C502 – Operating Systems Tutorial *

Device Management

1. In which of the four I/O software layers (user-level I/O software, device-independent OS software, device drivers and interrupt handlers) is each of the following done?

   (a) Computing the track, sector and head for a disk read

   (b) Maintaining a cache of recently used blocks

   (c) Writing commands to the drive registers

   (d) Checking to see if the user is permitted to use the device

   (e) Converting binary integers to ASCII for printing

2. Explain what direct memory access (DMA) is and why it is used. Although DMA does not use the CPU, the maximum transfer rate is still limited. Consider reading a block from disk. Name **three** factors that might ultimately limit the rate of transfer. (Exam question 2015-16).

3. What is spooling? Why is a printer spooling system better than direct user access to printers?

4. An operating system has to support I/O devices with very diverse properties. Complete the following table, as exemplified below, using your best guesses.

Device	**Type** (**C**haracter/**B**lock)	**Operation** (**R**ead, **W**rite, **S**eek)
Clock		
Keyboard		
Mouse		
56k Modem	C	R, W
ISDN line		
Laser Printer		
Scanner		
52x CD-ROM		
FastEthernet		
EIDE (ATA-2)disk		
ISA bus		
Fire Wire (IEEE 1394)		
USB 2.0		
XGA Monitor		
Gigabit Ethernet		
Serial ATA disk		
SCSI Ultrawide4 disk		
PCI bus		

5. Write a C program that implements the copy (cp) command. Your program should be invoked as:
   mycp <source file> <destination file>

*with thanks to Morris Sloman

(a) Make sure that you use the correct Linux I/O calls. How efficient is your implementation compared to the standard cp command? You can use the `time` command to measure execution times for various file sizes. If there is a performance difference, can you explain it?

(b) The `strace` command can be used to trace the system calls that a program makes. Compare the system calls between cp and mycp. Again, can you explain the differences?