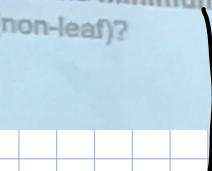


R-TREE

Assume we have a file of 170.000 records, each of them of size 200 bytes, 20 of which are used for the key field. Each block is of size 1024 bytes. A block pointer is of size 4 bytes.

If we use a B-tree and assume that blocks in the file are filled to the minimum, how many blocks are used for the main file (leaf) and how many for the index file (non-leaf)?
How much is the cost of search in this case?



blocks intermedi pgn, cn po -+ della metà

foglie riempite al max, l resto al mn.

$$N^{\circ} \text{Raddi Fogli} = N^{\circ} \text{BF}$$

$$\text{Rec per Blk} = \frac{\text{Blk Size}}{\text{Rsize}} = \frac{1024}{200} = 5$$

$$\text{Tot Blks file principale (Tot Blk/M)} = \left\lceil \frac{N^{\circ} \text{Record}}{\text{Rec per Blk}} \right\rceil = \frac{170000}{5} = 34000$$

$$N^{\circ} \text{Keys} \leq \frac{\text{Blk Size} - \text{Psize}}{\lfloor \text{Psize} + ksize \rfloor} = \begin{array}{l} \text{SF VO Glc HEMPIRE L' ALBSE} \\ \text{AL MAX la PERC VOLATILE L' ALBSE} \\ \text{AL MN.} \end{array}$$

$$d = \left\lceil \frac{(\text{Blk Size} / 2) - \text{Psize}}{\text{Psize} + ksize} \right\rceil = \frac{512 - 4}{4 + 20} = \frac{508}{24} = \underbrace{22 + 1}_{23} = 23$$

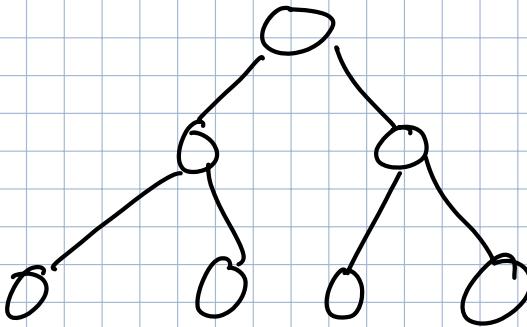
poiché deve essere pari + di uno

Lv 0 $\frac{34000}{23} = 1478$

Lv 1 $\lceil \frac{1478}{23} \rceil = 65$

Lv 2 $\lceil \frac{65}{23} \rceil = 3$

Lv 3 $\lceil \frac{3}{23} \rceil = 1$



Total Blk F = $1478 + 65 + 3 + 1 = 1545$

If cost of 1 level = 5

?

Assume we have a file of 170.000 records, each of them of size 200 bytes, 20 of which are used for the key field. Each block is of size 1024 bytes. A block pointer is of size 4 bytes.

If we use a B-tree and assume that blocks in the file are filled to the maximum, how many blocks are used for the main file (leaf) and how many for the index file (non-leaf)? How much is the cost of search in this case?

$$N_{key/max} = \frac{\lceil \frac{BkSize - Psize}{Psize + ksize} \rceil}{\lceil \frac{1020}{24} \rceil} = 43$$

Lv 0 $\frac{34000}{43} = 791$

Lv 1 $\lceil \frac{791}{43} \rceil = 18$

$$\text{Iuv 2} \quad \frac{\lceil \log_2 7917 \rceil}{43} = 19$$

$$\text{Iuv 3} \quad \frac{\lceil \log_2 187 \rceil}{43} = 1$$

$$\text{Cost}_0 = 4 = n^0 \text{ Iuv}$$

Q3 ISAM

2)

Assume we have a file of 1.750.000 records, each of them of size 130 bytes, 35 of which for the key. A block pointer is of size 5 bytes, blocks are of size 2048 bytes. By using an ISAM index and assuming that each block for data is fully occupied:

- 1 How many blocks are used for the main file?
- 2 How many blocks are used for the index file?
- 3 What is the maximum number of accesses needed to find a record, using binary search on the index file?

$$\text{Blk Size} = 2048$$

$$\text{Record} \times \text{Blk} = \left\lceil \frac{\text{Blk Size}}{\text{R Size} + \text{key size}} \right\rceil = \left\lceil \frac{2048}{5 + 35} \right\rceil = \left\lceil \frac{2048}{40} \right\rceil = 51$$

$$\text{Record} \times \text{Blk} = \left\lceil \frac{\text{Blk Size}}{\text{R size}} \right\rceil = \left\lceil \frac{2048}{130} \right\rceil = 16$$

$$1) \text{Total Blk} = \frac{\lceil N \rceil}{\text{R} \times \text{Blk}} = \frac{\lceil 1750000 \rceil}{16} = 116667$$

$$2) \text{No Blk Index} = \frac{\lceil \text{Total Blk} \rceil}{\text{Record} \times \text{Blk}} = \frac{\lceil 116667 \rceil}{51} = 2288$$

$$3) \text{Total Access} = \log_2 (\text{No Blk Index}) + 1 = \log_2 (2288) + 1 = 12 + 1 = 13$$

Q @ HASH

- 3) Consider a file with 145500 records, each of them of size 400 bytes. A block is of size 2048 bytes. A block pointer is of size 4 bytes. We are using a HASH organization with records being uniformly distributed in 250 buckets.
- Compute how many blocks are needed for the bucket directory and for a single bucket
 - Compute the average cost of a search, assuming unique hash keys
 - How many buckets are needed to have average cost for search being less or equal 20 seconds?

