Database Management System: Assignment 6

Total Marks : 20

August 21, 2023

Question 1

Consider the following table. If we create an index on CON_ID column, which type of indexing is preferred? *Marks: 2* **MCQ**

CONTEST		
CON_ID	PARTICIPANT	CATEGORY
C51	AMAN	DANCE
C02	RAJIB	PAINTING
C76	KRISHNA	DANCE
C32	MANAN	MUSIC

a) Clustering index

b) Dense index

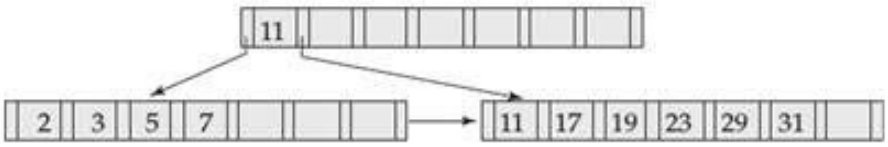
c) Secondary index

d) Sparse index

Answer: b)
Explanation: When the file is not sorted on the indexed field or when the index file is small, compared to the size of the memory, it is preferable to use dense indexing. The above table has only 4 records and **CON_ID** field is not in sorted order.
Hence, option b) is correct.

Question 2

Consider the following B+ tree:



Which of the following statement(s) is/are not valid for the given tree? *Marks: 2* **MCQ**

a) Leaf nodes must have between 4 and 7 values

b) Non-leaf nodes other than root must have between 4 and 8 children

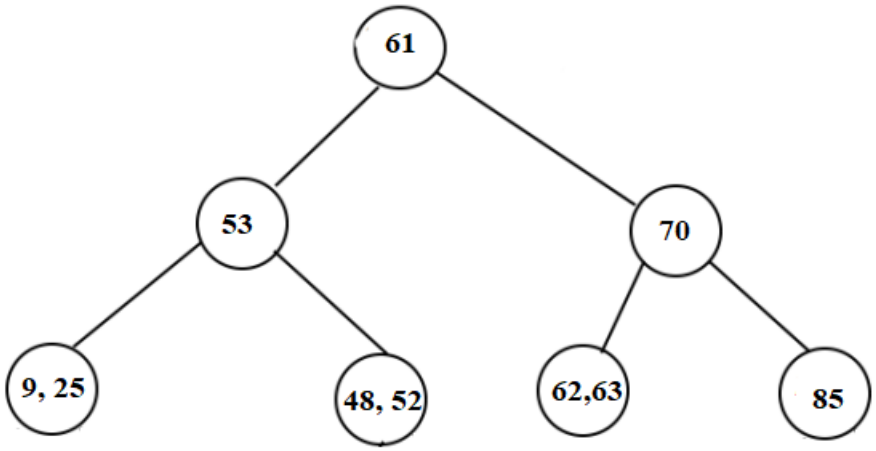
c) Root must have at least 2 children

d) Some leaf nodes may be empty

Answer: d)
Explanation: Based on the standard properties of the B+ tree, leaf nodes never be empty. Hence, option d) is the answer.

Question 3

Consider the following `2-3-4 Tree`:



How many comparisons are required to find `10` from the tree? *Marks: 2* **MCQ**

a) 2

b) 3

c) 4

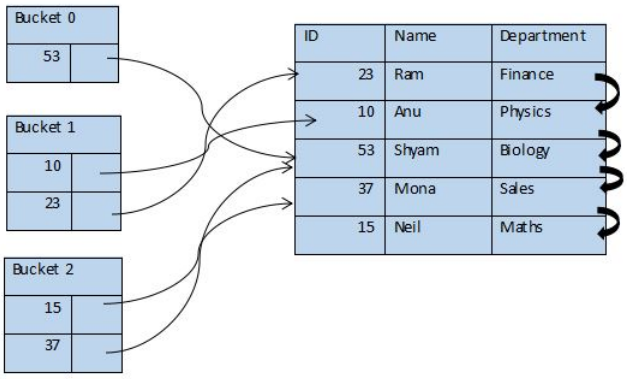
d) 5

Answer: c)
Explanation: Find `10` $\rightarrow$ `4` comparisons: First comparison with `61`, second comparison with `53`, third comparison with `9` and the last comparison with `25`.
So, option c) is correct.

Question 4

Identify the correct hash function used in the following hash table:

Marks: 2 **MCQ**



a) (ID) %3

b) (Sum of digits of ID) %8

c) (Sum of digits of ID) %4

d) (Product of digits of ID) %3

Answer: c)
Explanation: In every tuple, if the digits of ID are added and divided by 4, the remainder indicates the bucket number into which the IDs are hashed.
Like in ID 37, 3+7=10%4=2. Hence tuple having ID 37 is mapped into bucket 2.
Hence, option c) is correct.

