

Operating Systems

List 1

Exercise 1

In the C standard library two functions exist: `setjmp` and `longjmp`. They're used for non-local jumps. The first one saves the context of a program, the second one restores it. What data should constitute such a context, why?

Exercise 2

Talk briefly about instruction execution in pipelined processor. Recall five staged MIPS processor pipeline. What is the functionality of each of five stages? At which stage jumps are finalized?

Exercise 3

Describe in detail what operations are performed during a procedure call and when control flow returns from a procedure. Give a characteristics of re-entrant function.

Exercise 4

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.

Exercise 5

What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by a user program? If so, for what purpose?

Exercise 6

Describe in detail the mechanism of interrupt handling. Consider a case, when an interrupt is triggered when another interrupt is being handled. Why does processor change an operating mode to supervisor mode and switches a stack, when an interrupt is triggered?

Exercise 7

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?

Exercise 8

What is the distinction between spatial locality and temporal locality? In general, what are the strategies for exploiting spatial locality and temporal locality?

Exercise 9

Direct memory access is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.

- How does the CPU interface with the device to coordinate the transfer?
- How does the CPU know when the memory operations are complete?

- 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.

Exercise 10

In virtually all systems that include DMA modules, DMA access to main memory is given higher priority than processor access to main memory. Why?