Q.1) Max Marks: 1

The unix i node holds 8 direct disk block address a single indirect and double indirect disk block addresses. if the disk blocks are accessible with 16 bits and disk block offset is 12 bits. the maximum file size supported is (IN TERMS OF GB)??

A 4GB

B 8GB

C 16GB Correct Option

Solution: (C)

8 Direct Disk Blocks
Single Indirect
Single, double indirect disk block
DBA: 16 bits= 2B
DB size = 2^{12}B = 4KB
Maximum File size will be
no. of addresses per block = 4KB/2B = 2K
Max file size, when file is stored on single, double indirect disk block= $2^{11}*2^{11}$ * 4KB = $2^{22}*2^{12}$ B = 2^{34}B = 16GB
One indirect disk block =1*2^{11}*4KB = 8MB
8 direct disk blocks= 8*4KB =32KB
Total file size = 16GB+8MB+32KB =16.008GB =16GB (Approximately)

D 32GB

Q.2) Max Marks: 1

The set of tracks that are at one arm position make up a _____

A **magnetic disks**

B **electrical disks**

C **assemblies**

D **cylinders** Correct Option

Solution: (D)

A cylinder consists of the set of tracks that are at the same head position on the disk

Q.3) Max Marks: 1

A file system with 8 direct block address. 1 indirect block address and 1 doubly indirect block address. The size of each disk block is 256 Bytes and the size of each disk block address is 16 Bytes. The maximum possible file size in this file system in terms of KB(Approximately) is_____

Correct Answer

Solution: (70)

No. of block pointers in a block: 256B/16B = 16
Direct blocks size: 8*256B
Singly indirect block size: 1*16*256B
Doubly indirect block size: 1*16*16*256B
Maximum possible size: 8*256B + 1*16*256B + 1*16*16*256B ≈ 70KB

Q.4) Max Marks: 1

Consider a UNIX file system with 10 direct pointers, 1 indirect pointer, 1 double-indirect pointer, and 1 triple-indirect pointer in the i-node. Assume that disk blocks are 4K bytes and that each pointer to a disk block requires 4 bytes. Assume that the operating system has already read the i-node for your file into main memory (i.e., the file buffer cache). How many disk reads are required to read data block number 800 into memory?

A 1

B 2 Correct Option

Solution: (B)
Data-block number 800 will fall in the set of blocks accessible from the indirect block (blocks 10 - 1033). One disk read is required to read the indirect block and one disk read is required to read the actual data, for a total of two disk reads.

C 3

D 4

Q.5) Max Marks: 1

A disk has 200 tracks (numbered 0 through 199). At a given time, it was servicing the request of reading data from track 120, and at the previous request, service was for track 85. The pending requests (in order of their arrival) are for track numbers.
30 70 115 130 110 80 20 25.
How many times will the head changes its direction for the disk scheduling policies SSTF(Shortest Seek Time First) and FCFS (First Come First Serve)?

A 2 and 3

B 3 and 3

C 3 and 4 Correct Option

Solution: (C)
SSTF:
(85) 120 115 110 130 80 70 30 25 20
Direction changes at
120,110,130
FCFS:
(85) 120 30 70 115 130 110 80 20 25
direction changes at
120,30,130,20

D 4 and 4

Q.6) Max Marks: 1

Suppose we have a magnetic disk (resembling an IBM Microdrive) with the following parameters:

Average seek time	12 ms
Rotation rate	3600 RPM
Transfer rate	3.5 MB/second
# sectors per track	64
Sector size	512 bytes
Controller overhead	5.5 ms

The average time to read a single sector is_____ (Up to 2 decimal places)

Correct Answer

Solution: (25.97)
Disk Access Time = seek time + rotational delay + transfer time + controller overhead =
$12 + (0.5*60*10^3/3600) + (512/(3.5*2^{20}))*1000 + 5.5 = 25.97$ ms

Q.7) Max Marks: 1

An engineer has designed a FAT-like system and he has used 24 bits for each entry. For a 32-GB disk, what is the minimum size of a file allocation in this system?

