Computer Organization #2 *

FIT - HUI

May, 2013

External Memory

1. A computer has a bus with a 5 nsec cycle time, during which it can read or write a 32-bit word from memory. The computer has an Ultra4-SCSI disk that uses the bus and runs at 160 Mbytes/sec. The CPU normally fetches and executes one 32-bit instruction every 1 nsec. How much does the disk slow down the CPU?

2. To be able to fit 133 minutes worth of video on a single-sided single-layer DVD, a fair amount of compression is required. Calculate the compression factor required. Assume that 3.5 GB of space is available for the video track, that the image resolution is 720×480 pixels with 24-bit color, and images are displayed at 30 frames/sec.

3. A digital camera has a resolution of 3000×2000 pixels, with 3 bytes/pixel for RGB color. The manufacturer of the camera wants to be able to write a JPEG image at a 5x compression factor to the flash memory in 2 sec. What data rate is required?

4. Consider a 4-drive, 200GB-per-drive RAID array. What is the available data storage capacity for each of the RAID levels, 0, 1, 3, 4, 5, and 6?

5. Design a backup strategy for a computer system. One option is to use plug-in external disks, which cost $150 for each 500 GB drive. Another option is to buy a tape drive for $2500, and 400 GB tapes for $50 apiece. (These were realistic prices in 2008.) A typical backup strategy is to have two sets of backup media onsite, with backups alternately written on them so in case the system fails while making a backup, the previous version is still intact. Theres also a third set kept offsite, with the offsite set periodically swapped with an on-site set.

    - Assume you have 1 TB (1000 GB) of data to back up. How much would a disk backup system cost?
    - How much would a tape backup system cost for 1 TB?
    - How large would each backup have to be in order for a tape strategy to be less expensive?
    - What kind of backup strategy favors tapes?

*Following problems are taken from Chapter 8, William Stallings, eighth edition, and Chapter 2, Andrew S. Tanenbaum, fifth edition