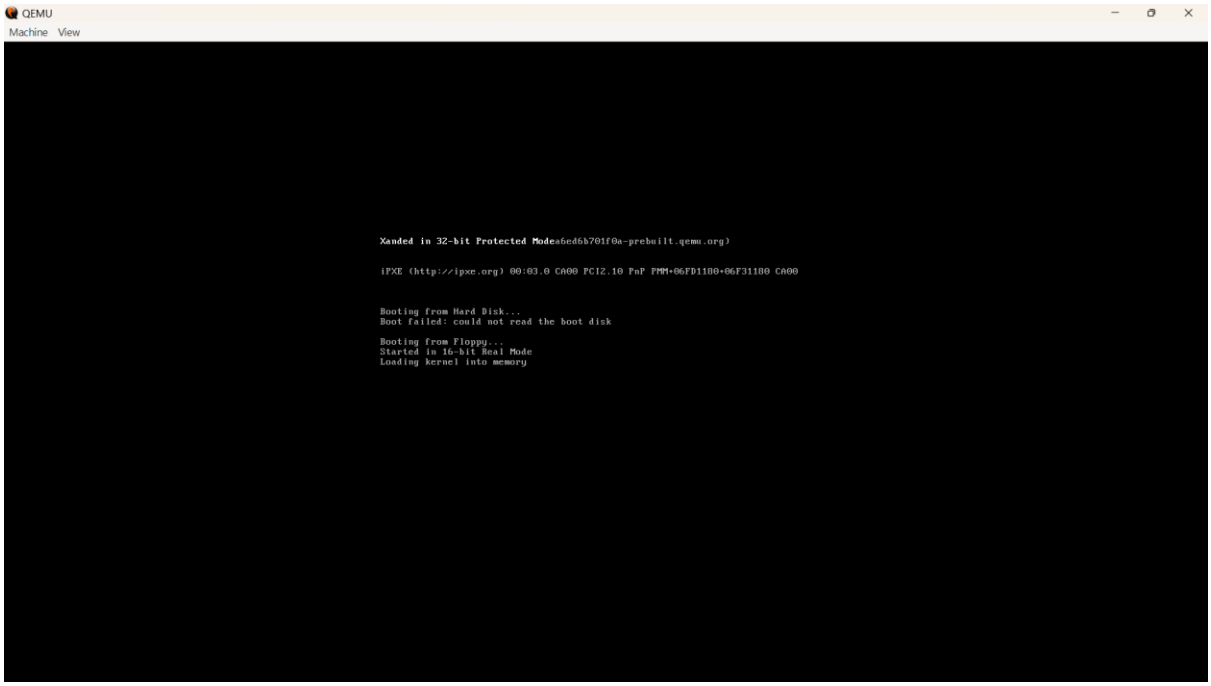

MINGW64:/c/Users/Dennis Sharon/OneDrive/Desktop/Create OS/os-tutorial/12-kernel-c
GNU nano 8.7 kernel_entry.asm
[bits 32]
[extern main]
global _start
_start:
call main
jmp $
[Read 7 lines (converted from DOS format)]
^G Help ^O Write Out ^F Where Is ^K Cut ^T Execute ^C Location M-U Undo
^X Exit ^R Read 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 functio
n `_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 functio
n `_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






QEMU
Machine View
Xanded in 32-bit Protected Mode
iPXE (http://ipxe.org) 00:03.0 CA00 PCIZ.10 PnP PMM+06FD1180+06F31180 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