Section 7:
Relational Algebra, Query Execution

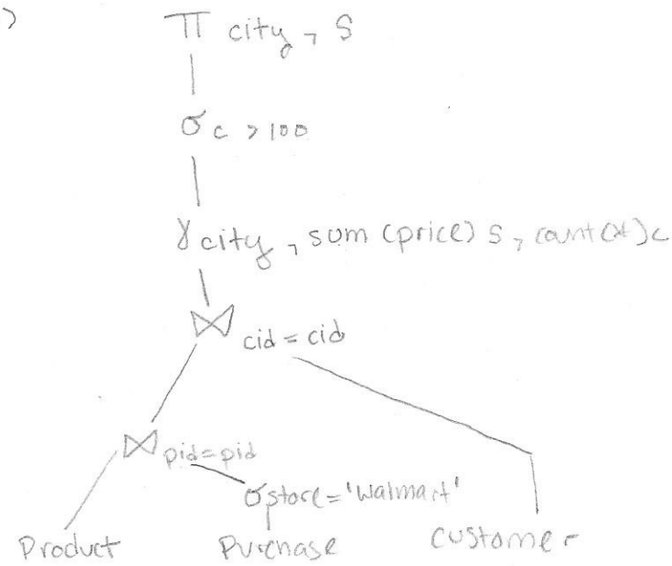
1. Write the logical plan for the queries below.

(a)

Product(pid, name, price)
Purchase(pid, cid, store)
Customer(cid, name, city)

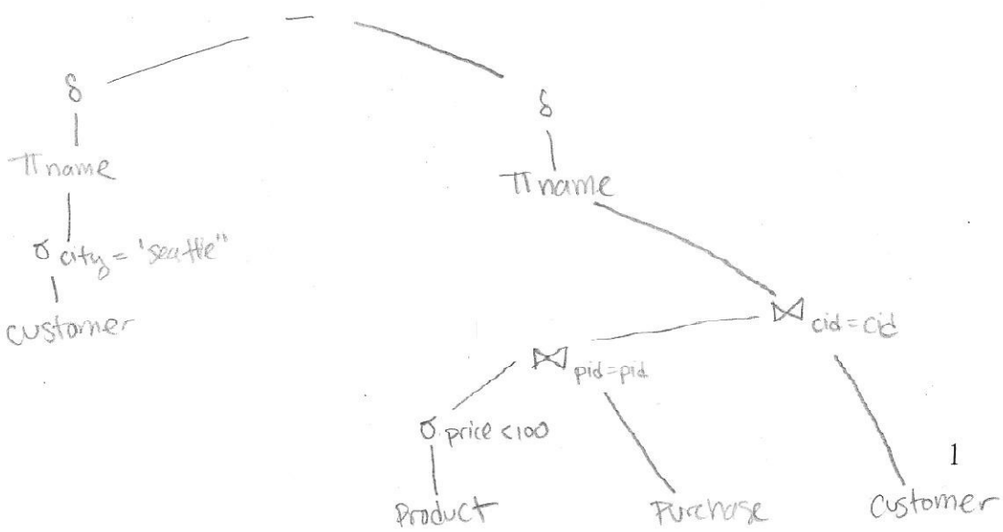
(i) SELECT z.city, sum(x.price)
FROM Product x, Purchase y, Customer z
WHERE x.pid = y.pid and y.pid = z.pid
and y.store = 'Walmart'
GROUP BY z.city
HAVING count(*) > 100

(i)

