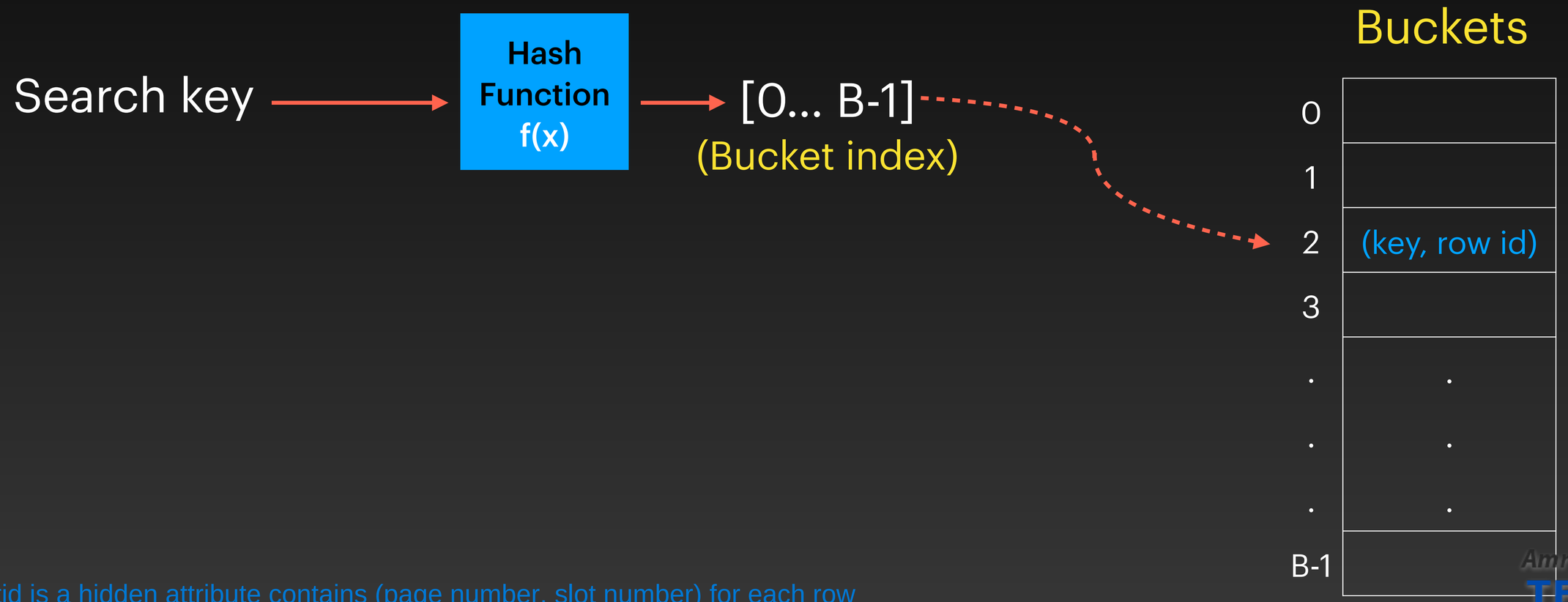
Amr Elhelw's

TECH VAULT

DATABASE INDEXES

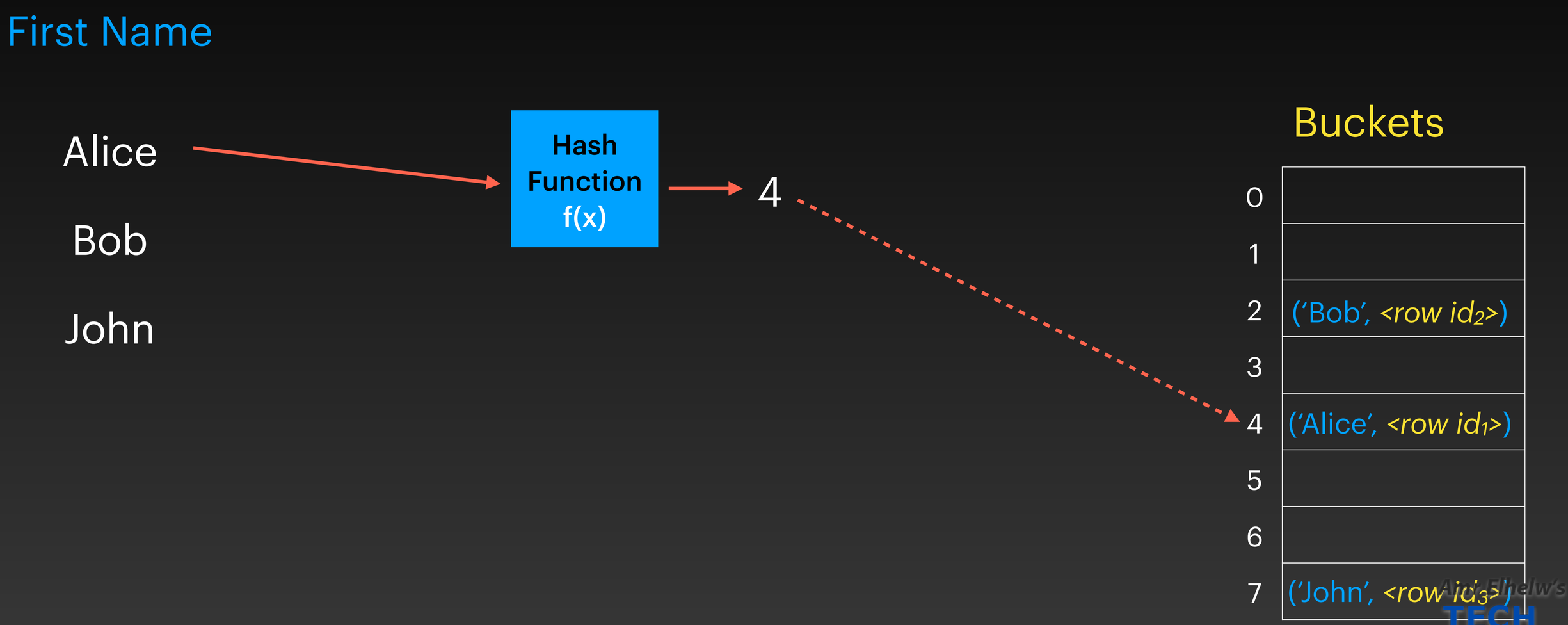
HASH & COMPOSITE

Hash Index



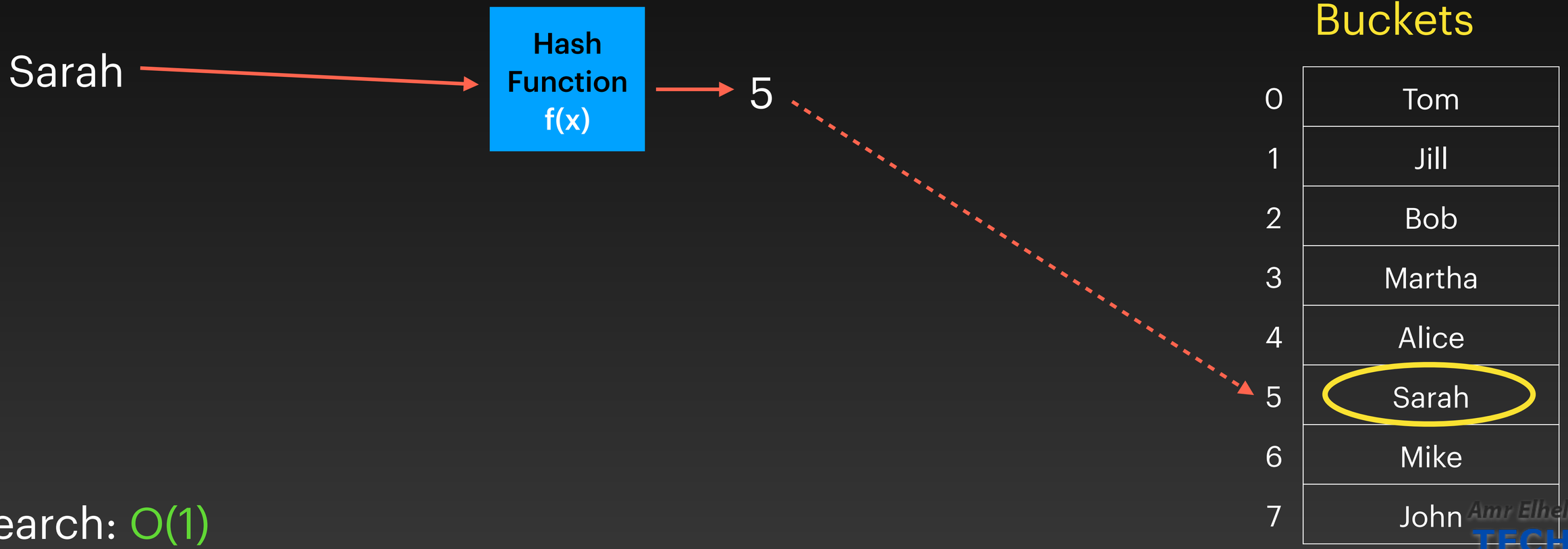
ctid is a hidden attribute contains (page number, slot number) for each row
you can select it in the query.

Hash Index (Build)



Hash Index (search)

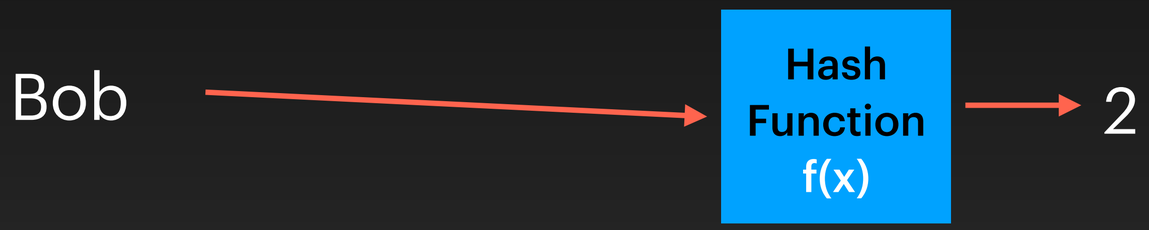
Search for: First Name = ‘Sarah'

