Name:
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Midterm Exam Summer 2024
CS525: Advanced Database Organization
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Part II: Attempt all questions.

Database Context:

Consider the following database schema (***CandyStoreDB***) to answer all the questions below.

Frequents (Kid, Store)

Sells (Store, Candy)

Likes (Kid, Candy)

Description:

- **Frequents** indicates which candy stores a kid likes to visit.
- **Sells** shows which candy each store sells.
- **Likes** tells which candy a kid likes.

Note: All attributes are strings.

1. Find the kids who neither like "Kit Kat" nor “Gumdrops” candy.
   [Write the SQL command here] [5 pts].

```
SELECT kid
FROM Likes
WHERE candy != “Kit kat” V  candy != “Gumdrops”;
OR
SELECT kid
FROM Likes
WHERE candy NOT IN (“Kit kat”, “Gumdrops”);
```

[Write the relational algebra here] [6 pts].

$R1 \leftarrow \sigma_{candy != "Kit Kat" \vee candy != "Gumdrops"} (Likes)$

$Final\ Result \leftarrow \pi_{R1.Kid} (R1)$

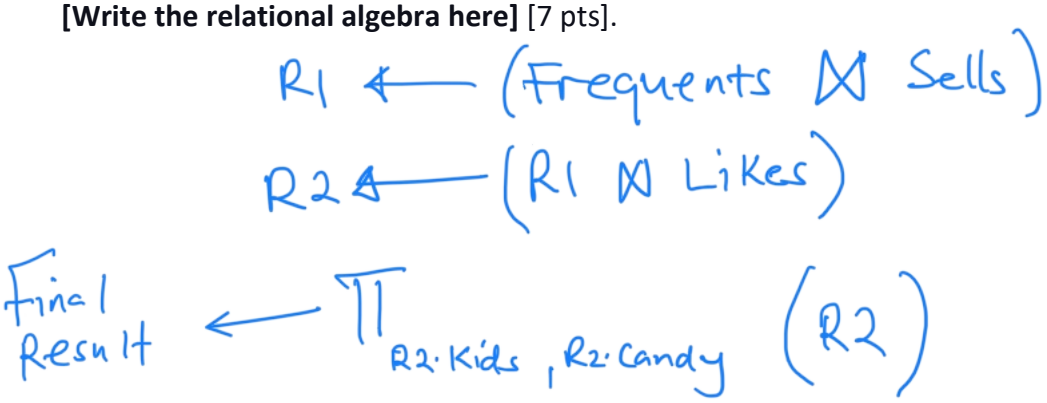
2. Assume every kid likes at least one candy and frequents more than one store. Find the kids who frequent only stores that sell some candy they like.
[Write the SQL command here] [6 pts].

```
SELECT kid, candy
FROM Frequents
INNER JOIN Sells ON Frequents.store = Sells.store
INNER JOIN Likes ON Frequents.kid=Likes.kid;

OR

SELECT kid, candy
FROM Frequents, Sells, Likes
WHERE Frequents.store = Sells.store AND  Frequents.kid=Likes.kid;
```

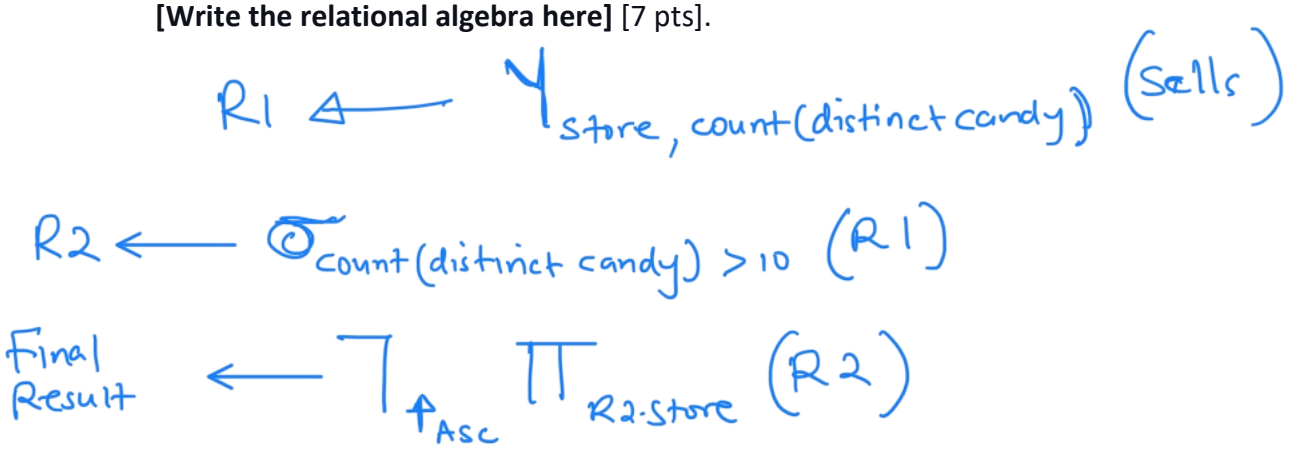
[Write the relational algebra here] [7 pts].



