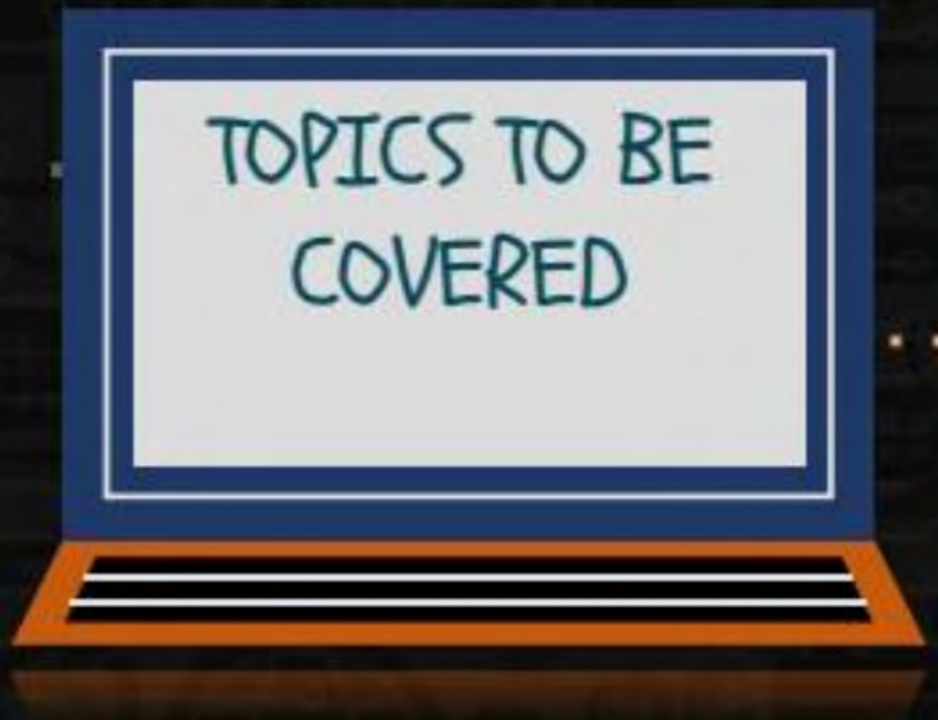
CS & IT ENGINEERING

Database Management System

File org & Indexing

DPP – 02 Discussion

By- Vijay Agarwal sir



01 Question

02 Discussion

Q.1

Consider the following specification of system with disk block size 2048 bytes, block pointer size 14 bytes, record pointer size 18 bytes long and file size 60,000 records. Each record of file is 256 bytes long and record of the size is sorted on the key field. If the primary index (sparse) is built on the key field (ESN) which is 18 bytes long. What is the Index blocking factors (That is number of indexes per block)

Assuming unspanned file organization .

[NAT]

64 Ans

RP = 18 Byte, Record Size = 256B

No. of Records = 60,000 Block size = 2048 Byte, BP = 14 Byte key = 18 Byte

One Index Record size = Size of search key + BP size ⇒ 18 + 14 = 32 Byte & Block size = 2048 Byte

Block factor of Index file [unspanned] $[B_{fi}] = \left\lfloor \frac{\text{Block size}}{\text{Index Record Size}} \right\rfloor = \frac{2048B}{32B} \Rightarrow \frac{2^{11}}{2^5} = 2^6 \Rightarrow 64$ Index entries per Block.

Ans (64)

Q.2 **Common data for next two Questions:**

Consider a disk blocking size B = 1024 bytes. A block pointer (BP) = 12 bytes long and a record pointer (RP) = 7 bytes long. A file has r = 60,000 patient records of fixed length. The size of record is 230 bytes. Suppose the file is not ordered by the key field PSN (18 bytes) and we want to construct a secondary index on key attributes (PSN).

The number of first level index entries are x and number of second level index entries are y then find the value of x + y? 61,500 Ans **[NAT]**

Record Size = 230 Byte

Block Size = 1024 Byte, BP = 12 Byte Rp = 7 Byte, Total #Records = 60,000, key = 18 Byte

Secondary Index

↳ Dense : Total # Index Entries ≡ Number of DB Records = 60,000.

61500 Ans

First level Number of Index entries [X] = 60,000.

One Index Record Size = 18 + 7 = 25 Byte

Block factor of Index file = $\left\lfloor \frac{1024\,B}{25\,B} \right\rfloor$ = 40 Index Entries per Blocks.