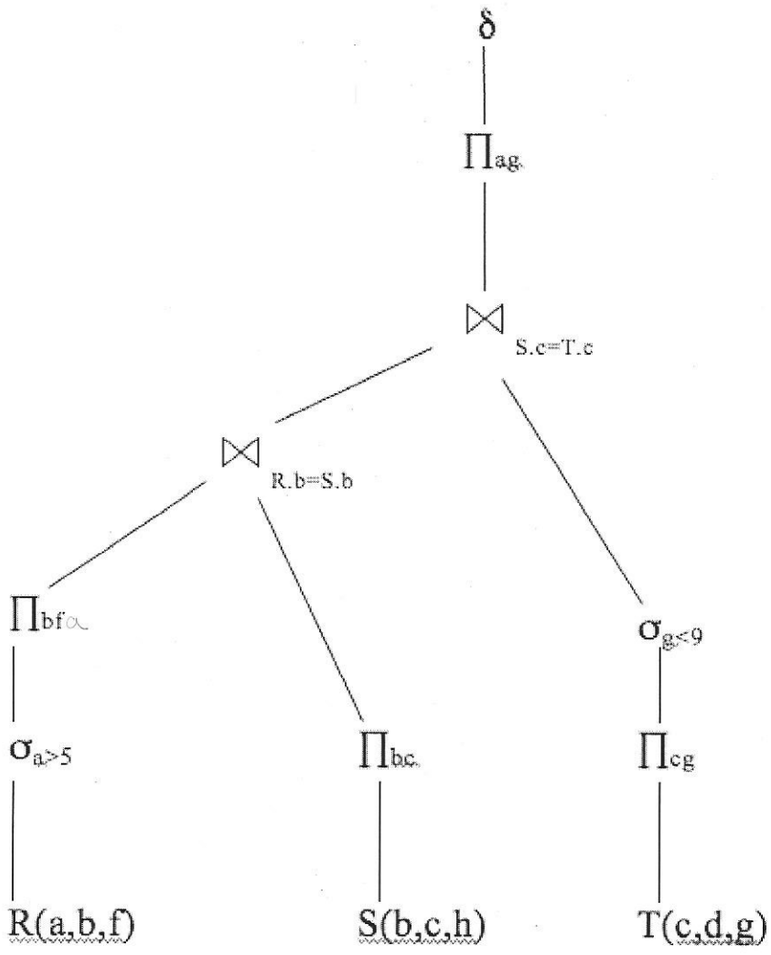


(ii) SELECT DISTINCT z. name
FROM Customer z
WHERE z.city='Seattle' AND
not exists (select *
from Product x, Purchase y
where x.pid= y.pid
and y.cid = z.cid
and x.price < 100)

(ii)



(b) [10 points] Write a SQL query that is equivalent to the logical plan below:

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SELECT  DISTINCT  r.a , t.g
FROM    Rr , Ss , Tt
WHERE   r.a > 5  and  t.g < 9  and
        r.b = s.b  and  s.c = t.c
```

2.

(a) **[10 points]** Consider two tables $R(A, B, C)$ and $S(D, E, F)$, and the query plan P below. Indicate which of the four query plans P_1, P_2, P_3, P_4 are equivalent to P. The symbol $\rtimes$ in P_4 represents the right semi join, i.e. $R \rtimes S = S \ltimes R$.

$$P = \sigma_{A>9}(\gamma_{A,sum(F)}(R \bowtie_{C=D} S))$$

$$P_1 = \gamma_{A,sum(F)}(\sigma_{A>9}(R) \bowtie_{C=D} \gamma_{D,sum(F)}S)$$ equivalent

$$P_2 = \gamma_{A,sum(F)}(\sigma_{A>9}(R) \bowtie_{C=D} \gamma_{D,E,sum(F)}S)$$ equivalent *

$$P_3 = \gamma_{A,sum(F)}(\sigma_{A>9}(R) \bowtie_{C=D} \gamma_{D,E,sum(F)}(\sigma_{A>9}(R) \bowtie_{C=D} S))$$ not equivalent *

$$P_4 = \gamma_{A,sum(F)}(\sigma_{A>9}(R) \bowtie_{C=D} \gamma_{D,E,sum(F)}(\sigma_{A>9}(R) \rtimes_{C=D} S))$$ equivalent *

* Try performing query plans on relations below:

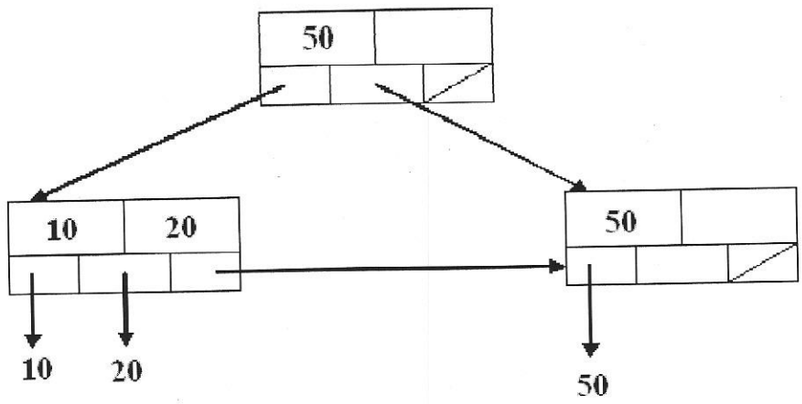
S

D	E	F
c_1	e_1	f_1
c_2	e_1	f_2
c_1	e_1	f_3

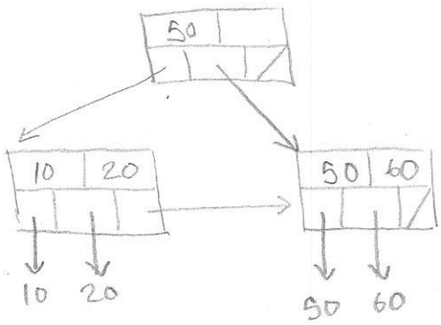
R

A	B	C
a_1	b_1	c_1
a_2	b_1	c_1

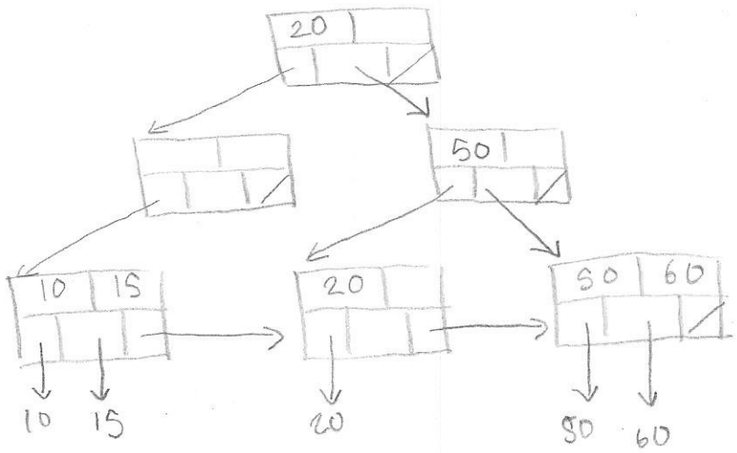
3. Start with the B+ tree below and perform the actions indicated in sequence. (D = 1)



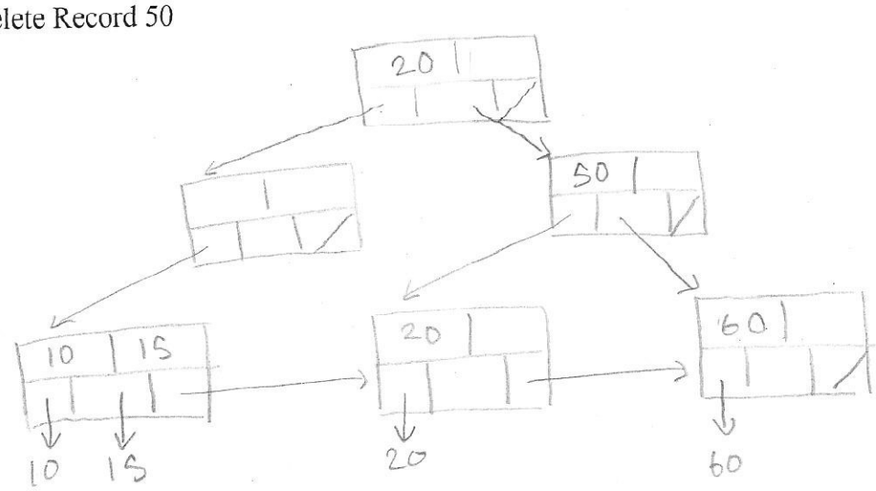
a) Insert Record 60



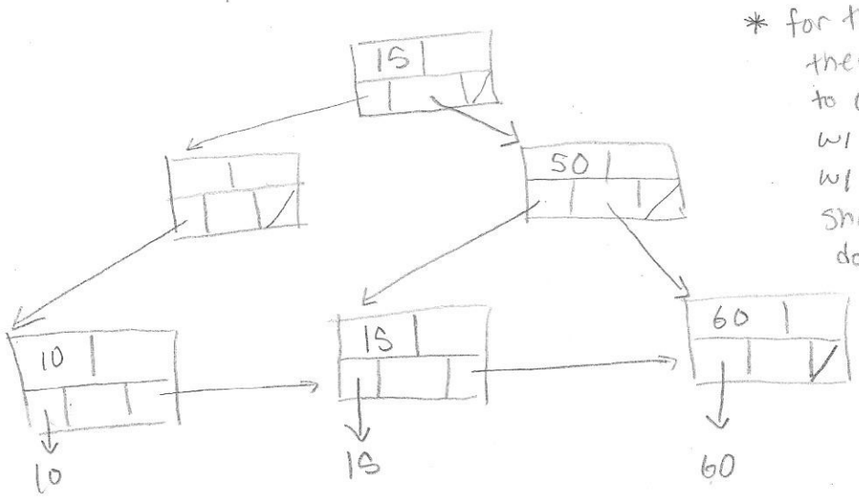
b) Insert Record 15



c) Delete Record 50



d) Delete Record 20 *



* for this example there is a possibility to colapse the node w/ 20 into the node w/ 60. This solution shows the choice of doing a rotation

e) Delete Record 10