Example 1

Suppose, for instance, that we want to store a **file** with **fifty thousand** fixed-length data records on a small disk with the following characteristics:

Number of bytes per sector = 512 bytes

Number of sectors per track = 63 sectors

Number of tracks per cylinder = 16 tracks

Number of cylinders = 4092 cylinders

How many cylinders does the file require if each data record requires 256 bytes? Since each **<u>sector can hold two records</u>**.

- the file requires = 50.000 / 2 = 25.000 sectors.
- **One Cylinder can hold** = Number of sectors per track* Number of tracks per cylinder= 63 sectors * 16 tracks = 1008 sectors.
- **cylinder required is approximately** = 25.000 / 1008 ~= 24.8 cylinders.

Example 2

Each group of records are collected together in one block, physically the data are transferred as group of sectors, so to get efficient use of the disk space the block size must contains certain number of sectors,

for example, we will see the following system: -

record length = 160 bytes

sector length = 256 bytes

number of records per block = 3 OR (blocking factor = 3)

number of sectors per block = 2

storage efficiency = (R*B) / (S*N) = 160 * 3 / 256 * 2 = 94 %

Example 3

Calculate the storage efficiency for the following: -

a) block length =2400-byte, density = 800 bpi, IRG = 0.75

b) block length =240-byte, density = 1600 bpi, IRG = 0.5

c) block length =1600-byte, density = 6250 bpi, IRG = 0.6

Answer:

a) The block size = block length + IRG

IRG = interior record

The block size = 2400 + 800 * 0.75 =

2400 + 600 = 3000 byte

Storage Efficiency = (2400 / 3000) *100 = 80%

b) The block size = block length + IRG

The block size = 240 + 1600 * 0.5 =

240 + 800 = 1040 byte

Storage Efficiency = (240 / 1040)*100 = 23.08 %

c) The block size = block length + IRG

The block size = 1600 + 6250 * 0.6 =

1600 + 3750 = 5350 byte

Storage Efficiency = (1600/5350)*100= 29.9%

and Calculate the number of bytes that can be stored on 2400 feet reel of magnetic tape for each of the tape files of the previous problem

<u>Answer:</u>

a) No of Inches = 2400 *12 = 28, 800 inches

Size of Data (bit) = 28,800 * 800 = 23,040,000 bit

Size of Data (byte) = 23,040,000 / 8 = 2,880,000 byte

Actual Data Size = 2,880,000* 0.8 = 2,304,000 byte

b) No of Inches = 2400 * 12 = 28,800 inches

Size of Data (bit) = 28,800 * 1600 = 46,080,000 bit

Size of Data (byte) = 46,080,000 / 8 = 5,760,000 byte

Actual Data Size = 5,760,000 * 0.2308 = 1,329,408 byte

c) No of Inches = 2400 * 12 = 28,800 inches

Size of Data (bit) = 28,800 * 6250 = 180,000,000 bit

Size of Data (byte) = 180,000,000 / 8 = 22,500,000 byte

Actual Data Size = 22,500,000 * 0.299 = 6,727,500 byte

Example 4

for an hp disk drive that has the following data : 256 bytes / sector , 64 sector /track , 9 surface /per disk pack , 815 track / surface

How many bytes of data can be stored on?

One track, one cylinder, one surface, one disk pack?

Answer:

The Data to be stored in one track = 64*256 =16,384 bytes

The Data to be stored in one cylinder = 64*256 *9 = 147,456 bytes

The Data to be stored in one surface = 64*256 *815 = 13,352,969 bytes

The Data to be stored in one disk = 64*256 *815*9 = 120,176,640 bytes

Example 5

find the most efficient blocking factor for each of the following files: sector size 256 , block size between 2560 to 3840 :

A. record =400,

Answer:

A) to get the most efficient blocking factor we calculate as in the following table: -

First : calculate the minimum block size =2560 /400 = 6.4 = 6

- **maximum block size = 3840 /400 = 9.6 = 9**

The blocking factor	The logical block size	Number of sectors in block	The physical block size	The storage efficiency
6	**2400**	**10**	**2560**	**93.75%**
7	**2800**	**11**	**2816**	**99.43%**
8	**3200**	**13**	**3328**	**96.15%**
9	**3600**	**15**	**3840**	**93.75%**

The Maximum Storage efficiency = 99.43%

The most efficient blocking factor is (7) which is belonging to the storage efficiency = 99.43%

Example 6

Calculate the size in bytes of a bit map file of 10000 record , is it sized object to hold in memory while the file is open?