Total # Index Block = $\left\lceil \frac{60000}{40} \right\rceil$ = 1500 Index Blocks

2nd Level

Total # Index entries [y] = 1500 (1st level Index Block)

X = 60000 y = 1500

∴ x + y = 60000 + 1500

= 61,500 Ans

Q.3 The number of first level index blocks are x and number of second level index blocks are y then x +y _____ [MCQ]

A. 1600

B. 1500

C. 45

D. 1545

Ans (D)

Using Previous Question Data

Sol^n First Level Index Block [X] = 1500

Block factor of Second Level = $\frac{1024}{18+12} \Rightarrow \left\lfloor \frac{1024}{30} \right\rfloor = 34$ Index per Block entries

2nd Level : Total # Index Entries = 1500 (1st level Block)

↳ Total # Index Block (2nd level) (y) = $\left\lceil \frac{1500}{34} \right\rceil = 45$ Index Block

y = 45

x+y = 1500+45

= 1545 Ans

Q.4

Consider a file of r = 40,000 records, each record is R = 100 bytes long and its key field is of size v = 20 bytes. The file is ordered on a key field, and the file organization is unspanned. The file is stored in a file system with block size B = 2000 bytes, and size of block pointer is 20 bytes. If the primary index is built on the key field of the file and multilevel index scheme is used to store the primary index, then the total number of blocks required by the multilevel index is (41 Ans) Ans(41) [NAT]

Primary Index

#Records = 40,000 Record Size = 100B key = 20B B_P = 20Byte Block size = 2000Byte

Block factor of DB file[unspanned] = $\left\lfloor \frac{\text{Block Size}}{\text{Record Size}} \right\rfloor = \left\lfloor \frac{2000}{100} \right\rfloor$ = 20 Record Per Block

Total # Records = 40,000

Total # Data Blocks = $\frac{40000}{20}$ = 2000 Data Block

One Index Record size = 20 + 20 Byte = 40 Byte.

Block factor of Index File = $\frac{\text{Block size}}{\text{Index Record size}} = \left\lfloor \frac{2000}{40} \right\rfloor$ = 50 Index Record per Block

Total # Index Entries = 2000 (# DB Blocks)

I^st Level

Total # Index Blocks = $\lceil \frac{2000}{50} \rceil$ = 40 Index Block

II^nd Level

Total # Index entries = 40 (# I^st Level Block)

Total # Index Block = $\lceil \frac{40}{50} \rceil$ = 1 Index Block

So we stop Here.

Total # Index Block = 40 + 1 = 41 Ans

Q.5

Assume that we have an ordered file with r = 60,000 records stored on a disk with block size B = 2048 bytes. File record are of fixed size & are unspanned with record length R = 200 bytes. Now assume that the ordering key field of the file is V= 18 bytes long, a block pointer P = 12 bytes long, and we have construed a primary index for the file. Let p and q be the number of blocks required to access a record in case of without index and with primary index using binary search respectively, Then the values of p + q is _____. **[MCQ]**

A. 18

B. 19

C. 20

D. 21

Ans (D)

P=13 q=8 13+8

P+q = 21

Records = 60,000 B = 2048 Byte Record Size = 200 Byte Key = 18 Byte Rp = 12 Byte

Unspanned, Ordered & Primary Index

Block factor of DB File [Unspanned] $= \left\lfloor \frac{\text{Block size}}{\text{Record size}} \right\rfloor = \left\lfloor \frac{2048B}{200B} \right\rfloor = 10$ Record Per Block

Total Number of Data Block [B] $= \left\lceil \frac{60000}{10} \right\rceil = 6000$ Data block.

To Access a Record Avg No. of Block Access (without Index) $= \lceil \log_2 B \rceil \Rightarrow \lceil \log_2 6000 \rceil$

$= 13$ Block Access.

$P = 13$

One Index Record Size = 18 + 12 = 30 Byte

Block factor of Index File $(BF_i) = \left\lfloor \frac{2048}{30} \right\rfloor$ = 68 Index Entries per Blocks

Primary Index

Total # Index Entries = 6000 (# DB Block)

Total # Index Block $(B_i) = \left\lceil \frac{6000}{68} \right\rceil$ = 89 Index Block

To Access a Record Avg # Block Access [with Index] = $\log_2 B_i + 1$ → Data Block

$= \lceil \log_2 89 \rceil + 1 \Rightarrow 7 + 1 = 8$ Block Access

$q = 8$

Q.6

Consider an unordered file of 10^6 records with records size of 200 bytes stored on blocks of 8KB with a spanned records organization. We will assume that no system related information is stored within a block, then how many blocks would it be need to store this file? [MCQ]

A. 24400

B. 24405

C. 24410

D. 24415

#Records = 10^6 Record Size = 200 Byte Block Size = 8KB ⇒ 8192 Byte

Block factor of DB file = $\frac{8192\,B}{200\,B}$ = 40.96 Record per Block

& Total #Records = 10^6 ⇒ 1000,000

Total # of DB Blocks = $\left\lceil \frac{1000000}{40.96} \right\rceil$ = 24415 Ans

Ans (D)

Q.7

Consider the following statements:

S_1: for any given data file, it is possible to create two different sparse first level indexes on various keys.

