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CMIS 310
HOMEWORK #6 – Week #6

This homework is worth 10% of your course grade.

Read each problem carefully. Failure to follow the instructions for a problem will result in a zero score for that problem.

Submit the completed Homework via Assignment in LEO.

1. A 32-bit computer has two selector channels and one multiplexor channel. Each selector channel supports two magnetic disk and two magnetic tape units. The multiplexor channel has two line printers, two card readers, and five VDT terminals connected to it. Assume the following transfer rates.

Disk drive	700 Kbytes/s
Magnetic tape drive	200 Kbytes
Line printer	6.6 Kbytes/s
Card Reader	1.2 Kbytes/s
VDT	1 Kbytes/s

Estimate the maximum aggregate I/O transfer rate in this system.

2 selector channels select 1 device (disk drive or magnetic tape): 2x700Kbps (maximum) = 1400Kbps
1 Multiplexor channel: (6.6kbps*2) + (1.2Kbps*2) + (1Kbps*5) = 13.2Kbps+2.4Kbps+5Kbps = 20.6Kbps

Maximum aggregate I/O transfer rate = 1400Kbps+20.6Kbps = **1420.6 Kbps**

2. Given the following set of events, show which routines the CPU is executing for times 0 to 100 ns. Each handler routine (with its interrupt request) takes 20 ns to complete. The priority of the interrupts ranges from IRQ6 as the **highest priority** interrupt to IRQ0 as **the lowest priority** interrupt.

Time	Action
0 ns	Start of main program
10 ns	IRQ1
25 ns	IRQ4
40 ns	IRQ6
50 ns	IRQ3

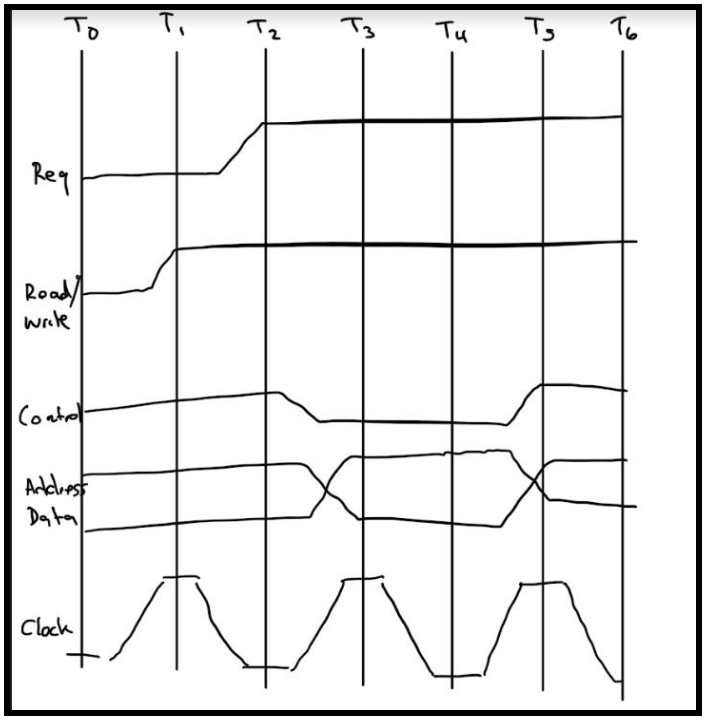
Time **Action**

0 ns: **Start of Main Program**
10 -25 ns: **IRQ1**

25 -40 ns:	**IRQ4 (IRQ1 has 5 ns left)**
40 -60 ns:	**IRQ6 (IRQ4 has 5 ns left)**
60 -80 ns:	**IRQ4 (higher priority than IRQ3)**
65 -85 ns:	**IRQ3 (higher priority than IRQ1)**
85 -90 ns:	**IRQ1**
90 -100ns:	**Main Program**

3. Do Exercise 8 in Chapter 7 (Input/Output and Storage Systems) of Null and Lobur

   We pointed out that I/O buses do not need separate address lines. Construct a timing diagram similar to Figure 7.7 that describes the handshake between an I/O controller and a disk controller for a write operation. (Hint: You will need to add a control signal.)



4. Do Exercise 11 in Chapter 7 (Input/Output and Storage Systems) of Null and Lobur

   Why do you think the term random access device is something of a misnomer for disk drives?

Accessing the memory locations on the storage devices is done in a purposeful and exact manner. However, they are known as that because the sectors can be accessed independently of its surrounding sectors (Null & Lobur, 2003).

5. Do Exercise 19 in Chapter 7 (Input/Output and Storage Systems) of Null and Lobur

   What are the advantages and disadvantages of having a small number of sectors per disk cluster?

   Each track on a disk platter is made of clusters, which are made of sectors. Since multiple files can't share the same cluster, smaller clusters would allow space usage to be optimized (Posey, 2000). A large cluster that contains only a small file will have unused space that could have been used for something else. However, this does have its disadvantage being the reduced speed of retrieving the information. This is due to the increased amount of information in the disk directory, which maps the logical file information to the location on the disk (Null & Lobur, 2003). Larger disk directories require more time to look through them to retrieve information.

References

Null, L. & Lobur, J. (2003). Chapter 8 - System Software. *The essentials of computer organization and architecture.* [Books24x7 version] Available from http://library.books24x7.com.ezproxy.umgc.edu/toc.aspx?bookid=5893.

Posey, T. (2000). Anatomy of Hard Disk Clusters. Retrieved from https://www.techrepublic.com/article/anatomy-of-hard-disk-clusters/