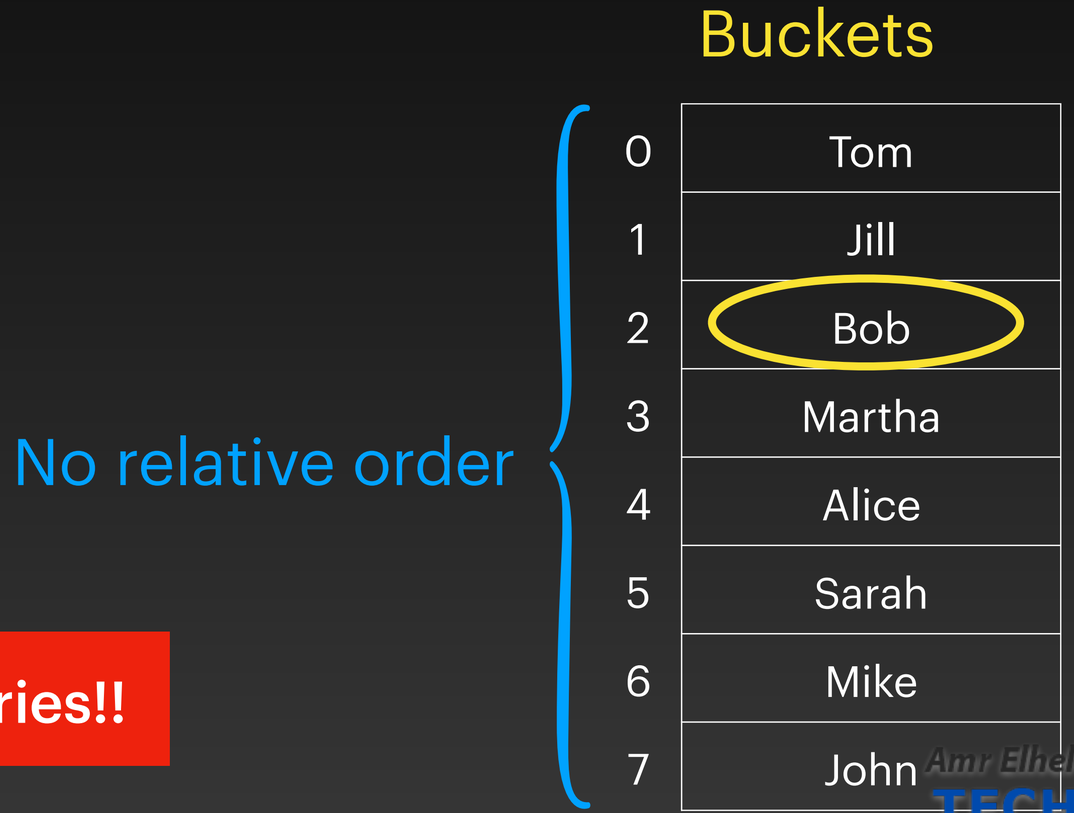


Search: O(1)

Hash Index (search)

Search for: First Name between ‘Bob’ and ‘Mike’??

