Rules for Quiz 1, 100 points: Work alone and independently; open books, open internet, and open notes. Place your name onto your document. Questions 1 .. 10 are worth 6 points each; questions 11 .. 15 are 8 points each. Answer via few words or short phrases where feasible; minimize use of full sentences.

1. List with few words, at least 5 progressive levels of the ***storage hierarchy*** in a Computer Systems; list from slowest to fastest.

   - magnetic disk → 20 – 150 MB/Sec
   - SSD (flash memory) → 500 MB/Sec
   - Main Memory → 1,000 – 5,000 MB/Sec
   - Cache → 5,000 – 10,000 MB/Sec
   - Registers → 20,000 – 100,000 MB/Sec

2. What is the ***added value*** of an OS? List at least 4 user-values. Be brief.

   - The added value of an OS is it being user friendly.
   - User interface, resource management, tasks management, files management

3. How does an OS get loaded at initial power-up, AKA at cold-start?

   - The OS gets loaded at initial power-up by the bootstrap program, that loads OS kernel and start execution.

4. Name (single word o.k.) four ***key SW or HW components*** of a computer system.

   - CPU
   - Application Programs
   - Operating System
   - Memory

5. Explain what is a ***process***. How is a process different from a program?

   - A process is a program in execution under the OS. While a program is a sequence of silent bits. A program becomes a process when it is ran/executed.

6. ***Why*** and ***how*** do some computers run multiple OSes on the same platform? Name an example, real or hypothetical.

   - Using virtual machines a MacOS X can host a windows OS as a guest. Most computers use this for testing reasons.

7. Some program **p** requires much more logical memory than physically available on its computer. Briefly ***name*** and ***outline*** key actions the OS takes, to enable **p** to execute.

   - Using High-Level VMM. Able to swap-out and wasp-in from hard drive to memory

8. What is a command-line interpreter (CLI)? What is the main function of a CLI? Do all OSes use a CLI? In the absence of a CLI, which other option would solve a similar problem?

   - It is a way for the user to directly enter commands to be performed by the operating system. The main function of a CLI is to get and execute the next user-specified command.

9. Name, and in few words outline, at least 4 states of a process that runs under OS control.

   - running: instructions are being executed
   - waiting: on standby for some event to occur
   - ready: waiting to be assigned to a processor
   - terminated: has completed execution

10. SW applications executing under control of an OS typically are interrupted by that OS. Explain what is essential of such interrupts; why they are needed? How can a user see in the object code, where interrupts arise? Use few short phrases.

11. Name and sketch in partial sentences the 4 conditions, under which deadlocks can arise.

12. For any context switch, the OS must store information of interrupted process. An OS designer contemplates, holding such information a.) in registers, b.) in memory, c.) on disk. Discuss pro and con of each option briefly, preferable a single word each. Which do you choose, and why?

    a) registers
    b) memory
    c) disk

13. Explain a key SWE advantage in the "modular" Solaris OS approach

    - loadable kernel modules used in Solaris OS, allows for the kernel to provide core services, while other services are implemented dynamically as the kernel is running. This preferred over adding new features directly to the kernel.

14. Briefly name/outline several method of passing parameters in system calls provided by an OS. State pros and cons of each method.

    - Passing through registers, fastest, but limited in number
    - Stored in block B, implied indirection during execution, costs execution time
    - Pushed onto a stack S, popped off by OS, no limit in number or length of parameters

15. List at least 4 HW and SW resources needed by a process. Are they HW or SW?

    - HW: resisters, static memory, stack, heap
    -SW: global objects, data from files, program code, local data