



COMP 346 - Winter 2015 Theory Assignment 1

Answer all questions

Question # 1

- I. What is an operating system? What are the main purposes of an operating system?
- II. Define the essential properties of the following types of operating systems:
 - Batch
 - Time sharing
 - Dedicated
 - Real time
- III. Under what circumstances would a user be better off using a time-sharing system rather than a PC or single-user workstation?

Question # 2

I. What is the performance advantage in having device drivers and devices synchronize by means of device interrupts, rather than by polling (i.e., device driver keeps on polling the device to see if a specific event has occurred)? Under what circumstances can polling be advantageous over interrupts?

II. Is it possible to use a DMA controller if the system does not support interrupts? Explain why.

IV. The procedure *ContextSwitch* is called whenever there is a switch in context from a running program A to another program B. The procedure is a straightforward assembly language routine that saves and restores registers, and must be atomic. Something disastrous can happen if the routine *ContextSwitch* is not atomic.

- (a) Explain why *ContextSwitch* must be atomic, possibly with an example.
- (b) Explain how the atomicity can be achieved in practice.

Question # 3

- I. If a user program needs to perform I/O, it needs to trap the OS via a system call that transfers control to the kernel. The kernel performs I/O on behalf of the user program. However, systems calls have added overheads, which can slow down the entire system. In that case, why not let user processes perform I/O directly, without going through the kernel?
- II. Consider a computer running in the user mode. It will switch to the monitor mode whenever an interrupt or trap occurs, jumping to the address determined from the interrupt vector.

- (a) A smart, but malicious, user took advantage of a certain serious loophole in the computer's protection mechanism, by which he could make run his own user program in the monitor mode! This can cause disastrous effects. What could have he possibly done to achieve this? What disastrous effects could it cause?
- (b) Suggest a remedy for the loophole.

Question # 4

Which of the following instructions should be privileged? Explain why.

- (i) Read the system clock,
- (ii) Clear memory,
- (iii) Turn off interrupts, and
- (iv) Switch from user to monitor mode.

➔ Assignment must be submitted electronically at <https://fis.encs.concordia.ca/eas>.