A 1KB

B 2KB Correct Option

Solution: (B)
A 32 GB disk has 2^35 bytes of storage; if each entry in the FAT has 24 bits, then there can be at most 2^24 allocation chunks (one per FAT entry), so each allocation chunk must be 2^11 bytes = 2KB

C 3KB

D None of these

Q.8) Max Marks: 1

Consider a file system with 4096 byte blocks and 32-bit disk and file block pointers. Each file has 13 direct pointers, 4 singly-indirect pointers, a doubly-indirect pointer, and a triply-indirect pointer. The maximum disk size and the number of i-nodes that can fit in a single block are..... and ..... respectively.

A 2^{44} and 53 Correct Option

Solution: (A)
Since block pointers are 32 bits, total size = $2^{32} \times 4096 = 2^{44}$ bytes. bytes maximum.
An inode has 13 + 4 + 1 + 1 = 19 pointers = 19 × 32 bits = 76 bytes.

Hence, the number of inodes per block = ⌊4096/76⌋ = 53.

B 2^{32} and 53

C 2^{44} and 52

D None of these

Q.9) Max Marks: 1

Consider a disk queue with request for input/output to block cylinders 98, 183, 37, 122, 14, 124, 65, 67 in that order. Assume that disk head is initially positioned at cylinder 53 and moving towards cylinder number 0. The total number of head movements using SCAN algorithm is _____

Correct Answer

Solution: (236)

Acc to SCAN 53 to 37 then to 14 and then to 0 (16+23+14=53) now direction will be reversed so 0 to 65 then to 67 then to 98,122,124,183 (65+2+31+24+2+59=183)total head movements=183+53=236

Q.10) Max Marks: 1

Disk requests are received by a disk drive for cylinders 5, 25,18, 3, 39,8 and 35 in that order. A seek takes 5 ms per cylinder moved. The seek time required to serve these requests if serviced by SSTF (Shortest seek time first) disk scheduling algorithm. Assume that the arm is at cylinder 20 when the last of these requests is made with none of these requests are yet served.

Correct Answer

Solution: (295)

Disk requests are 5, 25,18, 3, 39,8 and 35
Initially disk arm is at the cylinder 20 and we are using SSTF, header move towards the nearest cylinder 18.
Order: (20), 18, 25, 35, 39, 8, 5, 3
Seek : 2+7+10+4+31+3+2 = 59 cylinders.
Each seek takes 5ms per cylinder = 59*5 = 295ms.

Q.11) Max Marks: 1

What is the average time to read or write a 512-byte sector for a typical disk rotating at 7200 RPM? The advertised average seek time is 8ms, the transfer rate is 20MB/sec, and the controller overhead is 2ms. Assume that the disk is idle so that there is no waiting time.

Correct Answer

Solution: (14.17)

Disk Access Time = seek time + rotational delay + transfer time + controller overhead =
8 + (0.5*60*1000/7200) + (512/20*2^{20})*1000 + 2 = 14.17 ms

Q.12) Max Marks: 2

Consider the following information.
Assume that there are 10 direct pointers to data blocks, 1 indirect pointer, 1 double indirect pointer, and 1 triple indirect pointer. Assume that the size of the data blocks is 1024 bytes = 1Kb, i.e., BlockSize = 1Kb.
Assume that the block numbers are represented as 4 byte unsigned integers, i.e., BlockNumberSize = 4b.
Some data blocks are used as index blocks. They store 1024 bytes / 4 bytes/entry = 256 entries
Then Maximum number of bytes addressed by double indirect pointer and Maximum number of bytes addressed by triple indirect pointer is

A **64Mb and 16Gb** Correct Option

Solution: (A)