Question 5

A `2-3-4-tree`, can store a maximum 4095 number of keys. What will be the minimum height of the tree? The height of the root node is assumed to be zero.

Marks: 2 **MCQ**

a) 4

b) 5

c) 6

d) 10

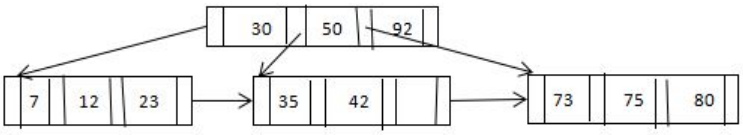
Answer: b)
Explanation: A node of a `2-3-4-tree` can store maximum 3 number of keys.
So, for the minimal height of a `2-3-4-tree`, we will have three keys(maximum possible number) per node.

keys at level 0 = 3*(4^0) = 3
keys at level 1 = 3*(4^1) = 3*(4)
keys at level 2 = 3*(4^2) and so on . . .
Hence, height = $log_4(N+1) - 1 = log_4(4095+1) - 1 = \frac{log(4096)}{log(4)}$ -1= 6-1 = 5

Hence, option b) is correct.

Question 6

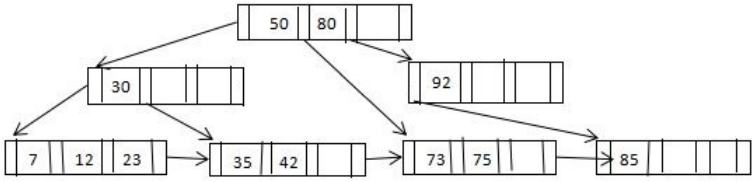
Consider the following right biased B^+ tree.



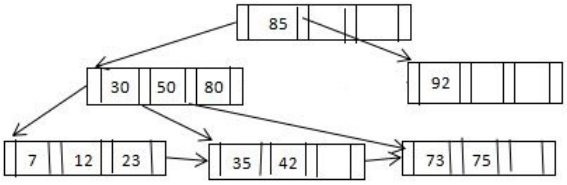
Inserting **85** into this tree will result in which of the following trees?

Marks: 2 **MCQ**

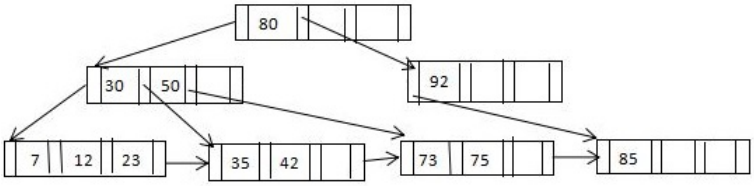
a)



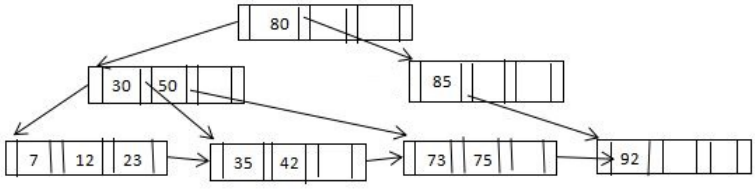
b)



c)

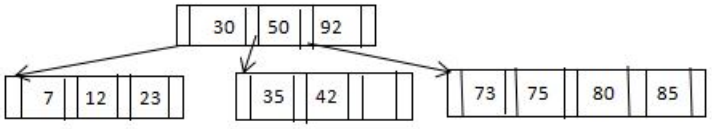


d)



Answer: c)
Explanation: On inserting `85` the following changes will occur:

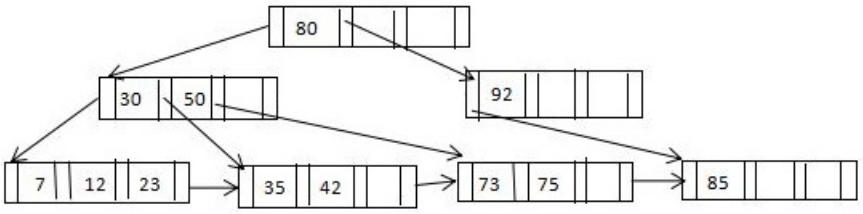
i) `85` will first try to fit in a leaf node depending on its value and the values of data items already present in the leaf nodes as shown below:



ii) But the leaf node having the capacity to hold 3 values maximum, cannot accommodate the newly arrived `85`, and hence the node splits. The mid value(ceiling) which is `80` moves upward in the immediate parent's node. `73, 75` being less than `80` becomes its left child,