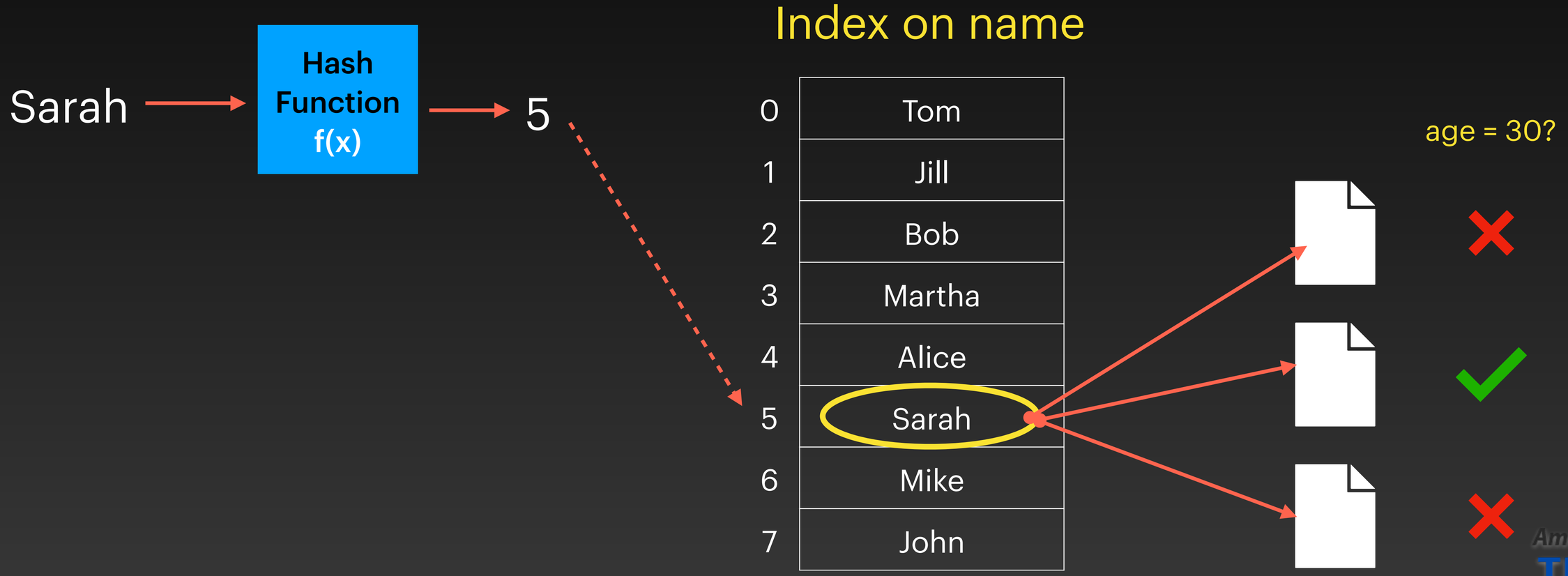




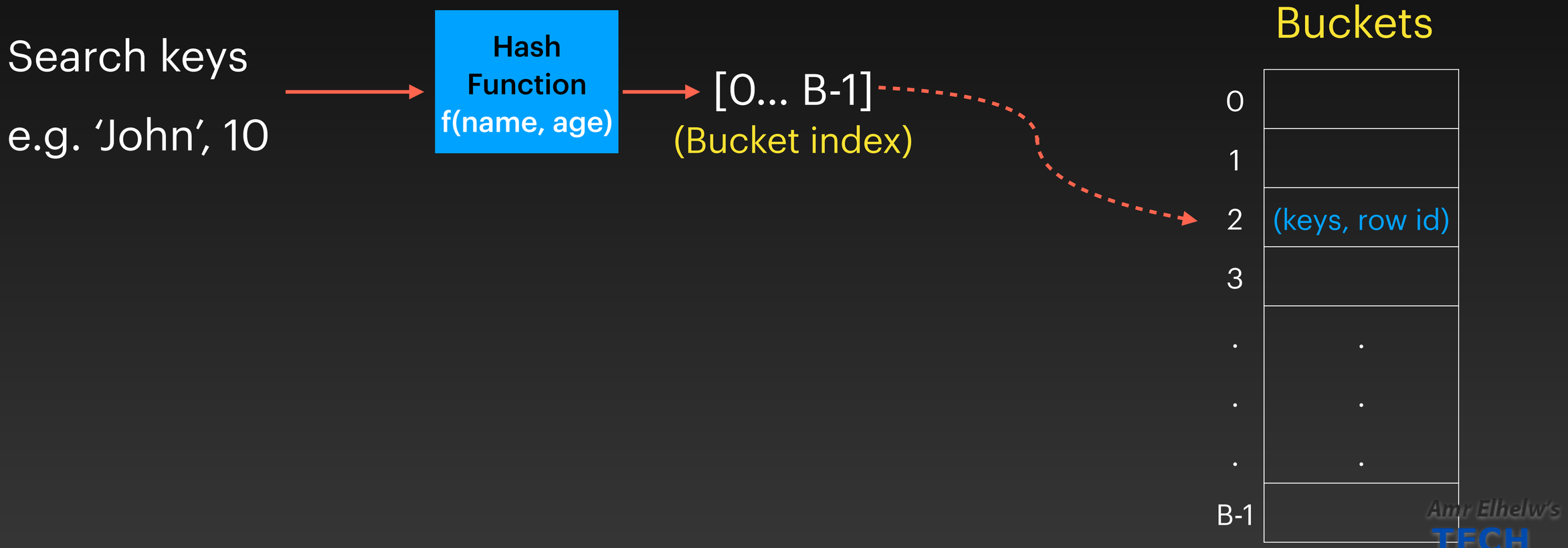
No range queries!!

