End of Chapter 10 Exercises

Due on July 21st, 2019
Computer Organization & Programming
CS550WS—Summer I
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Problem 3A. A multiplattered hard disk is divided into 1100 sectors and 40,000 cylinders. There are six platter surfaces. Each block holds 512 bytes. The disk is rotating a rate of 4800 rpm. The disk has an average seek time of 12 msec. What is the total capacity of this disk?

Solution

$$\begin{aligned}\text{Disk Capacity} &= 6 \text{ platters } \times 1100 \text{ sectors} \times 40,000 \text{ cylinders} \times 512 \text{ bytes} \\ &= 135,168,000,000 \text{ bytes} \\ &= \mathbf{135.168 \text{ Gigabytes}}\end{aligned}$$

Problem 10.4A. The average latency on a disk with 2200 sectors is found experimentally to be 110 msec. What is the rotating speed of the disk?

Solution

$$\begin{aligned}\text{Rotational Speed} &= \frac{1}{2} \text{ Average Latency} \\ &= \frac{1}{2}(110\text{ms}) \\ &= \mathbf{.004545 \text{ ms}}\end{aligned}$$

Problem I. For a display of 1920 pixels by 1080 pixels at 16 bits per pixel how much memory, in megabytes, is needed to store the image?

Solution

$$1920 \text{ pixels} \times 1080 \text{ pixels} = 2,073,600 \text{ pixels}$$

$$2,073,600 \text{ pixels} \times 16\frac{\text{bits}}{\text{pixel}} \times \frac{1 \text{ bytes}}{8 \text{ bits}} = 4,147,200 \text{ bytes}$$

$$4,147,200 \text{ bytes} \times \frac{1\text{MB}}{1,048,576 \text{ bytes}} = \mathbf{3.955 \text{ MB}}$$

Problem II. What is the average rotational latency of a hard drive rotating at 7,200 RPM or 120 revolutions per second? (Give your answer in milliseconds)

Solution

$$\begin{aligned}\text{Average Latency Time} &= \frac{1}{2} \times \frac{1}{\text{rotational speed}} \\ &= \frac{1}{2} \times \frac{1}{7200\text{rev/min} \times 1\ \text{min/60 sec}} \\ &= \frac{1}{2} \times \frac{1}{120\text{rev/sec}} = 0.00416\ \text{seconds} = \mathbf{4.167\ milliseconds}\end{aligned}$$

Problem III. What is the transfer time for a hard drive rotating at 7,200 RPM or 120 revolutions per second? Assume there are 30 sectors per track. (Give your answer in milliseconds)

Solution

$$\begin{aligned}\text{Transfer Time} &= (\text{Number of Sectors} \times \text{Rotational Speed})^{-1} \\ &= \frac{1}{30\ \text{sector/track}} \times \frac{1}{20\ \text{rev/sec}} = 0.000278\ \text{seconds} = \mathbf{0.278\ milliseconds}\end{aligned}$$