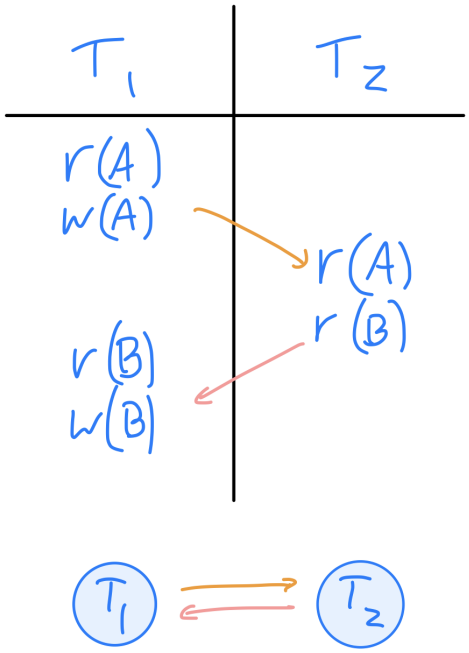
hommework 5

Part 1

1a

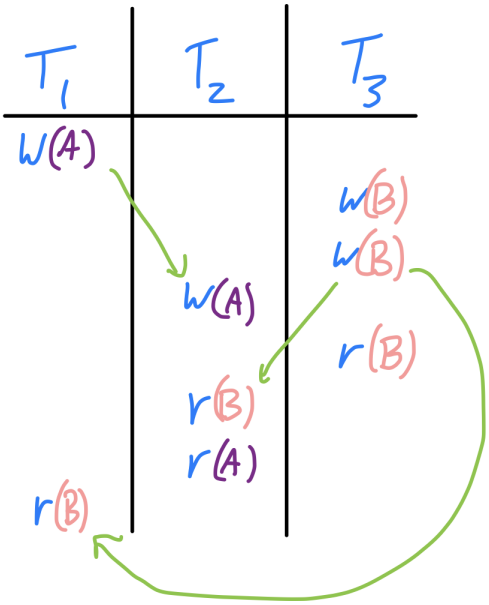
No S is `not serial` because T_2's operations do not come after all of T_1's operations finish.

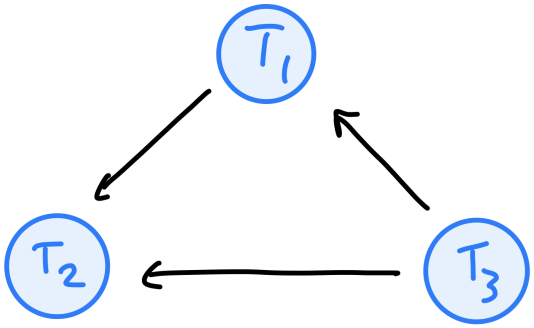
1b



No S is `not conflict serializable` because there is a **loop** in the graph.

2a

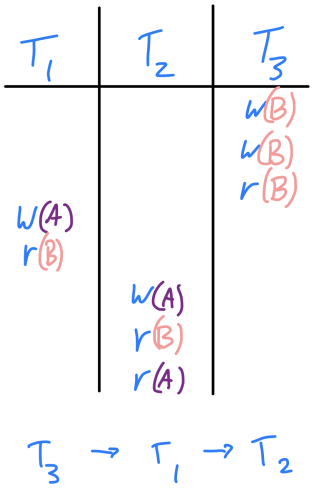




There are more dependences in the table but here is a minimum number of edges to represent all edges in the graph.

2b

Yes S is `conflict serializable`.



Part 2

1

Given: $R(A, B, C, D, E, F)$ split into $R_1 = (A, B, C, F)$ and $R_2 = (A, D, E)$

Does the following still hold?

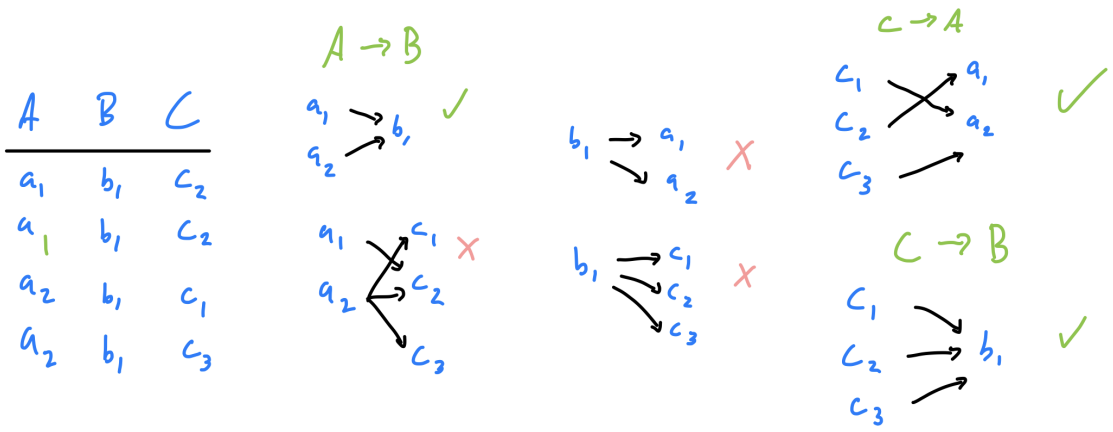
$$F = \{A \to B, A \to C, CD \to E, B \to D, E \to A\}$$

Yes it is lossless.

- $R_1 \cap R_2 = \{A\} \neq \{\}$
- $R_1 \cup R_2 = \{A, B, C, D, E, F\} = R$

$$A \to A$$
$$A \to B$$
$$A \to D$$
$$B \to D$$
$$CD \to E$$
$$\therefore Result = \{A, B, C, D, E, F\}$$
$$A \text{ is a superkey for } R_2 = (A, D, E) \subset Result$$

2



$$F = \{A \to B, C \to A\}$$

3

No it is not in BCNF

$$A \to B$$
$$A \to C$$
$$C \to E$$
$$B \to D$$
$$Result = (A, B, C, D, E)$$
$$G \notin Result$$

$A \to B$ makes it not be `BCNF` because A is not a key or a non trivial relationship.

The key is AG.

$$A \to ABCDE,\ B \to BD,\ C \to CE,\ D \to D,\ E \to E,\ G \to G$$

$B \to BD$:

- $R(A, B, C, D, E, G) = R_1(A, B, C, E, G)$ and $R_2(B, D)$

$C \to CE$:

- $R_1(A, B, C, E, G) = R_3(A, B, C, G)$ and $R_4(C, E)$

$A \to BC$:

- $R_3(A, B, C, G) = R_5(A, G)$ and $R_6(A, B, C)$

R in BCNF is

- $R_6(A, B, C)$ — R_6 preserves $A \to ABC$
- $R_5(A, G)$
- $R_4(C, E)$ — R_4 preserves $C \to E$
- $R_2(B, D)$ — R_2 preserves $B \to D$

$\therefore$ the decomposition is `dependency preserving`

4

The relation is `not` in 2NF because $C \to D$ "band sticks to one genre", where C a prime attribute determines D a no- prime attribute.

The relation is `not` in 3NF because it is not in 2NF.

Functional Dependencies

- $F = \{C \to D, ABC \to D\}$

Keys

- PK = ABC

5

$F = \{ABC \rightarrow D\}$

PK = ABC

The relation `is` in 2NF because every non-prime attribute depends solely on the whole PK.

The relation `is` in 3NF because the left hand side of each relation in F is the PK.

The relation `is` in BCNF because all non-trivial dependencies in F have their left hand side as the PK.