Hash Index

Search for: Name = ‘Sarah’ AND age = 30



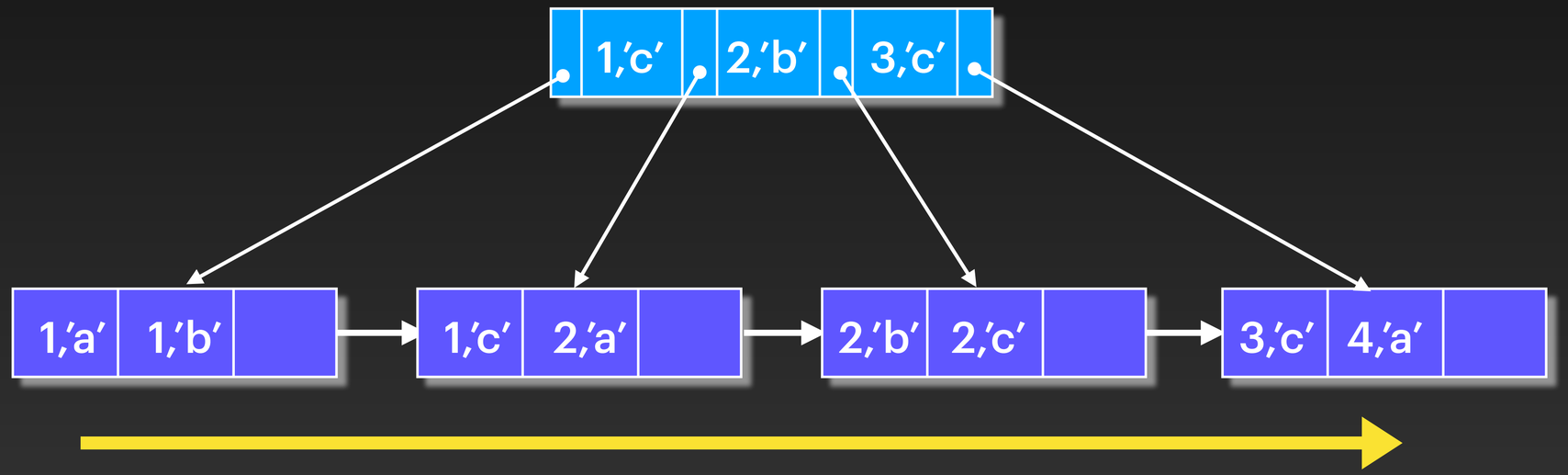
Composite Hash Index



Composite B+ Tree Index

Index on attributes: x, y ≠ Index on attributes: y, x

x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

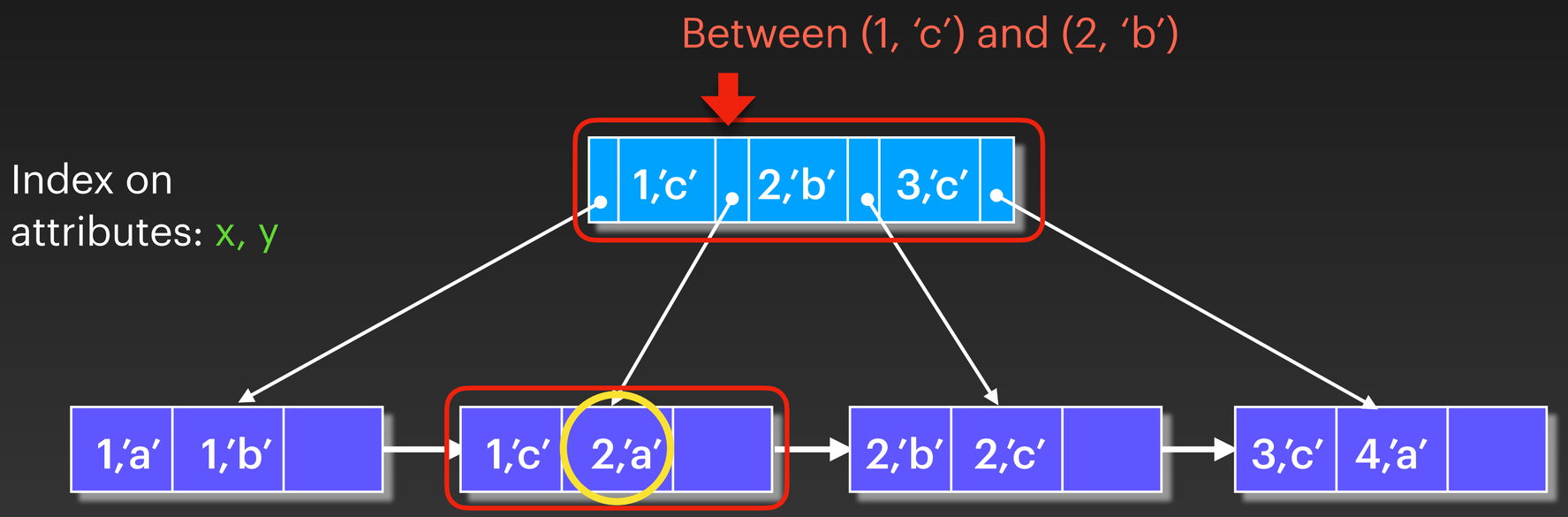


Sorted on the leaf

Query

Search for: x = 2 AND y = ‘a’

