DPP - 01

CS & IT

Operating System

File System

Q1 A particular disk unit uses a bit string to record the occupancy or vacancy of its disk blocks with '0' denoting occupied block and '1' denoting vacant block. A 32-bit part of this string has Hexadecimal value of AC0121DE. The percentage of occupied blocks on the disk for this part is ____ % (rounded to 1 decimal place)?

Q2 A system directory is kept in 2 disk blocks each of size 4Kbytes. It is a single level-directory and each directory entry is of size 64-bits. The maximum number of files possible in this system is _____k?

Q3 The index node (inode) of a unix-like file system has 10 direct, one single-indirect, one double-indirect and one triple-indirect pointer. The disk block size is 2KB and disk block addresses 64-bits. The maximum possible file size (rounded off to nearest integer) is _____ GB?

Q4 Consider a file which is stored on disk with either contiguous file allocation method or linked file allocation method or indexed file allocation method. The file is stored on 100 blocks. Which of the following will take minimum number of disk block accesses of the file for insertion of a new block?

(A) Insertion of a new block at starting if file is stored using contiguous file allocation method.

(B) Insertion of a new block after 50th block of file if file is stored using linked file allocation method.

(C) Insertion of a new block in the end if file is stored using indexed file allocation method.

(D) Insertion of a new block in the end if file is stored using contiguous file allocation method.

Q5 Consider a disk with 6 platters each with 2 recording surfaces and 100 cylinders (numbered as 0, 1, 2 ...., 99). The following 6 disk requests (for cylinder number) are received by disk controller at the same time:
61, 88, 23, 37, 12, 93
Currently the head is positioned at cylinder number 50 and is moving towards higher cylinder numbers. The average seek time in moving head over 3 cylinder is 2 milliseconds and for reversing the direction of the head once is 5 millisecond. The total seek time to satisfy all the above requests using the Shortest seek time first disk scheduling algorithm is _____?

Q6 Consider a disk with 60 cylinders (numbered 0, 1, 2 ....59). Disk requests are made for a disk drive for cylinders 5, 25, 18, 3,39, 8 and 35 in that order. Assume that the arm is current at cylinder 20 and moving towards higher cylinder numbers. The above all requests are serviced using scan algorithm. The number of head movements are _____?

Answer Key

Q1	59.4
Q2	1
Q3	32
Q4	C, D
Q5	104
Q6	95

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

A = 1010, hence number of '0' in A = 2
C = 1100, hence number of '0' in C = 2
0 = 0000, hence number of '0' in 0 = 4
1 = 0001, hence number of '0' in 1 = 3
2 = 0010, hence number of '0' in 2 = 3
1 = 0001, hence number of '0' in 1 = 3
D = 1101, hence number of '0' in D = 1
E = 1110, hence number of '0' in E = 1

Total number of 0s = 2 + 2 + 4 + 3 + 3 + 3 + 1 + 1
= 19
% of occupied blocks = (19/32) ×100% = 59.375
= 59.4 %

Q2 Text Solution:

Space available to store directory = 2 × 4 Kbytes
= 8 K bytes
One directory entry size = 64 bits
= 8 bytes
Number of directory entries which can be stored = 8kbytes / 8 bytes
= 1 K
Hence maximum number of files stored = 1k

Q3 Text Solution:

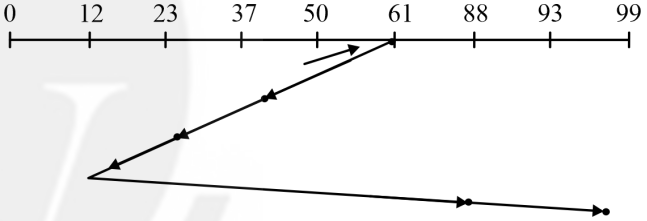
One disk address size = 64 bits
= 8 bytes
Number of disk addresses can be stored per block = 2KB / 8 bytes
= 256
= 2^8
Maximum size of file = (10 × 2KB) + (2^8 ×2KB) + (2^8 ×2^8 × 2KB) + (2^8 × 2^8 × 2^8 × 2KB)
= 20KB + 512KB + 128MB + 32GB
= 32GB

Q4 Text Solution:

If insertion is done in starting with contiguous file allocation method, then all existing blocks of file should be shifted hence block access will be more.
If insertion is done in middle with linked allocation, then to reach to 50^{th} block, sequential access will need more block accesses.
Insertion in indexed file allocation method will take only 1 block access which is the new block to be inserted.
Insertion at the end in contiguous file allocation method will take only 1 block access which is the new block to be inserted.

Q5 Text Solution:

The given requests are fulfilled as follows:



Total number of cylinder movements = (61-50) + (61-37) + (37-23) + (23-12) + (88-12) + (93-88)
= 141
Direction changed 2 times, one at 61 and one at 12.
Hence total seek time = (141 × (2/3)) + (2×5)
= 104ms

Q6 Text Solution:

The requests are serviced in the following order:
20 25 35 39 59 18 8 5 3
Total head movements = (59 – 20) + (59 – 3)
= 39 + 56
= 95