METRO STATE UNIVERSITY

ICS 232 Computer Organization & Architecture
Homework 11 - Chapter 7 - 10 points
Due Date: 7/26/2023

Name:

Note: Please post your homework to ICS232 D2L on or before the due date.

Chapter 7 – Input / Output Systems

Essential Terms and Concepts

23. Explain the differences between an SSD and a magnetic disk.
Magnetic disk: random/direct access storage devices, disks are mounted on spindles, low cost, slow, fragile, moving parts tear out
SSD:store data in non-volatile flash memory circuits, faster, block-addressable, highest degree of performance and reliability

40. Which RAID levels offer the best performance?

Raid 0

41. Which RAID levels off the best economy while providing adequate redundancy?
Level 5

Exercises

2. Calculate the overall speedup of a system that spends 40% of its time in calculations with a processor upgrade that provides for 100% greater throughput.
(Time of old component)/(Time of new component) = 1+ (speed of new component/ 100)
= 1+(100/100)
=2
S= 1/[(1-0.4)+(0.4/2)]
S=1.25
25% faster

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3. Suppose your company has decided that it needs to make certain busy servers 50% faster. Processes in the workload spend 60% of their time using the CPU and 40% on I/O. In order to achieve an overall system speedup of 25%:

a) How much faster does the CPU need to be?
100+25=125 S=1.25 f=0.6
1.25 = 1 / (1-0.6)+0.6/k
k=0.5k-0.75
k=1.5
50% faster

b) How much faster does the disk need to be?
100+25=125
S=1.25
1.25=1/(1-0.4)+0.4/k
k=0.75k-0.5
k=2
100% faster

14. Of programmed I/O, interrupt-driven I/O, DMA, or channel I/O, which is most suitable for processing the I/O of a:
a) Mouse - programmed I/O, because the polling device would obtain data form the pointer
b) Game controller - interrupt-driven I/O, because it triggers an interrupt according to priority from the game controller
c) CD - DMA I/O, because the device need to transfer large amounts of data to another device where the device requires to maintain efficiency
d) Thumb drive or memory stick - channeled I/O, because the DMAC could suffice multiple CD's
Explain your answers.

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21. Define the terms seek time, rotational delay, and transfer time. Explain their relationship.

Seek time: the time it takes for the disk arm to move to the cylinder's position
Rotational delay: the time it takes for the sector to move into position for read/write head
Transfer time: the time/rate it takes for data to be read from the disk
It relates to each other as its the metrics for disk performance, it determines how fast the data can be accessed form the rigid disk drives

29. Suppose a disk drive has the following characteristics:

- 5 surfaces
- 1024 tracks per surface
- 256 sectors per track
- 512 bytes/sector
- Track-to-track seek time of 8 milliseconds
- Rotational speed of 7500 RPM.

a) What is the capacity of the drive?

5 x 1024 x 256 x 512
= 5 x 2^10 x 2^8 x 2^9
= 5 * 2^27
=640 MB

b) What is the access time?

Seek time 8ms
1 rotation = x sec
7500 rotation = 60 sec
7500 * x = 60
X = 60/7500
=8 ms

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8/2 =4ms
8+4 = 12 ms

33. What are the advantages and disadvantages of having a small number of sectors per disk cluster? (Hint: You may want to think about retrieval time and the required lifetime of the archives.)
Advantages: more efficient usage, storage used properly
Disadvantage: data gets large and could slow down, reduce speed, size of disk is increased

37. Explain wear leveling and why it is needed for SSDs. We said that wear-leveling is important for the continual updating of virtual memory page files. What problem does wear-leveling aggravate for page files?
Wear leveling is used to prolong different types of storage service's life. Its needed for SSD as it increases the lifetime of the SSD controller's memory. Problems for the page files is when its rewritten file metadata, leading to constant rewriting of file metadata.

41. A company that has engaged in a business that requires fast response time has just received a bid for a new system that includes much more storage than was specified in the requirements document. When the company questioned the vendor about the increased storage, the vendor said that he was bidding a set of the smallest capacity disk drives that the company makes. Why didn't the vendor just bid fewer disks?
The company's main priority is for faster response time. When data is divided to different disks, and each disk is connected to different I/O lines, the processor can fetch data easily, decreasing response time, allowing the system to be faster

48. a) Which of the RAID systems described in this chapter cannot tolerate a single disk failure? RAID - 0, if it fails, it will affect whole array of independence, leading to data corruption
b) Which can tolerate more than one simultaneous disk failure? RAID-1, RAID-2, RAID-6

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Prepare for next class by reading Chapter 8 – System Software

Continue working on Project 2

Continue working on Your Group Project