Look for: (2, ‘a’) —> Point query

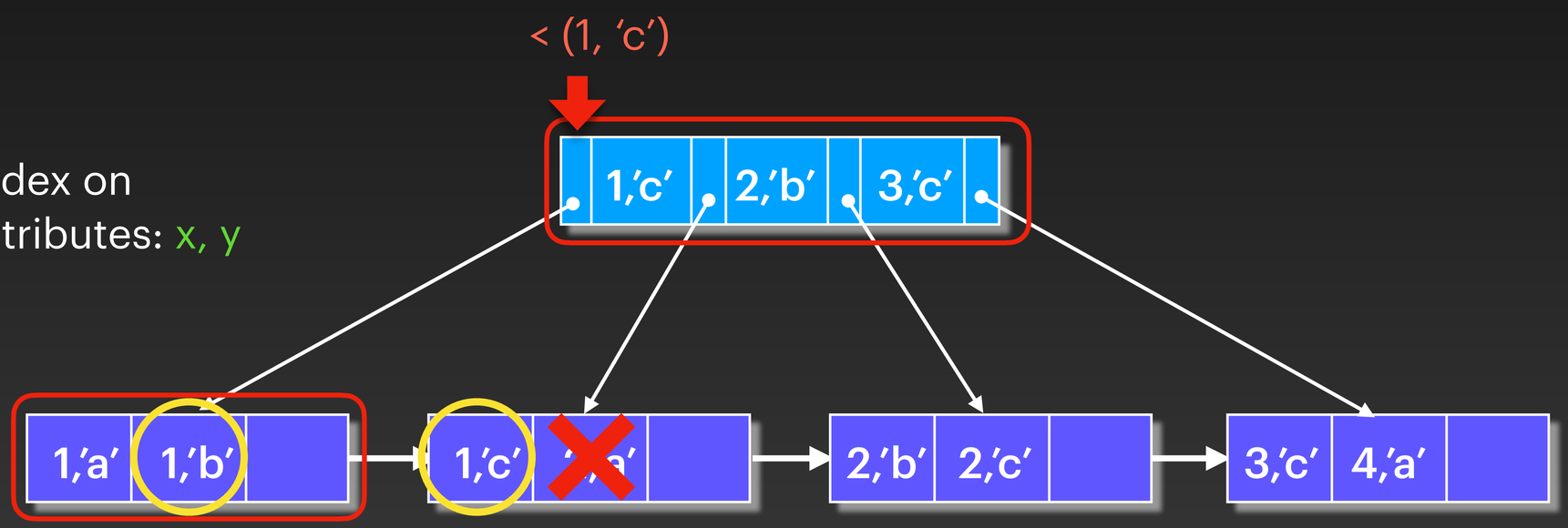


x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

Query

Search for: x = 1 AND y >= ‘b’ here the start is giving 1, b

Look for (1, ‘b’) Then follow leaf level while x = 1



x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

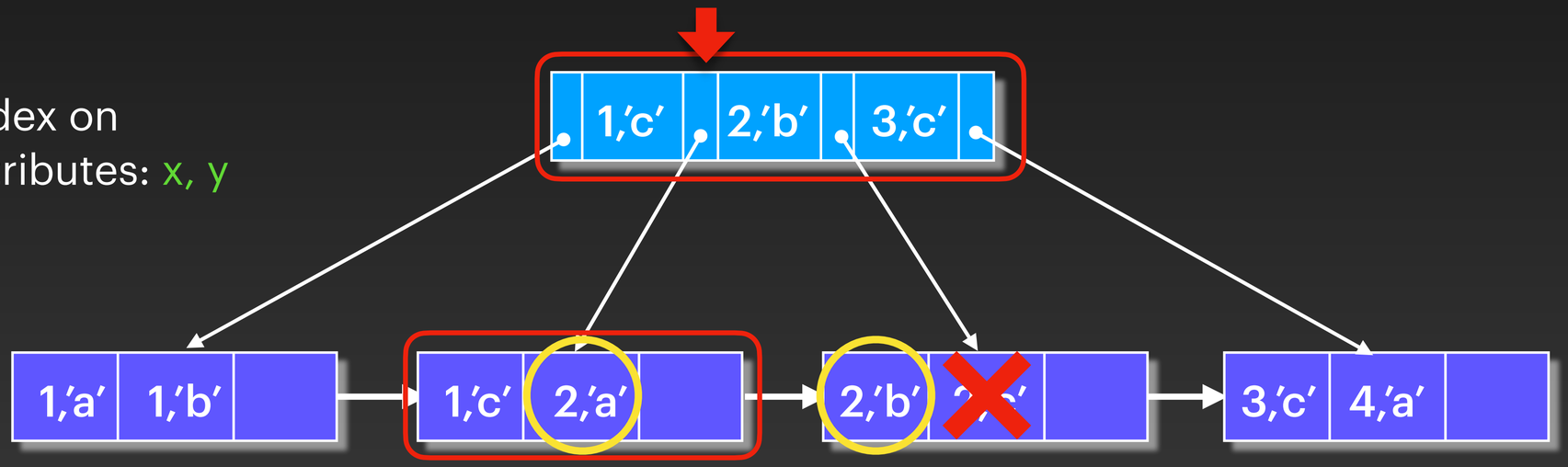
Query

Search for: x = 2 AND y < ‘c’

here not start are giving,
which means start from 2 a seq scan to find the sucess rows

Look for first key that has x = 2 Then follow leaf level while x=2 and y < ‘c’

