COMP2411 Fall 2023 Class Exercise 9

Student Name: _____

Student ID: _____

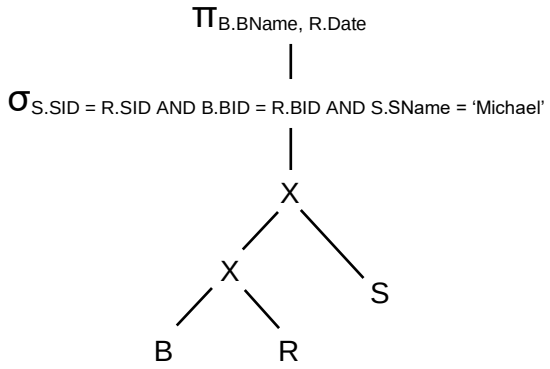
Question 1. Consider the following relations:

```
Sailor (SID, SName, Age, Rating)
Boat (BID, BName, Capacity)
Reserve (SID, BID, Date, Price)
```

Assume there are 10,000 *Sailor* tuples and 100 *Boat* tuples in the database. *SName* is a unique field in the *Sailor* relation. Given the following SQL query:

```
SELECT B.BName, R.Date
FROM Sailor S, Boat B, Reserve R
WHERE S.SID = R.SID AND B.BID = R.BID AND S.SName = 'Michael';
```

The initial query tree is illustrated as follows:

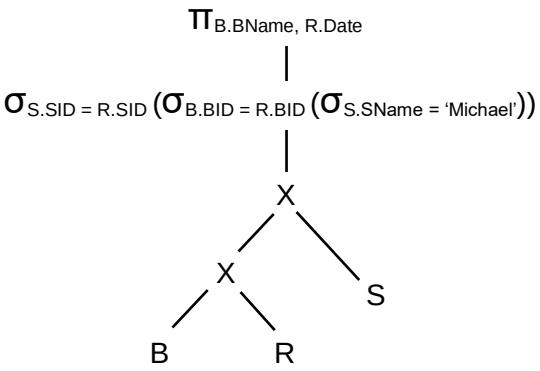


Show the equivalent query tree generated after applying each of the following steps one by one for heuristic-based query tree optimization.

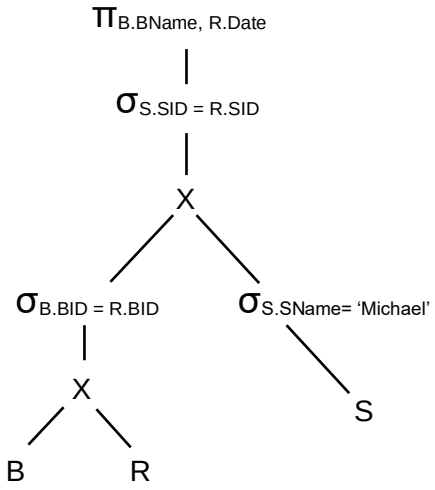
A. Break up the conjunctive selection into a cascade of selection operators.
B. Push down selection operators.
C. Convert cross-products into joins.
D. Rearrange leaf nodes to execute the most restrictive selection operators first.
E. Push down projection operators.

Answers for Question 1:

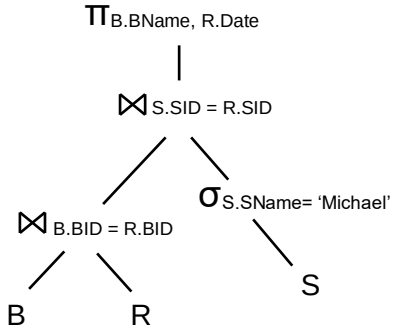
A. Break up the conjunctive selection into a cascade of selection operators:



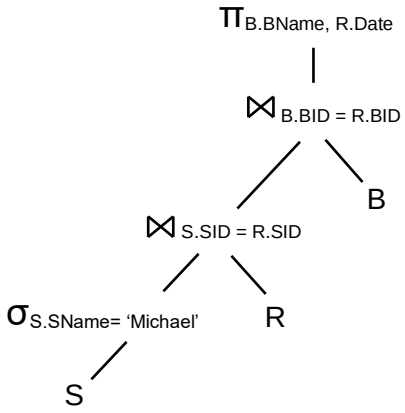
B. Push down selection operators:



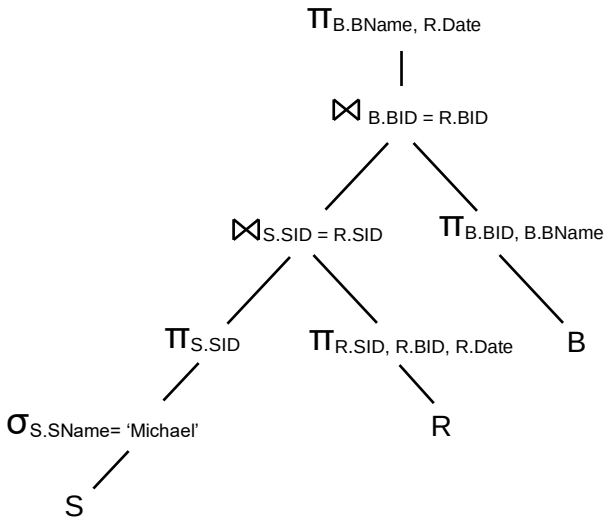
C. Convert cross-products into joins:



D. Rearrange leaf nodes to execute the most restrictive selection operators first:



E. Push down projection operators:



Question 2. Consider two transactions T1 and T2, which are concurrently executed as follows:

Time	T1	T2
1	R(y)	
2		R(y)
3	y = y + 50	
4		y = y × 3
5	W(y)	
6		W(y)
7		

Assume that no concurrency control protocol is used and initially y=20. Answer each of the following questions:

A. What is the possible correct value(s) of y when executing the above transactions under a serial schedule?
   i. T1 followed by T2.
   ii. T2 followed by T1.

B. What would be the actual value of y at time 7?

C. What type of concurrency anomaly has occurred due to the above interleaving execution? Briefly explain that anomaly.

Answers for Question 2:

A. T1 followed by T2: y=210.
T2 followed by T1: y=110.

B. y=60.

C. Lost Update anomaly: The final value of y is incorrect because its update by T1 is lost (overwritten by T2).