HW5.2

5.{24,28,31,37,38,39,41,44,46,53}

**24.** Why are optical storage devices inherently capable of higher data density than magnetic

storage devices? *Note*: This problem requires some knowledge of high-school

physics and how magnetic fields are generated.

Magnetic storage devices need to consider interference, optical storage devices are precise as size of the laser.

**28.** Consider a magnetic disk consisting of 16 heads and 400 cylinders. This disk has four

100-cylinder zones with the cylinders in different zones containing 160, 200, 240. and

280 sectors, respectively. Assume that each sector contains 512 bytes, average seek

time between adjacent cylinders is 1 msec, and the disk rotates at 7200 RPM. Calculate

the (a) disk capacity (160+200+240+280)\*16\*100\*512=720896000

, (b) optimal track skew

|  |  |
| --- | --- |
| zone | Skew=zone\*.12 |
| 160  200  240  280 | 19.2  24  28.8  33.6 |

, and (c) maximum data transfer rate.

280\*120\*512=17203200bytes/sec

**31.** Disk requests come in to the disk driver for cylinders 10, 22, 20, 2, 40, 6, and 38, in

that order. A seek takes 6 msec per cylinder. How much seek time is needed for

1. First-come, first served.

10, 22, 20, 2, 40, 6, 38

10 + 12 + 2 + 18 + 38 + 34 + 32 = 146 cylinders (\* 6 msec) = 876 milliseconds

1. Closest cylinder next.

20, 22, 10, 6, 2, 39, 40

0+2+12+4+4+36+2=60 cylinders = 360 milliseconds

1. Elevator algorithm (initially moving upward).

20,22,38,40,10,6,2

0+2+16+2+30+4+4=58 cylinders = 348 milliseconds

In all cases, the arm is initially at cylinder 20.

**37.** The clock interrupt handler on a certain computer requires 2 msec (including process

switching overhead) per clock tick. The clock runs at 60 Hz. What fraction of the CPU

is devoted to the clock? 2 \* 60 = 120 msec, 12%cpu

**38.** A computer uses a programmable clock in square-wav e mode. If a 500 MHz crystal is

used, what should be the value of the holding register to achieve a clock resolution of

(a) a millisecond (a clock tick once every millisecond)? 500,000

(b) 100 microseconds? 5 e^13

**39.** A system simulates multiple clocks by chaining all pending clock requests together as

shown in Fig. 5-30. Suppose the current time is 5000 and there are pending clock requests

for time 5008, 5012, 5015, 5029, and 5037. Show the values of Clock header,

Current time, and Next signal at times 5000, 5005, and 5013. Suppose a new (pending)

signal arrives at time 5017 for 5033. Show the values of Clock header, Current time

and Next signal at time 5023.

At 5000 current 5000 next 8 header 8-4-3-14-8

At 5005 current 5005 next 3 header 3-4-3-14-8

At 5013 current 5013 next 2 header 2-14-8

At 5023 current 5023 next 6 header 6-4-5

**41.** A bitmap terminal contains 1600 by 1200 pixels. To scroll a window, the CPU (or

controller) must move all the lines of text upward by copying their bits from one part

of the video RAM to another. If a particular window is 80 lines high by 80 characters

wide (6400 characters, total), and a character’s box is 8 pixels wide by 16 pixels high,

how long does it take to scroll the whole window at a copying rate of 50 nsec per byte?

If all lines are 80 characters long, what is the equivalent baud rate of the terminal?

Putting a character on the screen takes 5 sec. How many lines per second can be displayed?

79 lines of 80 char = 6320

1 char= 16 byes= 800 nsec

Window 5.056msec

80 char in 400 nsec

New line 4.9844 msec

200.626 lines/sec

**44.** The designers of a computer system expected that the mouse could be moved at a maximum

rate of 20 cm/sec. If a mickey is 0.1 mm and each mouse message is 3 bytes,

what is the maximum data rate of the mouse assuming that each mickey is reported

separately?

200 mm/sec

2000mickeys/sec

If 3 bye report, 6000 byes/sec

**46.** One way to place a character on a bitmapped screen is to use *BitBlt* from a font table.

Assume that a particular font uses characters that are 16 24 pixels in true RGB color.

1. How much font table space does each character take?

3 bytes per pixel in RGB table space 16\*24\*3=1152 bytes

(b) If copying a byte takes 100 nsec, including overhead, what is the output rate to the

screen in characters/sec? 115.2 microsec per char, 8681 char/sec

**53.** If a CPU’s maximum voltage, *V*, is cut to *V*/*n*, its power consumption drops to 1/*n*2 of

its original value and its clock speed drops to 1/*n* of its original value. Suppose that a

user is typing at 1 char/sec, but the CPU time required to process each character is 100

msec. What is the optimal value of *n* and what is the corresponding energy saving in

percent compared to not cutting the voltage? Assume that an idle CPU consumes no

energy at all.

N=10

E=1sec

Full speed for 100msec

Idle for 900msec uses E/10

1/10 Speed for 1 second = E/100

9E/100 saved

90%