Index on attributes: x, y



x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

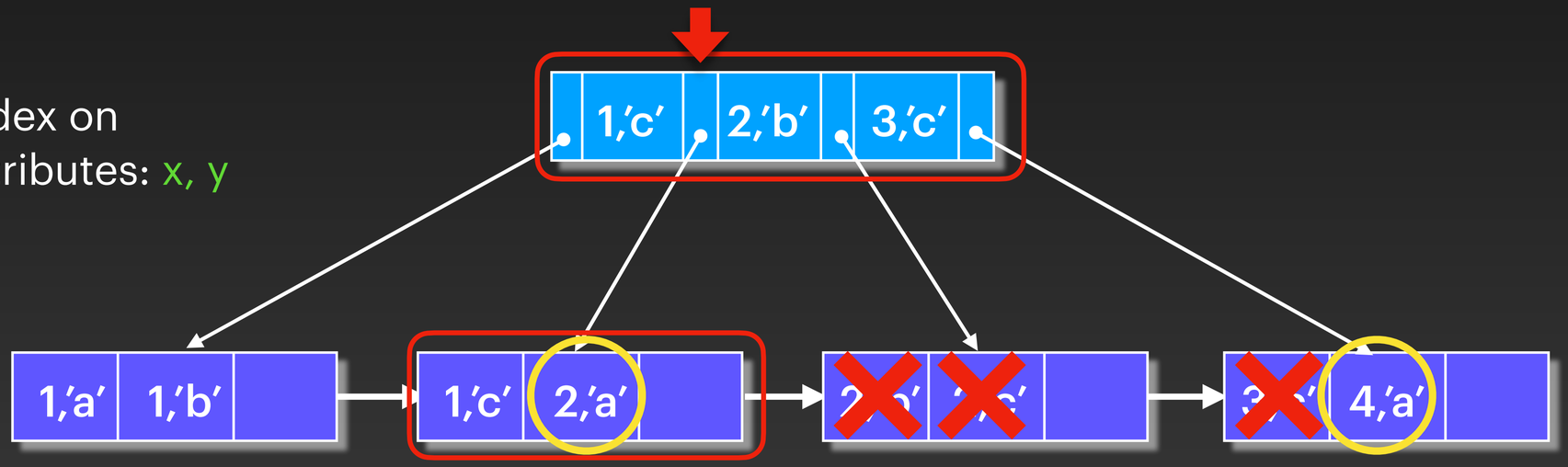
Query

Search for: x > 1 AND y = ‘a’

find the first node greater than 1, then seq scan

Find the first key that has x > 1 Then follow all remaining leaf nodes and check y=‘a’

Index on attributes: x, y



x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

index usage stops at the first range (included).

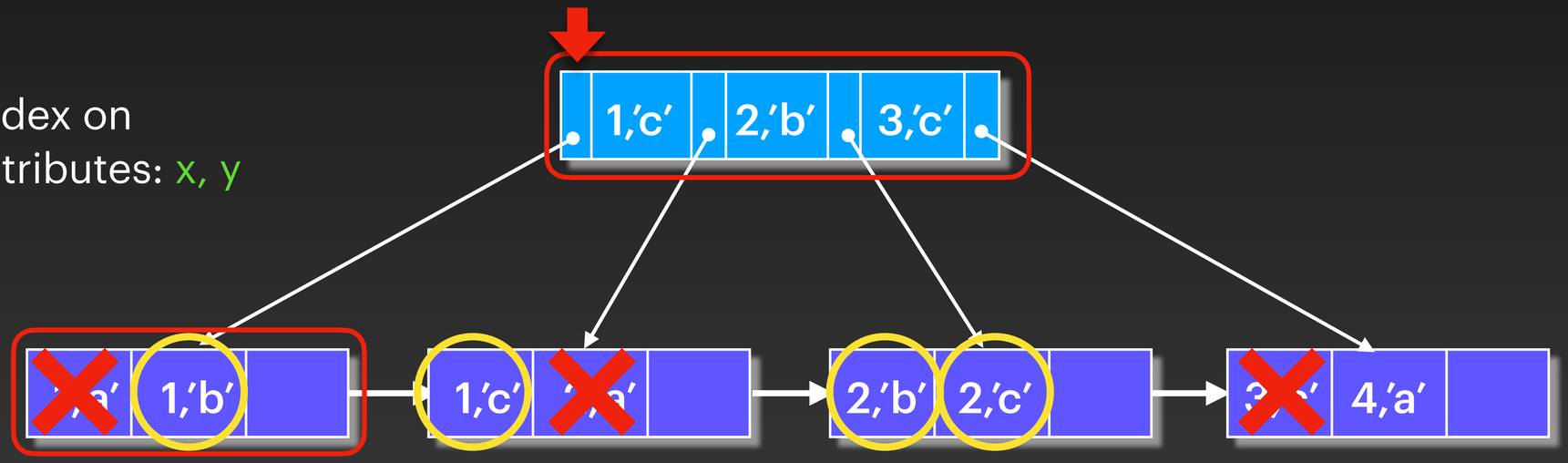
Query

Search for: x < 3 AND y > ‘a’

start node is the least one, then seq scan on leaf.