3. List the stores (in alphabetical order) that sell more than 10 different candies.
[Write the SQL command here] [6 pts].

```
Select store
From sells
Group by store
Having count(distinct candy) >10
Order by store ASC;
```

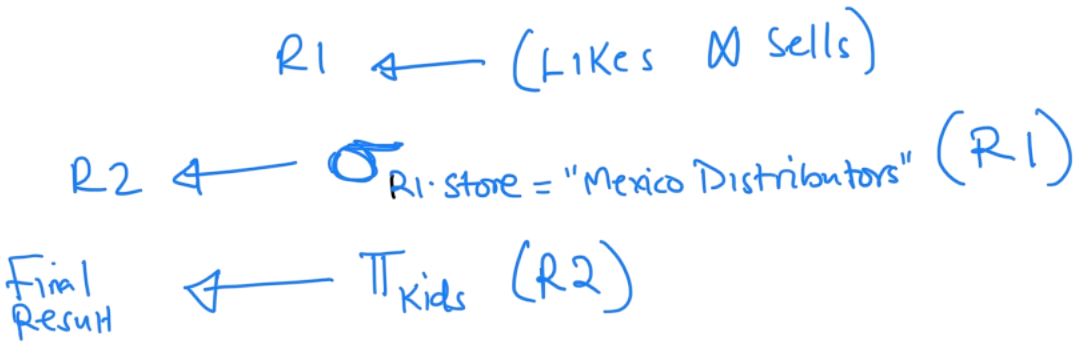
[Write the relational algebra here] [7 pts].



4. List the kids whose liked candies are all sold by the store named "Mexico Distributor". **[Write the SQL command here]** [6 pts].

```
SELECT kids
FROM likes
INNER JOIN Sells ON Sells.candy = Likes.candy
WHERE Sells.store=”Mexico Distributors”;
```

[Write the relational algebra here] [7 pts].



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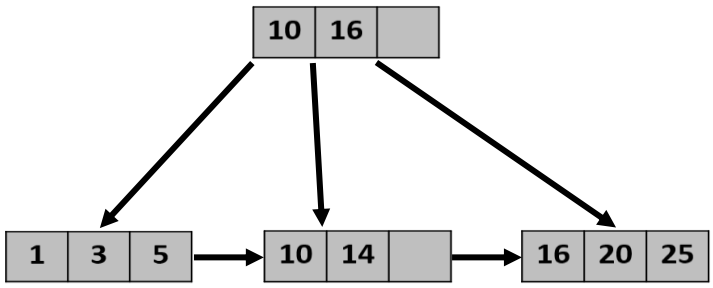
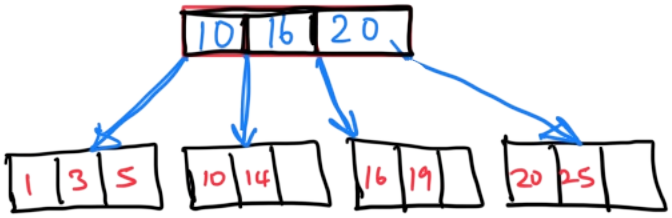
5. Suppose each B+-tree node can hold up to four (4) pointers and three (3) keys. Draw the B+-trees resulting after insertion (a), and deletion (b) operations as shown below.

