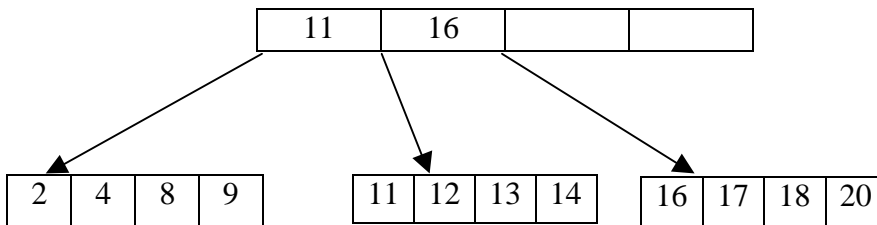


Question 1:

a) 4 points.

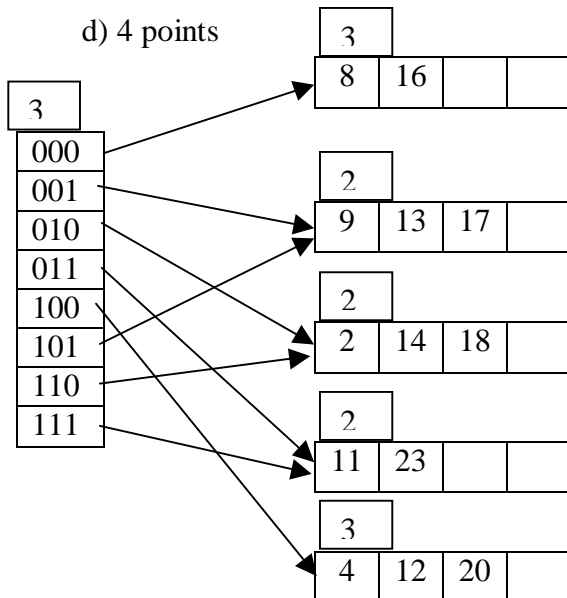
- i. True, since the file is sorted on name
- ii. True, you can build a dense index on any file
- iii. False, the file is not sorted by phone
- iv. False, the file is not primarily sorted by eno

b) 2 points



c) 5 points  
9 deletions

d) 4 points



e) 5 points

2 entries, Insertion of 2 entries into the second, third, or last will cause overflow, which will then cause a split.

f) 5 points

2 entries, Insertion of 2 entries into the last bucket will cause a split. Since the global == local depth, the global depth will increase by one.

Question 2:

a) 18 points

- i. E
- ii. E
- iii. F
- iv. F
- v. A
- vi. B

b) Full credit was given to everyone ( 3 points )

c) 4 points

$\Pi_{\text{filename, song}}(\text{User NATURAL JOIN Has NATURAL JOIN Song}) / \Pi_{\text{speed}}(\text{User})$

d) 5 points

Solution 1:

SELECT S.filename, S.title

FROM Song S

WHERE NOT EXISTS( SELECT \*

FROM User U1

WHERE NOT EXISTS ( SELECT \*

FROM Has H, User U2

WHERE U2.speed = U1.speed

AND H.name = U2.name

AND S.filename = H.filename

Solution 2:

SELECT S.filename, S.title

FROM Song S

WHERE NOT EXISTS (

SELECT U1.speed

FROM User U1

EXCEPT

SELECT U2.speed

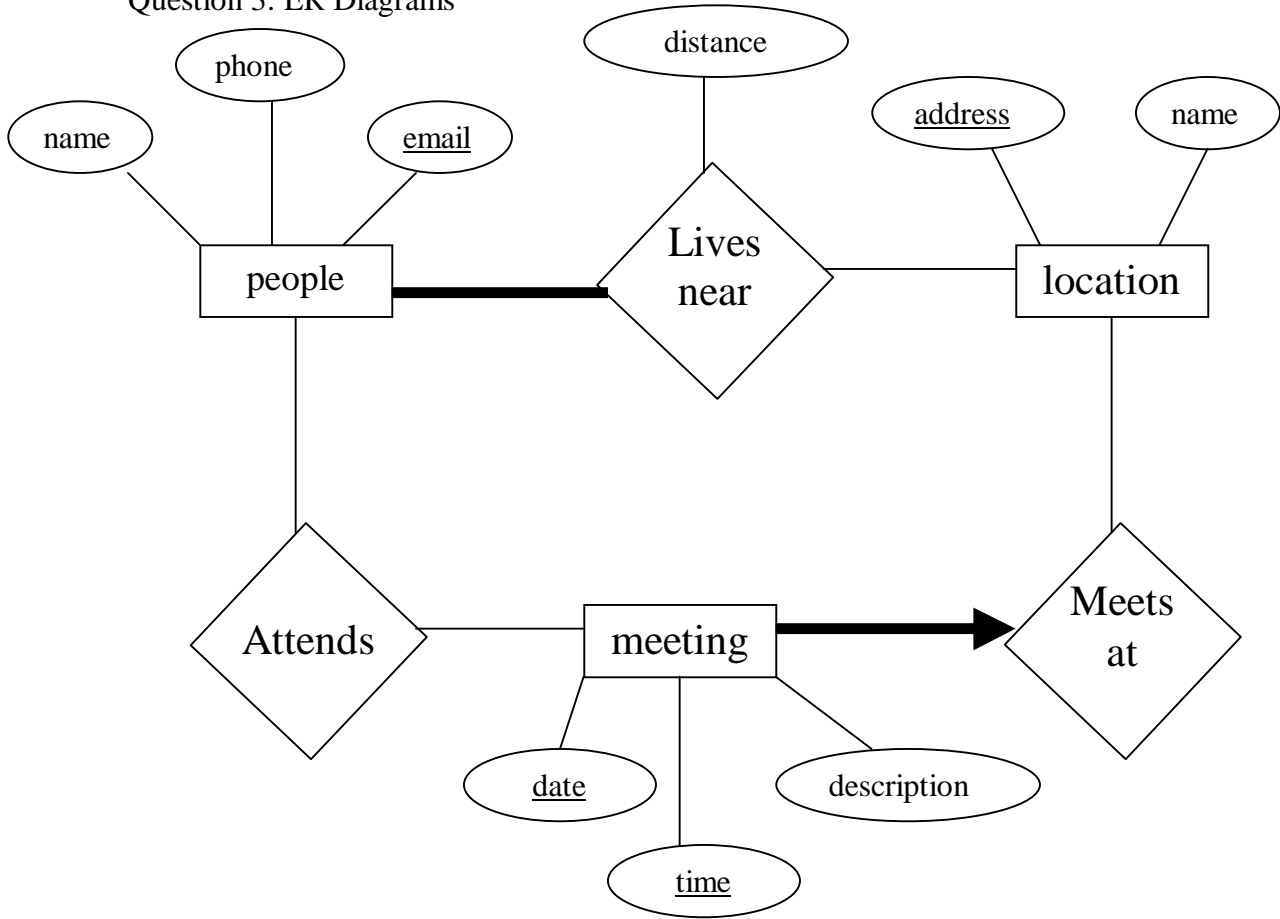
FROM Has H, User U2

WHERE H.filename = S.filename

AND H.name = U2.name

)

Question 3: ER Diagrams



Question 4: Join Algorithms

a) 5 points

$$\begin{aligned} [\text{CARTS}] + [\text{CARTS}] * [\text{CONTENTS}] &= 1,000 + 1,000 * 5,000 \\ &= \mathbf{5,001,000} \end{aligned}$$

b)

$$\begin{aligned} [\text{CARTS}] + [\text{CONTENTS}] + ([\text{CARTS}] - 1) * ([\text{CONTENTS}] - 999) \\ &= 1,000 + 5,000 + (999 * 4,001) \\ &= 6000 + 4,001,000 - 4,001 = \mathbf{4,002,999} \end{aligned}$$

c)

$$\begin{aligned} [\text{CONTENTS}] + \lceil [\text{CONTENTS}] / 1,000 \rceil * [\text{CARTS}] \\ &= 5,000 + 5 * 1,000 = 10,000 \end{aligned}$$

d)

1. Hash Join, since  $\sqrt{[\text{CARTS}]}$  fits in memory ( 2 passes )
2. Sort-Merge Join, since  $\sqrt{[\text{CONTENTS}]}$  Does not fit in memory ( 3 passes )
3. Block Nested Loops Join, 20 passes of CONTENTS !

