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**De La Salle University • College of Computer Studies**

**OPERSYS**

Exercise 1

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**What happens when a computer boots up?**

When the machine is powered up, ideally, the following take place: the BIOS is loaded into memory and executes followed by the bootloader, which then loads the kernel.

The BIOS searches the first kilobyte of a device for a magic number to determine if it is bootable. If so, it loads it to memory address 0x7c00. This loaded program is called the bootloader.

The bootloader then searches for a kernel, which also follows a certain convention involving a magic number. It must contain the magic number 0x1BADB002, an industry standard, at least for Intel-based machines, followed by the flags for that kernel, followed by a checksum, which, when added to the two numbers that precede it, must give a total of zero, otherwise, it is not considered a valid kernel. Once such programs are found, it might give the user a choice if there are multiple kernels available. Otherwise, it loads the kernel to memory address 0x100000. It must be noted that a processor begins in “real mode” or 16-bit mode, which entails it can only use 64KB of memory. On more advanced machines, the bootloader is also the one who might tell the processor to go into 32-bit or 64-bit mode, depending on the configuration, which allows it to use more memory.

After which, the kernel, which may contain a fully functioning operating system, loads, allowing the user to access their applications.

**Define the ff.**

**BIOS**

The BIOS, or the Basic Input/Output System, is software stored in the motherboard. Through this, the user can control system settings such as fan speeds, load order of devices, voltage supply, and hardware overloading. This is the first program launched by the computer. It also checks the first kilobyte of a device to determine if it is bootable.

**Bootloader**

The bootloader is the program which verifies if a kernel is valid, and if so, loads the program into memory location 0x100000 so the CPU can execute it, and possibly run an operating system. It also determines whether the hardware should run in 16-bit mode, etc.

**Kernel**

The kernel is a computer program that translates I/O from the user into data processes. It communicates between the software and hardware. Like a popcorn kernel, the kernel is the core of the operating system.

**What are the following tools?**

**Compiler**

A compiler is a program that interprets code written in high-level language, including assembler, checks if it is correct, and if so, translates high-level language into a language understandable by the computer (machine language). Examples include gcc, nasm, tasm, and javac. These usually produce object (.obj) files.

**Linker**

A linker enables multiple object files access functions or subroutines in separate object files, and puts all of this into a single file (.exe). Without a linker, a programmer would have to write his own code for even the most common of functions in that language. An example of a linker is the TASM linker (TLINK) and the GNU linker (ld).