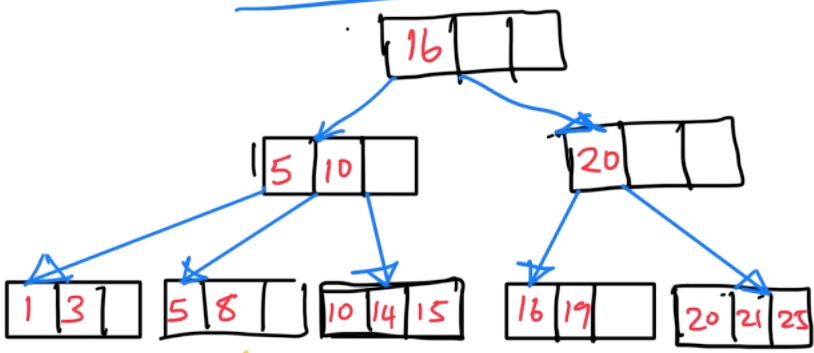
a) **Insertion**: **[show individual tree at each insertion] [15 pts].**
First, insert **19**. Then, insert **15**. Next, insert **8**. Then, insert **21**. Finally, insert **24**



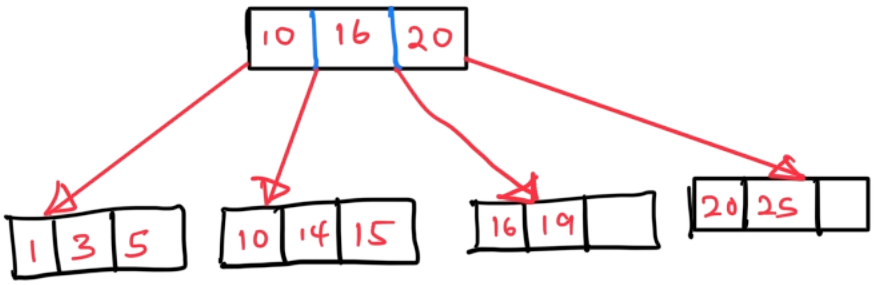
Insert 19



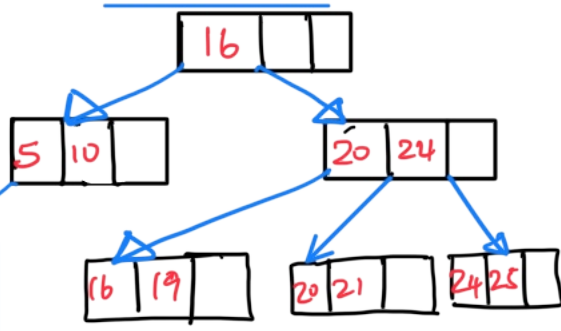
Insert 21



Insert 15

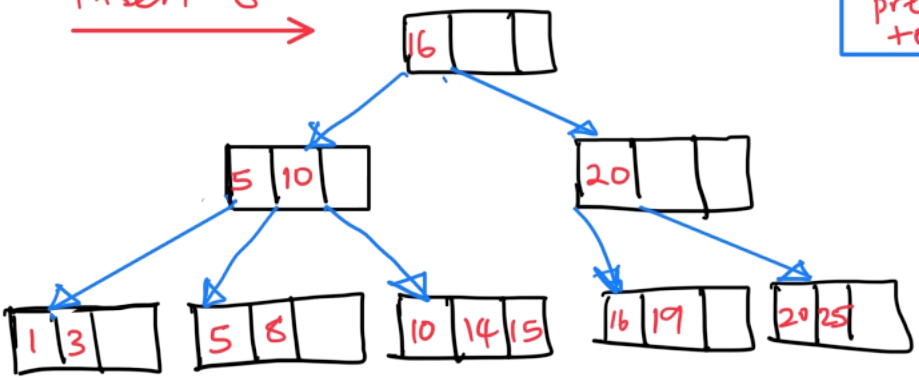


