① No, It's not possible to have two clustering indices on the same relation for different search keys.

- A clustering index defines the physical order in which data rows are stored in a table. There can be only one order in which data is physically stored.
- Therefore, there can only be one clustering index per table.

2. a) Select * from instructor where name = 'mozart';

→ 'c' indicates Root Node

'v' indicates Search value.

If c = v

Result: | 15151 | Mozart | Music | 40000 |

→ Then move on to Right side pointer of Mozart
→ It is Second sub-tree of the Node.
→ Now, Compare first key in the internal Node as current node is not equal to the Leaf Node.
→ Mozart is less than Srinivas, So go to the left side pointers of the key Srinivas.
→ It points to the block that has Record "Mozart". Now Current becomes the leaf Node
→ Now Mozart index directly gives the record which is having name as mozart by following left side pointers.
→ Therefor, we found the location of target record.

b.) Select * from instructor where name = "calvert";

→ Now v<c, then goto the left side pointer of the root node.

→ Current node is not equal to leaf node, So compare the first key value 'Einstien'.

→ calvert is less than the Einstien So go to the left side pointer of the Einstein.

→ Now it points to the block where Current node is Equal to leaf Node.

→ Now Compare Calvert with first value Brandt and there is no match. Similarly Compare with all the index value in the block. There is no match it returns Null value.

Result : NULL

C) Select * from instructor where name >= 'crick' and name <= 'Sign';

→ lb = crick, ub = Singh, c = Mozart

lb ≤ c ≤ ub

→ first get the lb index, Now lb<c, then goto the left side pointer of Mozart.

→ Current Node is not equal to leaf Node, So Compare first key value 'Einstien'. 'crick' is less than 'Einstein' So, go to the left side pointer of 'Einstein'.

→ Now it directs to the block. Compare the values in block with search key value and crick is found.

→ Now Consider Ub = Singh, So go to the right side link and check Einstein and it is less than Singh. So it satisfies and get record for it

→ Now check right of Einstein, Similarly it gets the record of Einstein, EI Said, Gold, Katz, Kim, Mozart and Singh.

→ Now when we move to right we get Srinivasan as Singh < Srinivasan the iteration stops.

→ finally we get the records of

Crick, Einstein, EI Said, Gold, Katz, Kim, Mozart, Singh

3. a) We have total 12 Records.

Now Constructing Bitmap index on the attribute salary

As a Given dive salary values into 4 ranges

0 - 50,000

50,000 - 60,000

60,000 - 70,000

70,000 - Infinity

Now, bitmap index for above ranges is :-

Salary Range	Bitmap index
0 - 50,000	0 0 1 0 0 0 0 0 0 0 0 0
50,000 - 60,000	0 0 0 0 0 0 0 0 0 0 0 0
60,000 - 70,000	1 0 0 0 1 0 0 1 0 0 0 0
70,000 - Infinity	0 1 0 1 0 1 1 0 1 1 1 1

b. We have bitmap index of salary ≥ 80,000

So, Consider range as 0 - 80,000 + 80,000 to infinity

0 - 80,000	1 0 1 0 1 0 1 1 0 1 0 0
80,000 - Infinity	0 1 0 1 0 1 0 0 1 0 1 1

Now, Construct Bitmap index on the attribute department

Given department record are categorized as 7 types.

Computer Science	0 0 0 0 0 1 0 0 0 1 0
finance	0 1 0 0 0 0 0 0 0 1 0 0 0 → (2)
Music	0 0 1 0 0 0 0 0 0 0 0 0
physics	0 0 0 1 0 1 0 0 0 0 0 0
History	0 0 0 0 1 0 0 1 0 0 0 0
Biology	0 0 0 0 0 0 0 0 0 1 0 0
Elec. Eng	0 0 0 0 0 0 0 0 0 0 0 0

Do Bitwise AND operation for 2 Records.

80,00 - Infinity 0 1 0 1 0 1 0 0 1 0 1 1

AND

finance 0 1 0 0 0 0 0 0 1 0 0 0

Result : 0 1 0 0 0 0 0 0 1 0 0 0

We got 2nd record & 9th record with finance department and salary >= 80,000