Question 1

a. False
b. True
c. False
d. True
e. False
f. False
g. False
h. True
i. False

+9

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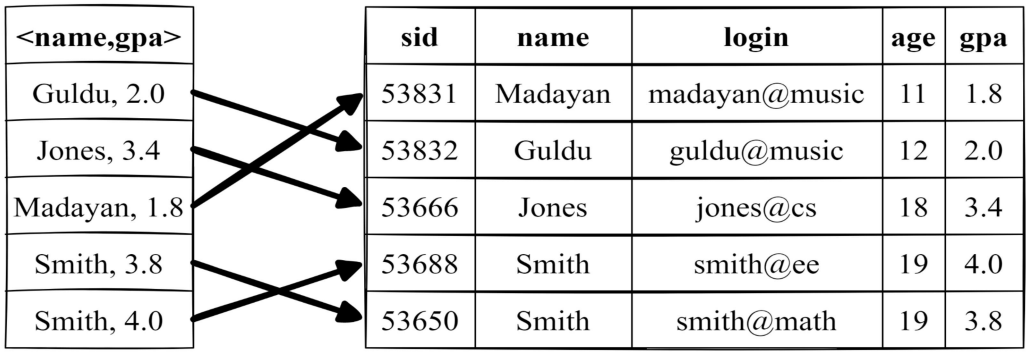
Question 2

a. Unclustered index on <name, gpa> using Alternative (2) can be constructed and it will first sort the data entries by name and then by age.

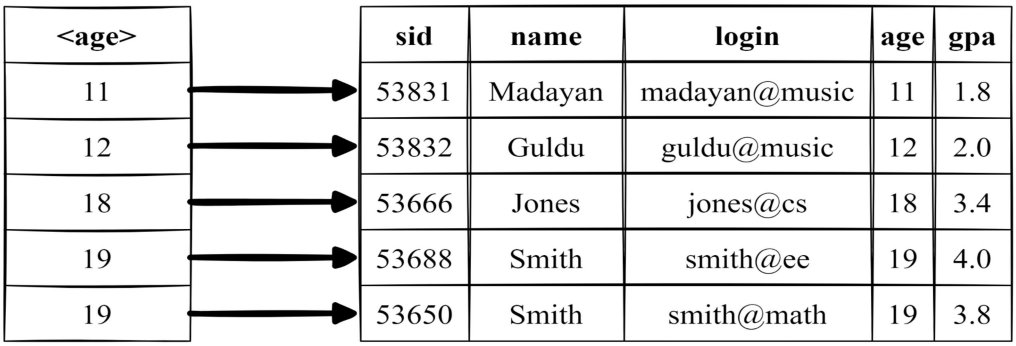


<name,gpa>
Guldu, 2.0
Jones, 3.4
Madayan, 1.8
Smith, 3.8
Smith, 4.0

sid	name	login	age	gpa
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0
53666	Jones	jones@cs	18	3.4
53688	Smith	smith@ee	19	4.0
53650	Smith	smith@math	19	3.8

+5

b. Clustered index on <age> using Alternative (2) can be constructed and it will sort the data entries by age.



<age>
11
12
18
19
19

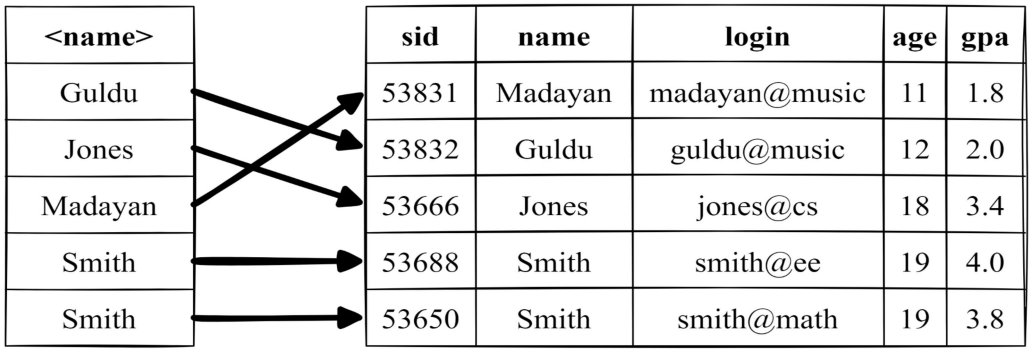
sid	name	login	age	gpa
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0
53666	Jones	jones@cs	18	3.4
53688	Smith	smith@ee	19	4.0
53650	Smith	smith@math	19	3.8

+5

c. Clustered index on <name, gpa> using Alternative (2) cannot be constructed as there can be one clustered index on file which in this case is created on <age>.