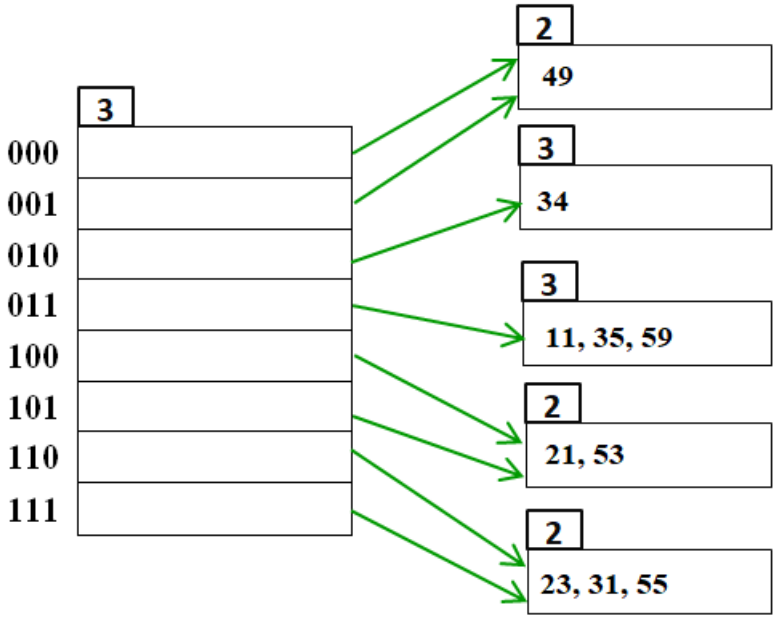
while 85 becomes its right child as shown below.

iii) But the parent node also has the capacity to hold 3 values maximum, hence it cannot accommodate 4 values and splits as a result. Following the rule, 80 becomes the topmost node and values less than 80 becomes its left children, whereas values more than 80 becomes its right children as shown in the picture below.



Question 7

Consider the extendable hashing on a file that contains records with the search-key values:
`11, 21, 23, 31, 34, 35, 49, 53, 55, 59` *Marks: 2* **MCQ**



Choose the incorrect statement(s) based on the above hash structure.

a) For inserting key 18, a new bucket needs to be allocated.

b) `h(x) = x mod 8`, where $h(x)$ is a hash function.

c) The bucket can be removed if we delete key 34.

d) In extendable hashing, performance will not degrade with the growth of the file.

Answer: a)
Explanation: Key 18 will be allocated in the same bucket of 34, no new bucket will be required.
Hence, the statement given in option a) is incorrect.

Question 8

Suppose a database management system uses dense indexing. Suppose that 128 blocks are required to store a database file and its index file. How many records does the database file contain? Given that one memory block of the disk can store either 48 key pointers or 16 whole records.

Marks: 2 **MCQ**

a) 1024

b) 1536

c) 2048

d) 4096

Answer: b)
Explanation: Suppose there are N number of records.
Number of blocks needed to store data file with N records = $N/16$
Number of blocks needed to store dense index file = $N/48$
Total blocks required = $N/16$ + $N/48$ = $4N/48$ blocks = $N/12$ blocks =128
So, total number of records = $128 * 12 = 1536$ records
So, option b) is correct.

Question 9

Consider the following table:

Code	Paper	Type
CS2322	C Programming	Theory
IT1221	Data Structure	Theory
EC3242	Data Structure	Sessional
CS5850	Python	Sessional
IT1972	C Programming	Theory

What are the Bitmap indices of `Paper 'Data Structure'` and `Type 'Sessional'`?

Marks: 2 **MCQ**

a) 01001 and 11001

b) 01100 and 10011

c) 10011 and 11001

d) 01100 and 00110

Answer: d)
Explanation: `Paper 'Data Structure'` is present in 2nd and 3rd tuple and absent in 1st, 4th and 5th tuples. So the bitmap indices for `'Data Structure'` is 01100. Similarly `Type 'Sessional'` is present in 3rd, and 4th tuples and is absent in 1st, 2nd and 5th tuples. So the bitmap indices for `'Sessional'` is 00110.
Hence, option d) is correct.

Question 10

Identify the correct SQL query to create Bitmap index on attribute `Type` on the following table **Course**

Course		
Code	Paper	Type
CS2322	C Programing	Theory
IT1221	Data Stucture	Theory
EC3242	Data Stucture	Sessional
CS5850	Python	Sessional
IT1972	C Programing	Theory

Marks: 2 **MCQ**

a) `CREATE BITMAP INDEX CType on Course`(Type)

b) `CREATE BITMAP INDEX CType on Type`(Course)

c) `CREATE BITMAP CType on Course`(Type)

d) `CREATE INDEX CType on Type`(Course)

Answer: a)
Explanation: The syntax is **CREATE BITMAP INDEX**<index-name> **on** <relation-name> (<attribute-list>).
'INDEX' word is missing in c) & 'BITMAP' word is missing in d). So they are incorrect.
Option b) is also incorrect.
Option a) follows the actual syntax.
Hence, option a) is correct.