Answer:

The size = 10000 /8 = 1250 byte

Yes , it is sized object to hold in memory while the file is open.

Example 7

Modify the grade out function for the fixed length student records file so that the reports are produced in alphanumeric order by name using algorithm 3.7 in place of 3.4 . Determine the increase of physical access as function of N, B?

Function	**Algorithm**	**Physical access / record**	**Number of records**	**Multiplication**	**Total**
Grades out	3.7	N/B	N	1	N^2/B

The increase of physical access = N3/B - N/B

$$= N/B * (N^2-1)$$

Example 8

Calculate the most efficient blocking factor for each of the following files for a sector size of 256 bytes and lower and upper limits of 2500 and 5000 bytes :

- **Fixed length student record file**
- **Variable length student record file**
- **Enrollment file**

Answer:

1-Fixed length student record file:

The record size = 735

The lowest blocking factor =2500 / 735= 3.4= 3

The highest blocking factor =5000/ 735= 6.8 = 6

Blocking factor	Logical block size	Sectors per block	Physical block size	Storage efficiency %
3	2205	9	2304	95.7%
4	2940	12	3072	95.7%
5	3675	15	3840	95.7%
6	4410	18	4608	95.7%

The storage efficiency is 95.7% for blocking factors from 3 to 6

2- Variable length student record file:

The file size = 475

The lowest blocking factor =2500 / 475= 5.2=5

The highest blocking factor =5000/ 475= 10.5 =10

Blocking factor	Logical block size	Sectors per block	Physical block size	Storage efficiency %
5	2375	10	2560	92.77 %
6	2850	12	3072	92.77 %
7	3325	13	3328	99.90%
8	3800	15	3840	%98.95
9	4275	17	4352	%98.23
10	4750	19	4864	%97.65

The storage efficiency is 99.90% for blocking factors =7

Example 9

Calculate the time required for each function of the fixed length student record file design for N= 5000 . Assume an average access time of 50 millisecond, B=4.

Answer:

Number of accesses for registration = N/B=5000/4 = 1250

Time= 1250 *50 /1000 =62.5

=1 minute 2.5 second

Number of accesses for change = $N^2/2*B + N$

Example 10

Write an algorithm for a file with fixed length records that implement the READ-DIRECT operation . Include the reading of the block into the buffer using the READBLOCK(j) operation described in 4.1 and the moving of the selected record form the buffer to the user's work space . Assume a file of N records , each of length l with blocking factor B

Answer:

The algorithm:-

Found = false

For i =1 to n/b do begin

Read block (i)

For j= 1 to b do begin

If rec (j) = rec then found = true

End

Example 11

Why magnetic tape is not an appropriate medium for relative file. Is it possible to implement relative file on magnetic tape?

Answer:

Magnetic tape is not an appropriate medium for relative file because the relative file has the ability to access records directly without having read the previous records . Yes it is possible to implement relative file on magnetic tape with some software.

Example 12

Why are the three constraints imposed on the ordered relative file more of a problem with disk files than with tape files?

Answer:

In case of the magnetic tape file the records are stored in sequence (records are ordered), but in case of disk file the records are stored in distributed manner on the disk.

Example 13

Another form of tree search that is possible with the ordered relative file is a “ternary search “ instead of one record , mid-way between him and lo being examined , two records are probed , one a third of the way from hi to lo and the other two thirds of the way between them :

a) Show that the ternary search requires fewer iterations than the binary search by calculating the number of iterations required for the worst case.

b) Explain why the ternary search is not as efficient as the binary search in spite of the results of part (a).

Answer:

a. Ternary search will require number of searches in the order of $\log_3 (N)$, so number of iterations will be fewer than in case of binary search.

b. Efficiency of ternary search is less than that of binary search because it does not define single record for the result of search, it defines two records.

Example 14

Why is it necessary that records not be removed by flagging as empty if the binary search is to be used with a file ?

Answer:

It is necessary that records not be removed by flagging as empty if the binary search is to be used, because in binary search we need to read all records with all keys.