+5

d. Unclustered index on <name> using Alternative (2) can be constructed and it will sort the data entries by name.



<name>
Guldu
Jones
Madayan
Smith
Smith

sid	name	login	age	gpa
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0
53666	Jones	jones@cs	18	3.4
53688	Smith	smith@ee	19	4.0
53650	Smith	smith@math	19	3.8

+5

Question 3

1. Table: Prof
   Attributes: <dept_did, age>

2. Table: Prof
   Attributes: <specialty, pname>

+16

3. Table: Dept
   Attributes: <budget, <dname>

4. Table: Dept
   Attributes: <dname, did, chair_sin>

Question 4

Given:

Pages takes 2024 bytes
Key value takes 12 bytes
Pointer to a tree node or record takes 8 bytes

a) There are totally m+1 pointers and m keys in the tree node

∴ 12*m + 8*(m+1) <= 2024

∴ 20m + 8 <= 2024

∴ m <= 100.8

Therefore, the maximum number of keys in each node should be **m=100**

+5

b) Given, height = 2,

m = 100 [from (a)]

Maximum number of data records N = (Maximum number of keys in each node) $^{\text{height of tree}}$

∴ $N = 100^2$

∴ N = 10000

Therefore, maximum number of data records **N = 10000**

+1

$F^h = (m+1)^2 = 10201$

$N = 10201 \times 101$

c) N = 10000 [from (b)]

Number of I/O operations required for searching through N data records using sorted file should be $\log_{100} N$

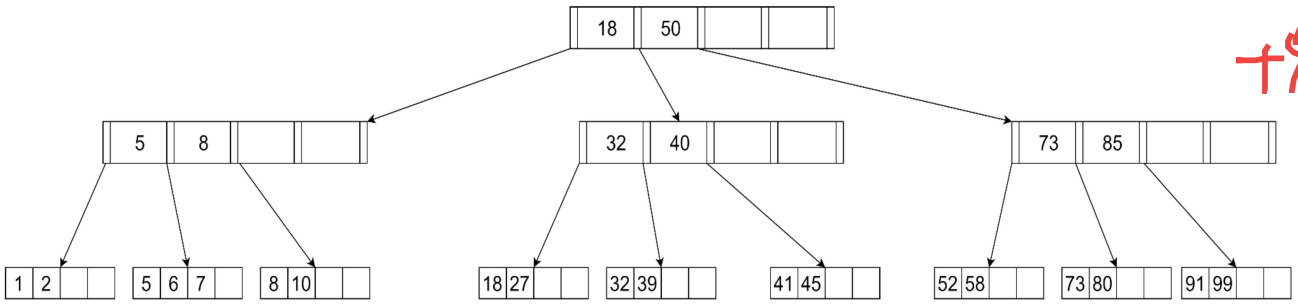
Therefore, **Number of I/O operations** required is **2**