Find the first key Then follow leaf nodes while x<3 and check y>‘a’

Index on attributes: x, y



x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

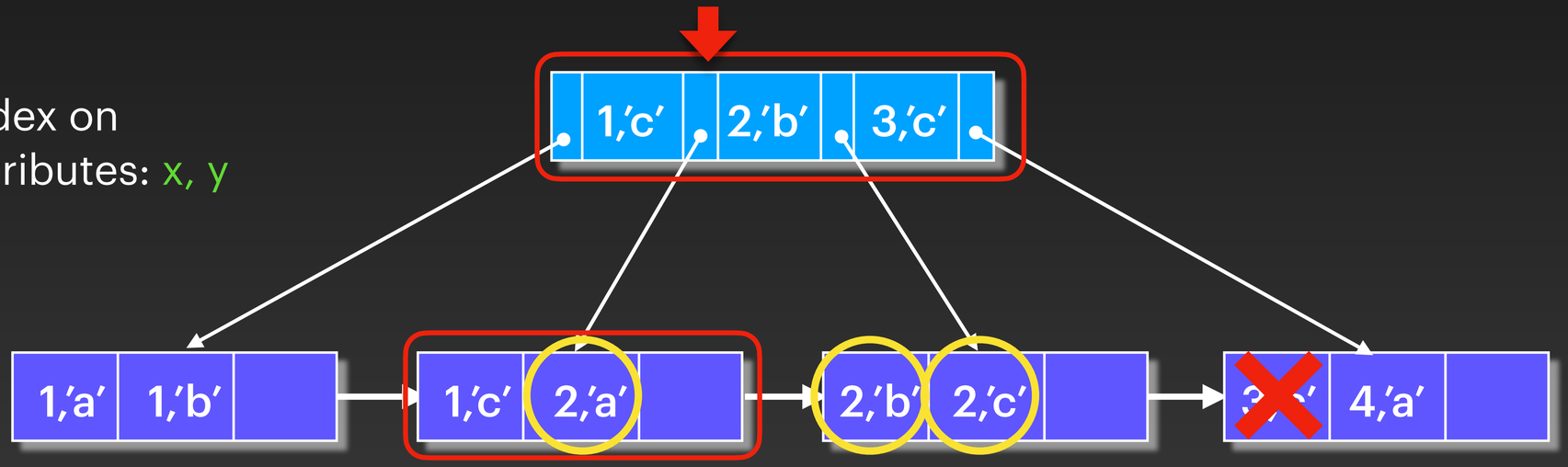
Query

Search for: x = 2

hash index doesn't work here beacuse it must take 2 inputs to hash the key

Find first key with x=2 Then follow leaf level while x = 2

Index on attributes: x, y



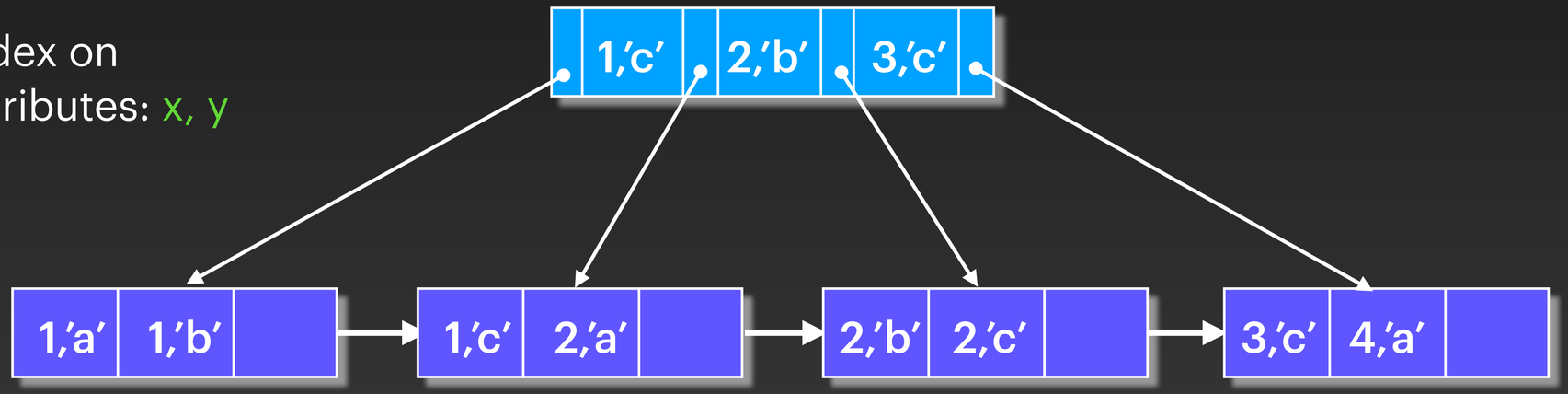
x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

Query

Search for: y = ‘a’

We have to scan ALL the leaf nodes!

Index on attributes: x, y



x	y
1	'a'
1	'b'
1	'c'
2	'a'
2	'b'
2	'c'
3	'c'
4	'a'

Composite Indexes

- Index on attributes (a_1, a_2, ..., a_n)

- Can be used to answer any prefix search
  - Any search involving a conjunction of a_1, a_2, ..., a_k; k <= n

except for OR operation

Composite Indexes

Indexes

Searches

	(x)	(y)	(x, y)	(y, x)	(z, y, x)
x > 1	✓		✓		
y = 3		✓		✓	
x = 7 AND y < 4	✓	✓	✓	✓	
x = 7 OR y < 4					
x = 7 AND y < 4 AND z = 1	✓	✓	✓	✓	✓