S_2: for any given data file, it is possible to create two different denes first level indexes on various keys. Select the correct statements.

[MCQ]

S_1 : Sparse Index : Sorted

↳ Incorrect

S_2 : Dense Index

↳ Correct

Ans (B).

A. Only S_1 correct

B. Only S_2 correct

C. Both S_1 and S_2 are correct

D. Neither is S_1 and S_2 is correct

Q.8

Which of the following is NOT a benefit of using Indexes in a database? [MCQ]

A. Improved query performance

B. reduced disk I/O

C. Increased storage space

D. Faster data retrieval

Ans (C)

Q.9

Which of the following best describes an index in a database.

[MCQ]

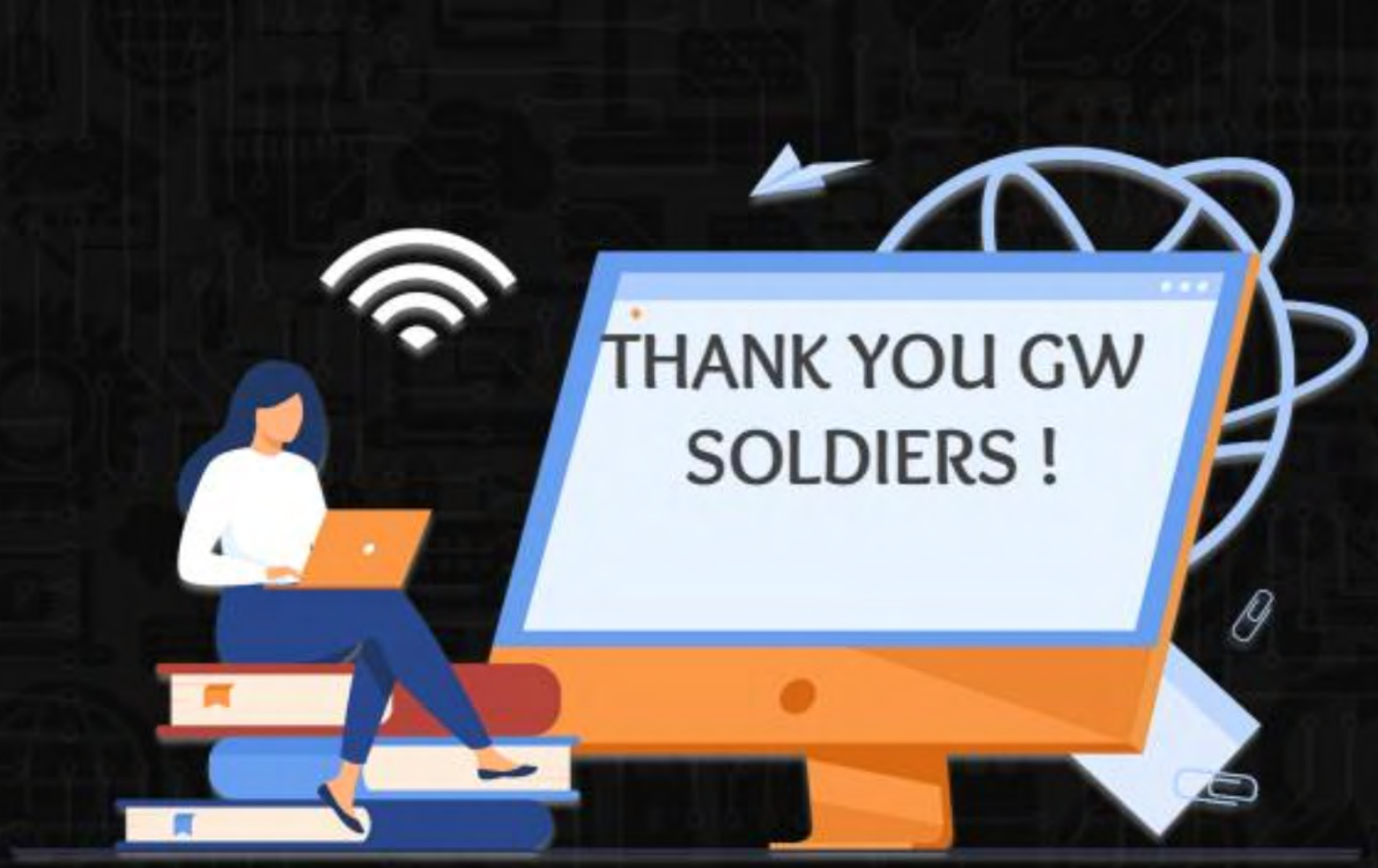
A. A column that stores unique identifiers for each row in a table.

B. A data structure that allows for fast searching and retrieval of data, based on certain criteria.

C. A set of constraints that enforce rules for data integrity

D. None of the above.

Ans (B)


THANK YOU GW
SOLDIERS !