Maximum number of bytes addressed by double indirect pointer is
= NumberOfEntries^2 * BlockSize
= (Block Size / BlockNumberSize)^2 * BlockSize
= (1Kb / 4b)^2 * 1Kb
= (2^10 / 2^2)^2 * (2^10b)
= (2^8)^2 * (2^10)b
= (2^16) * (2^10)b
= 2^6 * 2^20 b
= 64 Mb
Maximum number of bytes addressed by triple indirect pointer is
= NumberOfEntries^3 * BlockSize
= (Block Size / BlockNumberSize)^3 * BlockSize
= (1Kb / 4b)^3 * 1Kb
= (2^10 / 2^2)^3 * (2^10b)
= (2^8)^3 * (2^10)b

= (2^24) * (2^10)b
= 2^4 * 2^30 b
= 16 Gb

B **16Mb and 4Gb**

C **32Mb and 8 Gb**

D **None of these**

Q.13) Max Marks: 2

Consider a UNIX file system with 10 direct pointers, 1 indirect pointer, 1 double-indirect pointer, and 1 triple-indirect pointer in the i-node. Assume that disk blocks are 4K bytes and that each pointer to a disk block requires 4 bytes. What is the largest possible file that can be supported with this design approximately in terms of TB(Terabytes).

Correct Answer

Solution: (4)

Each direct pointer points to 4KB of data, for a total of 10*4KB.
The indirect pointer points to an indirect block that contains pointers to data. The indirect block is a 4KB block filled with 4-byte pointers, for a total of 1024 pointers. Thus, the indirect pointer can refer to 1024*4KB of data.
Similarly, the double-indirect pointer points a double-indirect block containing 1024 pointers to indirect blocks, each of which points to 4KB*1024 for a total of 1024*1024*4KB of data.
Finally, the triple-indirect pointer refers to 1024*1024*1024*4KB.
The total data is thus 10*4KB + 1024*4KB + 1024*1024*4KB + 1024*1024*1024*4KB.
40KB+4MB+4GB+4TB ≈ 4.004 TB (Approximately)

Q.14) Max Marks: 2

A disk pack has 19 surfaces and storage area on each surface has an outer diameter of 33 cm and inner diameter of 22 cm. The maximum recording storage density on any track is 200 bits/cm and minimum spacing between tracks is 0.25 mm. Calculate the capacity of disk pack.

A **6.42 MB**

B **6.88 MB** Correct Option

Solution: (B)

Given-
Number of surfaces = 19
Outer diameter = 33 cm
Inner diameter = 22 cm
Maximum recording density = 200 bits/cm
Inter track gap = 0.25 mm

Number of tracks on each surface
= (Outer radius – Inner radius) / Inter track gap
= (16.5 cm – 11 cm) / 0.25 mm
= 5.5 cm / 0.25 mm
= 55 mm / 0.25 mm
= 220 tracks

Capacity of each track
= Maximum recording density x Circumference of innermost track
= 200 bits/cm x (3.14 x 22 cm)
= 200 x 69.08 bits
= 13816 bits
= 1727 bytes

Capacity of disk pack
= Total number of surfaces x Number of tracks per surface x Capacity of one track
= 19 x 220 x 1727 bytes
= 7218860 bytes
= 6.88 MB

C **3.79 MB**

D **None of these**

Q.15) Max Marks: 2

A certain moving arm disk storage with one head has the following specifications-
Number of tracks per surface = 200
Disk rotation speed = 2400 RPM

Track storage capacity = 62500 bits
Average latency = P msec
Data transfer rate = Q Mbits/sec
What is the value of P and Q?

A 12.5 and 2.5 Correct Option

Solution: (A)

Given Number of tracks per surface = 200
Disk rotation speed = 2400 RPM
Track storage capacity = 62500 bits

Time Taken For One Full Rotation= (60 / 2400) sec = (1 / 40) sec
= 0.025 sec = 25 msec
Average latency or Average rotational latency
= 1/2 x Time taken for one full rotation
= 1/2 x 25 msec
= 12.5 msec

Data transfer rate
= Number of heads x Capacity of one track x Number of rotations in one second
= 1 x 62500 bits x (2400 / 60)
= 2500000 bits/sec
= 2.5 x 10^6 bits/sec = 2.5Mbps

Thus, P = 12.5 and Q = 2.5Mbps

B 25 and 2.5

C 12.5 and 4

D None of these

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