

# Coursework 3: SQL Statements, Schedule and Transactions

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## Part A: SQL Statements & Queries

1)

All attributes involved in a primary key are required to be NOT NULL.

All other attributes also considered necessary so set as NOT NULL. Limited the integers to 4 for id variables, ensures they all follow same format same with bsid. Book isbn always 13 numbers.

Constraints used always reference the primary keys from the parent entities. On update they may cascade to ensure all tables have correct up to date information. However, due to primary keys needing non NULL values, if the foreign key is deleted from a parent entity there should be no action in either Writes or Sells, as id, isbn and bsid, isbn are both part of the Primary Key for these entities. So ON DELETE these foreign constraints are set to NO ACTION, and will CASCADE ON UPDATE.

3)

All attributes involved in a primary key are required to be NOT NULL.

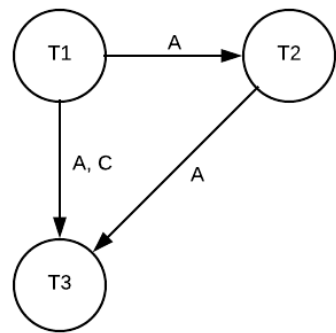
All attributes are NOT NULL, excluding. Age from Employee as it is assumed this is not always required. Since from WorksIn, as it is assumed this is also not always required, this uses the DATE type. Product colour can also be NULL to allow for products when colour isn't relevant. In Sells the quantity can be NULL meaning a shop can add a product before the amount of stock has been bought.

As above the constraints used always reference the primary keys from parent entities meaning the ON DELETE action must be set to NO ACTION but will CASCADE ON UPDATE.

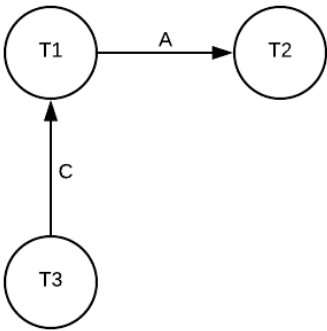
Part B.

1)

a)



S1



S2

b)

Serial Schedule **S1**:

Time	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1	Read A		
2	Read B		
3	Write A		
4	Read C		
5	Write C		
6		Read A	
7		Write A	
8			Read C
9			Read B
10			Write A

Serial Schedule **S2**:

Time	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1			Write C
2	Read A		
3	Read B		
4	Write A		
5	Write C		
6		Read A	
7		Write A	

c)

### Two Phase Locking:

Both schedules may occur through 2 phase locking as they are both conflict serialisable.

There are two phases in 2PL, first the growing phase where locks are obtained but not released, and shrinking phase where locks are released but no new locks are acquired.

Locks required for reading an item are called shared locks, meaning the item can still be read by other transactions but not written to. If an item is being written to, this lock must be exclusive meaning it can be neither written or read while the lock is active.

For example, in S1, T1 will exclusively lock item A and item B, and will shared lock item B. All these locks are acquired at the start of the transaction and will not allow T2 to begin before all locks are released once T1 has completed and the shrinking phase has finished. T2 will then acquire the exclusive lock for item A, then release this lock allowing T3 to occur. T3 will acquire the shared lock on C and B, and the exclusive lock on A.

In S2, T3 will acquire the exclusive lock for C, after the transaction has completed, this lock is removed in the shrinking phase. T1 will then begin and acquire the exclusive locks for A and C and the shared lock for B during the growing phase. After this transaction has completed, all locks are removed during the shrinking phase. T2 will then begin and acquire the exclusive lock for A, once complete this lock is removed during the shrinking phase.

2)

a) Initial: A = 3, B = 5, C = 6

Time	A	B	C	prod
0	3	5	6	n/a
1	3	5	6	n/a
2	3	5	6	n/a
3	3	5	6	n/a
4	3	5	6	n/a
5	1	5	6	n/a
6	1	5	6	3
7	1	5	6	3
8	1	5	6	3
9	2	5	6	3
10	2	5	6	3
11	2	5	6	15
12	2	5	6	15
13	2	6	6	15
14	2	6	6	15
15	2	6	6	15
16	2	6	5	15
17	2	6	5	15
18	2	6	5	75

Final Values: A = 2, B = 6, C = 5, prod = 75

b) A: 0, B: 6, C: 5, prod: 30

c) A: 0, B: 6, C: 5, prod: 90