

Assignment 1

1. We have stressed the need for an operating system to make efficient use of the computing hardware. When is it appropriate for the operating system to forsake this principle and to "waste" resources? Why is such a system not really wasteful?
 - *In Single user systems, use of the system maximize as the GUI needed to be smooth enough to have an efficient interaction between user and the system.*
2. What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment?
 - *Keeping system task completion time constraints strictly is a must as if it is not, it may cause an entire system collapse.*
3. How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system?
 - *Control over hardware is more facilitated by kernel mode (eg : Control over interrupts), but in user mode these capabilities are limited. Hence, hardware resources are only exposed to experts via kernel mode. Therefore there is a rudimentary protection for the system.*
4. Some early computers protected the operating system by placing it in a memory partition that could not be modified by either the user job or the operating system itself. Describe two difficulties that you think could arise with such a scheme.
 - *System can't be updated, hence security patches and modifications can't be done.*
 - *Sensitive data like, access control information and security password would've to be saved in unprotected memory as the protected memory can't be altered.*
5. Give two reasons why caches are useful. What problems do they solve? What problems do they cause? If a cache can be made as large as the device for which it is caching (for instance, a cache as large as a disk), why not make it that large and eliminate the device?
 - *Caches are useful because, they can increase the speed of accessing the memory without using much physical space. And also useful when two or more components exchanging data, where component's transfer speeds are different.*
 - *They solve these problems. When consider according to the computer time, it takes years to access memory. If a program uses physical memory efficiency of the program reduces. But, cache provides high speed data access to the program as it is fast and small in capacity. When consider about the data exchanging different components exchange data in different speeds. Caches act as an intermediate buffer and hold an intermediate speed to exchange data.*
 - *These memory components (caches) are very expensive.*
6. In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems.
 - a) What are two such problems?
 - b) Can we ensure the same degree of security in a time-shared machine as in a dedicated machine? Explain your answer.

- a) *In multiprogramming program tasks are done simultaneously. Therefore, processor switch between multiple processes within a given time period. In such situation switching between memory locations are also critical as they can be cause to a security problem. One problem is overwriting the existing memory and the other one is accessing other user's memory location.*
 - b) *No / Even non-automated (human involved) memory sharing systems can be manipulated.*
7. Describe the differences between symmetric and asymmetric multiprocessing. What are three advantages and one disadvantage of multiprocessor systems?
- **Symmetric** – *All processors run a copy of OS, There is no difference between processes (No master/slave), No special hardware or software requirements needed.*
 - **Asymmetric** – *There is a master slave relationship between processes, Master assign tasks to slaves, there is a difference between master and slave hardware/software configuration.*
 - **Advantages** - *Increment of the throughput, low cost as they share storage and other components, Increment of reliability as if one fails there are more to continue.*
 - **Disadvantage** – *It cost a lot of time when restarting as each process need to have a copy of OS.*
8. How are network computers different from traditional personal computers? Describe some usage scenarios in which it is advantageous to use network computers
- *In most cases networked computers are based on centralized system. Therefore, it can have a minimal OS to manage its resources. But the personal computers should be capable of providing all functionality as it serves in standalone manner.*
 - *Network computers are preferred when sharing resources make more efficient use of the system and when administrative cost are high.*
9. What is the purpose of interrupts? How does an interrupt differ from a trap? Can traps be generated intentionally by a user program? If so, for what purpose?
- *Interrupts are generated by hardware in order to change the flow of the system to serve events that needs immediate attention.*
 - *Interrupts generated by software are called traps.*
 - *Traps can be generated intentionally by user program.*
 - *A trap can be used to call operating system routines or to catch arithmetic errors.*
10. Direct memory access is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.
- a) *How does the CPU interface with the device to coordinate the transfer?*
 - b) *How does the CPU know when the memory operations are complete?*
 - c) *The CPU is allowed to execute other programs while the DMA controller is transferring data. Does this process interfere with the execution of the user programs? If so, describe what forms of interference are caused.*
- a) *Requests are send to devices via special registers (I/O registers), device notices these requests and perform particular relevant actions.*
 - b) *Device can generate an interrupt or write to a special register which is checked by CPU frequently.*

c) *Memory controller may fairly allocate bus cycles between CPU and the device. But user programs that use more cycles may slow down.*

11. Some computer systems do not provide a privileged mode of operation in hardware. Is it possible to construct a secure operating system for these computer systems? Give arguments both that it is and that it is not possible.

- *Yes / because, all requests can be operated through OS. All the operations that can be done through hardware is also possible through software.*
- *No / because, there can be ways to exploit the OS by attackers.*

12. Many SMP systems have different levels of caches; one level is local to each processing core, and another level is shared among all processing cores. Why caching systems are designed this way?

- *These levels of caches are designed based on speed and size. Faster caches cost high. Therefore, faster caches are small in size. These faster caches are placed local to each processor as they could be accessed faster. Larger, but slower caches are shared among all processing cores.*

13. Describe a mechanism for enforcing memory protection in order to prevent a program from modifying the memory associated with other programs.

- *Processor can keep track of the memory limits and the memory locations those are associated with each process. This check need to be done per every memory access.*

14. Identify several advantages and several disadvantages of open-source operating systems.

Include the types of people who would find each aspect to be an advantage or a disadvantage.

- *In open-source operating systems there are many people to debug and work on them for further development of features. For students and programmers open-source OSs are very useful as those OS codes are available to view and modify. But when we consider about commercial OS developers, these open source OSs are barriers for their business as they are offered free. Open source OS codes have lack of discipline as many personals contribute to develop the code. This is a drawback of open source OSs for Programmers, students and also developers.*