Example 15

How many index levels for the indexed sequential files with the following parameters ? Assume no binding between the file and medium. All sizes in bytes

	Record size	Block size	Key size	Pointer size	No of records
a)	100	1000	38	4	100,000
b)	100	1000	48	4	100,000
c)	400	1200	30	2	4,000
d)	400	1200	30	2	6,000
e)	400	400	30	2	6,000

Answer:

b= number of index entries per node (index blocking factor)

L= total size of each block

K= length of one key field

P= length of one pointer field

The numbers of entries $b <= L \div (K + P)$

The number of entries $k >= \log_b (M)$

a) $b = 1000/(38 + 4) = 23.8$

$k = \log_{23.8}(10000) = 2.9$

The number of levels is 3 levels

b) $b = 1000/(48 + 4) = 19.23$

$k = \log_{19.23}(10000) = 3.12$

The Number of levels is 4 levels

c) $B = 1200\backslash 32 = 37.5$

$K = \log_{37.5}(1334) = 2$

The Number of levels is 2 levels

d) $B = 1200\backslash 32 = 37.5$

$K = \log_{37.5}(2000) = 2.1$

The Number of levels is 3 levels

e) $B = 400\backslash 32 = 12.5$

$K = \log_{12.5}(6000) = 3.45$

The Number of levels is 4 levels

Example 16

for each of the files in problem 6.1 calculate the number of physical access for :

A) Binary search

<u>Answer:</u>

a) Binary search log2 (m)

Log 2(10000) = 13.9

Number of search = log23.8 (10000) =2.9

b) Binary search = log2 (10000) =13.9

Number of search = log19.23 (10000) = 3.12

c) Binary search = log2 (1334) =10.4

Number of search = log37.5 (1334) = 2

log10 (100000) = 5 , log10 (23.8) =1.37

log10 (100000) = 5 - 1.37 = 3.63

log10 (23.8)

log23.8 (100000) = 23.8 X

<u>Part 2:</u>

a) Number of physical access for binary search = log2 (N/B) = log 2(10000) = 13.3

Number of physical for tree search =log 23.8(N/B) =

Log 23(10000) = 2.9

b) Number of physical access for binary search

= log 2(N/B) = log 2(10000) = 13.3

Number of physical for tree search =

= log 19.23(N/B) = log 19.23(10000) = 3.12

Example 17

Consider a file of N = 10,000 records , r= 160 bytes Key field = 16 bytes and pointers are = 4 bytes long , The machine has 1000 bytes per sector, 24 sector per track ,12 tracks per cylinder , and total of 815 cylinder with blocking factor of 6 will yield a storage factor of 93.8 % and block size = four sectors or 1024 byte .

Answer:

The Number of cylinders is

cyl = blks÷(BPT x TPC - IBPC)

blks = number of data blocks in one file

BPT = number of blocks in one track

TPC = number of track per cylinder

IBPC = number of index blocks per cylinder

Where:

blks = 10000/6=1667 blks

BPT = 24/1 = 24

TPC = 12

IBPC = 12+1=13

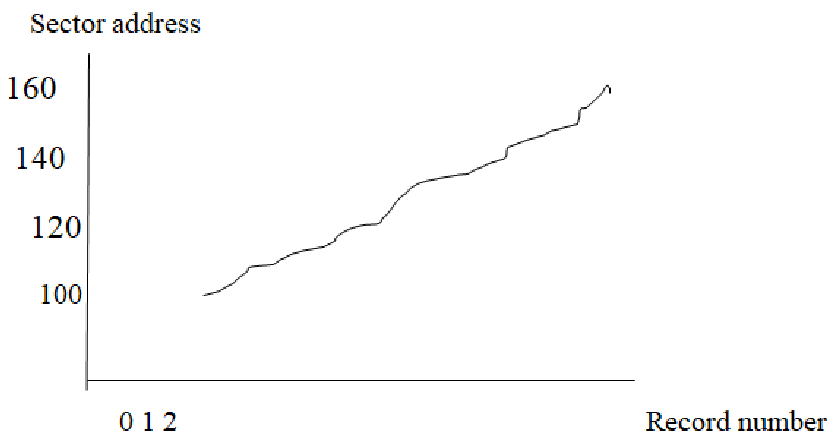
Cyl= (1667)/ (24*12-13) = 6.061= 7 CYLINDER

The Number of cylinders= 7 cylinder

The Physical size = 7 * 12 * 24 * 1000 = 2 016 000

The Logical size = 160 * 10000 = 1 600 000

The Efficiency = 1 600 000 /2 016 000= 79%



B= 4, SPB=10, FA=100