Insert 24



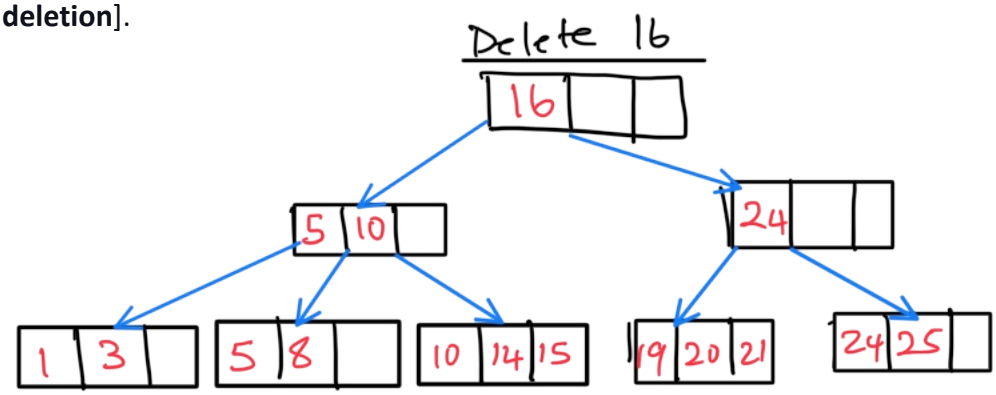
Same as previous tree

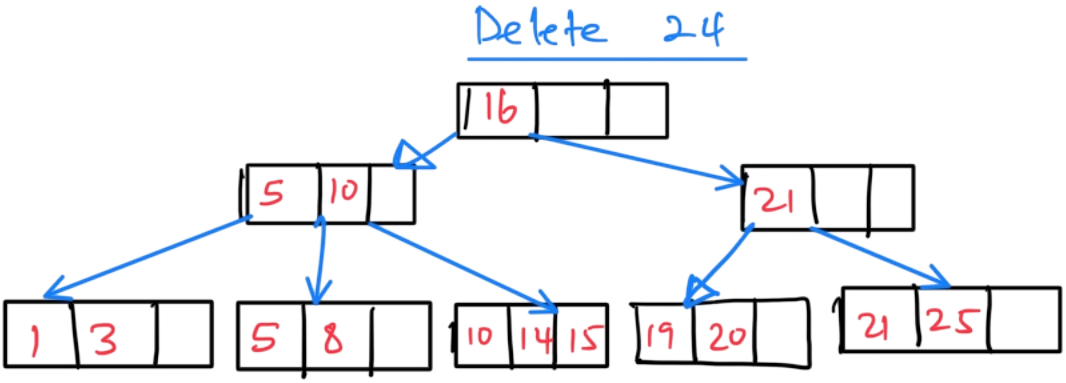
Insert 8

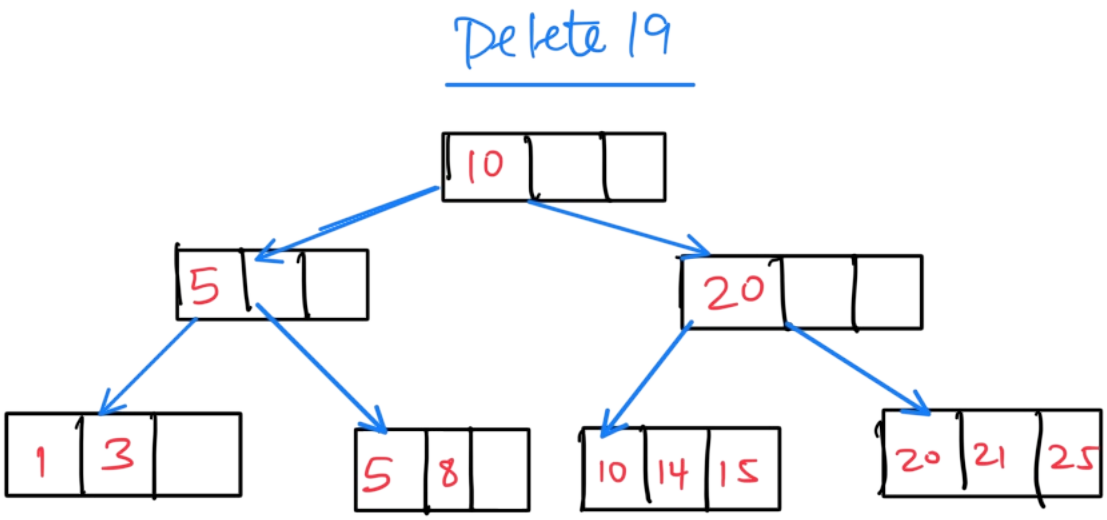


b) Deletion: Use the tree after inserting 24 in part (a) [15 pts]

First, delete **16**; then delete **24**, and finally, delete **19** [**Show individual trees at each deletion**].







Good luck