$$2a \frac{\text{Recd} \times \text{Rblk}}{(\text{Rblk})} = \frac{\text{Blk Size}}{\text{Record Size}} = \left\lceil \frac{2048}{400} \right\rceil = 512$$

$$n^o \text{ Block, per Bucket} = \frac{\lceil N^o \text{ Bucket} \rceil}{\text{Rblk}} = \frac{250}{512} = 1$$

$$\text{Block, per Bucket} = \frac{\lceil \frac{\text{Recd} \times \text{Bucket}}{\text{Record} \times \text{Blocks}} \rceil}{512} = 117$$

$$\text{Record} \times \text{Blocks} = \frac{\text{Blk Size} - \text{pointer Size}}{\text{Record Size}} = \left\lceil \frac{2048 - 4}{400} \right\rceil = 5$$

$$\text{Record} \times \text{Bucket} = \frac{\lceil N^o \text{ Record} \rceil}{N^o \text{ Bucket}} = \frac{145500}{250} = 582$$

Assume Block dr in Main. mem.

$$\text{Avg Time} = \frac{\lceil \text{Block, per Bucket} \rceil}{2} = \frac{117}{2} = 59$$

3c

$$\frac{\text{Block, per Bucket}}{2} \leq 20 = \text{Block, per Bucket} \leq 40$$

$$\frac{\text{Record} \times \text{Block}}{2} \leq 40$$

Lac x Blok

$$\frac{Lac \times Blk}{S} \leq 40 = Lac \times Blk \leq 200$$

$$\frac{N^{\circ}_{\text{page}}}{N^{\circ}_{\text{Bucket}}} \leq 200$$

$$145500 \leq 200 \cdot N^{\circ}_{\text{Bucket}}$$

$$N^{\circ}_{\text{Bucket}} \geq \lceil \frac{145500}{200} \rceil = 725 + 3 = 728$$

FORMULE 3° ESERCIZIO Base d. Dati

- Hash

$$\text{Record} \times \text{Blocco} = \left\lfloor \frac{\text{Block Size}}{P_{size}} \right\rfloor$$

$$N^o \text{ Blocc.} \times \text{Bucket} D_r = \frac{\lceil N^o \text{ Bucket} \rceil}{\text{Record} \times \text{Blocco}}$$

$$\text{Blocc.} \times \text{Bucket} = \frac{\lceil \frac{\text{Record} \times \text{Bucket}}{\text{Record} \times \text{Blocco}} \rceil}{2}$$

$$\text{Record} \times \text{Blocco} = \left\lfloor \frac{\text{Block size} - \text{Point size}}{\text{Record size}} \right\rfloor$$

$$\text{Record} \times \text{Bucket} = \frac{\lceil N^o \text{ Record} \rceil}{N^o \text{ Bucket}}$$

$$\text{Avg Time} = \frac{\lceil \text{Blocc.} \times \text{Bucket} \rceil}{2}$$

- ISAM

$$\text{Record} \times \text{Blocco Index} = \left\lfloor \frac{\text{Block size}}{\text{Pointer size} + \text{key size}} \right\rfloor$$

$$\text{Record} \times \text{Blocco} = \left\lceil \frac{\text{Block size}}{\text{Record size}} \right\rceil$$

$$\text{Total Blck Main} = \frac{\lceil N^o \text{ Record} \rceil}{\text{Record} \times \text{Blocco}}$$

$$\text{Total Block Index} = \frac{\lceil \frac{\text{Total Block Main}}{\text{Record} \times \text{Block Index}} \rceil}{\lceil \frac{\text{Record} \times \text{Block Index}}{\text{Record}} \rceil}$$

$$T_{Access} = \log_2 (\text{Total Block Index}) + 1$$

B-Tree

$$\text{Rec per Block} = \frac{\text{Blk Size}}{\lfloor \frac{\text{Rec Size}}{\text{Blk Size}} \rfloor}$$

$$\text{Total Block file Pmapd} (\text{Tot Blk}, M) = \frac{\lceil \frac{N^{\text{Record}}}{\text{Rec per Blk}} \rceil}{\lceil \frac{\text{Record}}{\text{Blk Size}} \rceil}$$

$$N^{\text{Kap}} \leq \frac{\text{Blk Size} - \text{PSize}}{\lfloor \frac{\text{PSize} + \text{Ksize}}{\text{Blk Size}} \rfloor} = \text{SF VO GIC HEMPIDE 2' ALBEE}$$

ALways

$$d = \frac{\lceil (\text{Blk Size} / 2) - \text{PSize} \rceil}{\text{PSize} + \text{Ksize}} = \min$$

$$1) \quad Q_{11} \phi \quad 34000$$

$$2) \quad Q_{11} 1 \quad \lceil \frac{34000}{23} \rceil = 1479$$

$$3) \quad L_{11} 2 \quad \lceil \frac{1479}{23} \rceil = 65$$

$$4) \quad Q_{11} 3 \quad \lceil \frac{65}{23} \rceil = 3$$

$$S) \quad l_{10} \leftarrow \frac{\lceil \frac{3}{2} \rceil}{23} = 1 \rightarrow M^1 \text{ FERMO}$$

$$\text{TAT}_B(x) \leftarrow 147x + 65 + 3+1 =$$

Il costo è il n° di livelli = 5