

IA Operating Systems: Scheduling, Processes, Protection, Interrupts, System Calls

Lent 2024

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- 1 For each of the following, indicate if the statement is true or false, and explain why:
 - (a) Preemptive schedulers require hardware support.
 - (b) A context switch can be implemented by a flip-flop.
 - (c) System calls are an optional extra in modern operating systems.

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 - (a) Operating systems need to be able to prevent applications from crashing or locking up the system, or from interfering with other applications. Which three kinds of hardware support do we require to accomplish this?
 - (b) How do applications request that the operating system perform tasks on their behalf?
 - (c) What could we do if we did not have the requisite hardware support?

- 3 Process scheduling can be *preemptive* or *non-preemptive*. Compare and contrast these approaches, commenting on issues of simplicity, fairness, performance and required hardware support.

- 4 (a) Describe with the aid of a diagram the life-cycle of a process. You should describe each of the states that it can be in, and the reasons it moves between these states.
- (b) What information does the operating system keep in the process control block?
- (c) Give one advantage and one disadvantage of non-preemptive scheduling.
- (d) What steps does the operating system take when an interrupt occurs?
- (e) What problems could occur if a system experienced a very high interrupt load?

5 *System calls* are part of most modern operating systems.

- (a) What is the purpose of a system call?
- (b) What mechanism is typically used to implement system calls?

6 Suppose we have a system with three users a , b and c and ten files f_0, f_1, \dots, f_9 .

Further suppose we have four operations for which we wish to control access: *read*, *append*, *replace* and *modify*.

- (a) Do we require all of these or can some be described by combinations of others?
- (b) Create a nontrivial example set of access tuples of the form (user, file, permission) and show how it might be represented as:
- (i) an access matrix,
 - (ii) access control lists,
 - (iii) capability sets

7 Past paper questions

- [y2013p2q3](#)
- [y2012p2q3](#)
- [y2010p2q3](#) [not (c)]
- [y2015p2q3](#) [not (c)]
- [y2014p2q3](#)
- [y2011p2q3](#) [not (a)(iv), (a)(v), (b)]
- [y2007p1q8](#) (a)–(c)