COMPUTER ORGANIZATION

SOLUTIONS

1. Consider a disk drive with the following specifications: 16 surfaces, 512 tracks/ Surfaces, 256 sectors/ track and 512 Bytes/ sector. If the format overhead is 64 Bytes/ sector, what is the effective track capacity?

Solution: 112 KB

Explanation:

1 track = 256 sectors
= 256×512 Bytes

Format overhead/ track = 256×64 Bytes

So, effective track capacity = 256×512 − 256×64
= $2^8 \cdot 2^6 \cdot 7$ Bytes
= 112 KB

2. A disk drive has innermost track diameter as 28 cm with maximum recording density as 1 KB/cm. Using a R/W head the disk is rotating at 3000 RPM. What is the data transfer rate?

Solution: 4.4 KB/ ms

Explanation:

Perimeter = $\pi \times D = \frac{22}{7} \times 28$ cm = 88 cm

1 cm → 1 KB
88 cm → 88 KB

So, 1 track capacity is 88 KB

3000 rotation → 60 sec
1 rotation → $\frac{60}{3000}$sec = 20 ms
1 rotation → 1 track covers
20 ms → 88 KB
1 ms → $\frac{88}{20}$ = 4.4 KB

So, Data transfer rate is 4.4 KB/ ms.

3. A hard disk has 64 sectors/ track, 16 platters, each with 2 regarding surface and 2000 cylinders. The address of a sector is given as <c, h, s> where c → cylinder no., h → surface no., s → sector no. 0^{th} sector is addressed as <0, 0, 0>. The address <500, 20, 32> corresponds to sector number is

(a) 1025310 (b) 1025311
(c) 1025312 (d) 1025313

Solution: Option (c)

Explanation:

$500 \times 16 \times 2 \times 64 + 20 \times 64 + 32 = 1025312$

4. For the above case the address of 1051 sector is?

(a) <0, 15, 28> (b) <0, 16, 27>
(c) <0, 17, 27> (d) <0, 16, 28>

Solution: Option (b)

Explanation:

$0 + 15 \times 64 + 28 = 988$
$0 + 16 \times 64 + 27 = 1051$
$0 + 17 \times 64 + 27 = 1115$
$0 + 16 \times 64 + 28 = 1052$

5. A magnetic tape is consisting of some 16 kb blocks. Inter block gap length is 0.2 inch. The recording density is 2 KB/ inch. If the tape length is 1530 feet then what is the tape capacity?

Solution: 30.6 MB

Explanation:

Gap length $G_L = 0.2$ inch
Recording density $\rho = 2$ KB/ inch
Length of tape $L = 1530 \times 12$ inch
Block capacity $B_C = 16$ kb

$B_L = \frac{B_C}{\rho} = \frac{16\times10^3}{2\times8\times10^3} = 1$ inch

No. of blocks $= \frac{L}{B_L+G_L} = \frac{1530\times12}{1+0.2} = 15300$

Capacity of tape = no. of blocks × B_C
= 15300 × 16 kb
= 30.6 MB

6. A device has been used in cycle stealing mode of DMA. A word of 4 bytes can be transferred when it is available. The memory cycle time is 40 ms and CPU is idle for 10% of its time. What is the data transfer rate of the device?

Solution:11.11 B/ sec

Explanation:

If x is data transfer time and y is memory cycle time
Then, % CPU idle = $\frac{y}{x+y} \times 100 = 10$
y = 40 ms

So, $\frac{40}{x+40} \times 100 = 10$
⇨ 400 = x + 40
⇨ x = 360 ms

360 ms → 4 B
1 ms → $\frac{4}{360}$ B
1 sec→ 11.11 Byte

Data transfer rate is 11.11 B/ sec.

7. A synchronous transmission T has transfer rate of 100 char/ sec. If T uses some synchronous characters followed by some 8 bit info characters, what is the total number of synchronous bits required where bit rate is 1000 bits/ sec?

Solution: 200 bits

Explanation:

Let total no. of synchronous bits required = x

$\therefore \frac{1000 - x}{8} = 100$

$\Rightarrow x = 200$ bits