+1

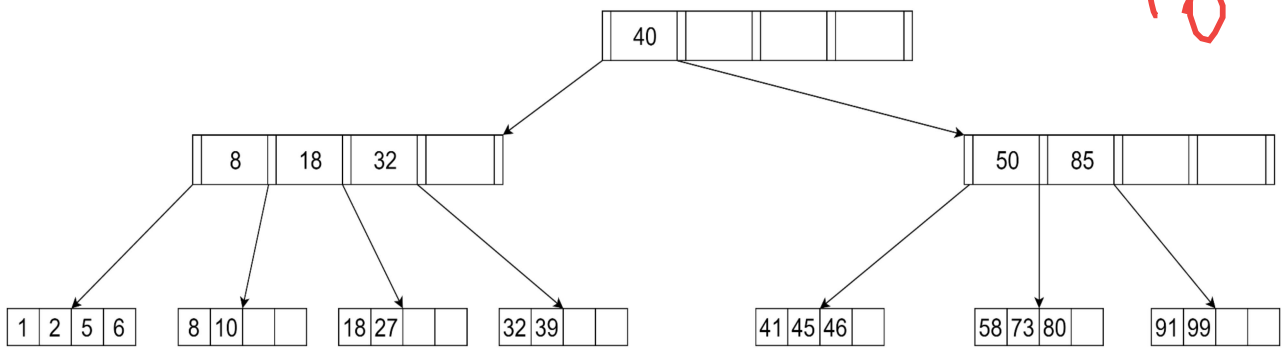
$\log_2 N$

Question 5

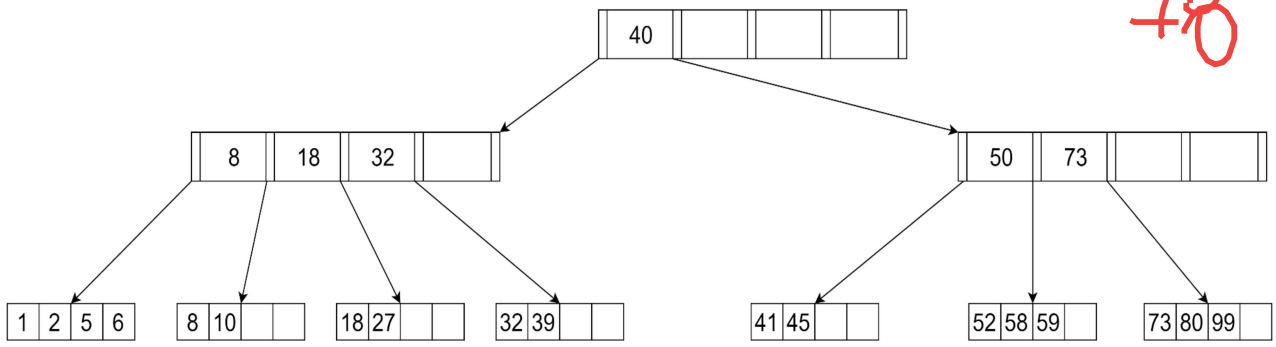
a. Number of nodes to be **read = 3**, Number of nodes to be **updated = 1**



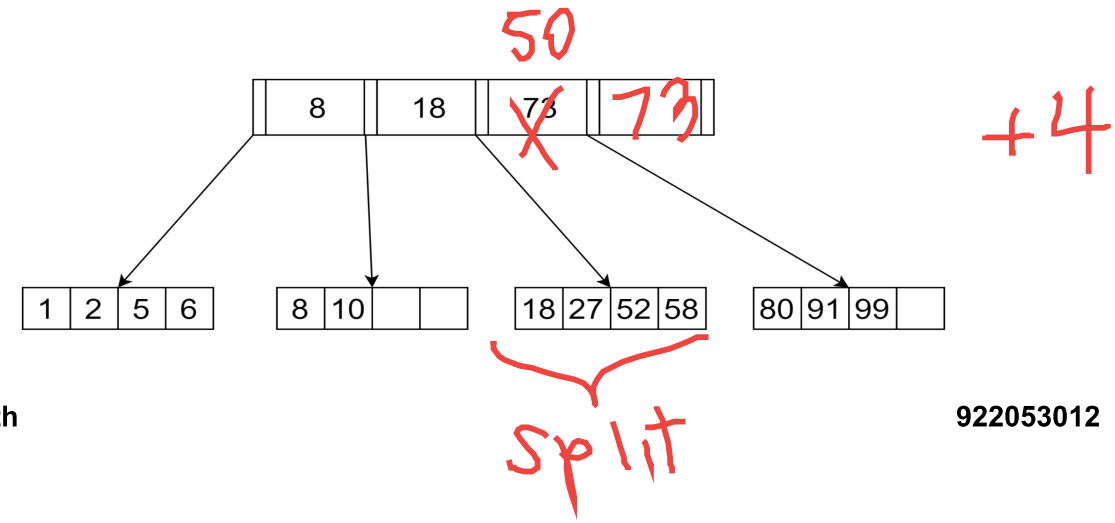
b.



c.



d.



Question 6