Exercise 7

1. Assume the following two transactions start at nearly the same time and there is no other concurrent transaction. The 2nd operation of both transactions is Xlock(B). Is there a potential problem if Transaction 1 performs the operation first? What if Transaction 2 performs the operation first?

Transaction 1		Transaction 2	
1.1	Slock(A)	2.1	Slock(A)
1.2	Xlock(B)	2.2	Xlock(B)
1.3	Read(A)	2.3	Write(B)
1.4	Read(B)	2.4	Unlock(B)
1.5	Write(B)	2.5	Read(A)
1.6	Unlock(A)	2.6	Xlock(B)
1.7	Unlock(B)	2.7	Write(B)
		2.8	Unlock(A)
		2.9	Unlock(B)

2. What degree of isolation does the following transaction provide?

Slock(A)
Xlock(B)
Read(A)
Write(B)
Read(C)
Unlock(A)
Unlock(B)

3. The following operations are given with Degree 2 isolation locking principles in place. Convert the locking sequence to Degree 3.

Degree 2

Slock(A)
Read(A)
Unlock(A)
Xlock(C)
Xlock(B)
Write(B)
Slock(A)
Read(A)
Unlock(A)
Write(C)
Unlock(B)
Unlock(C)

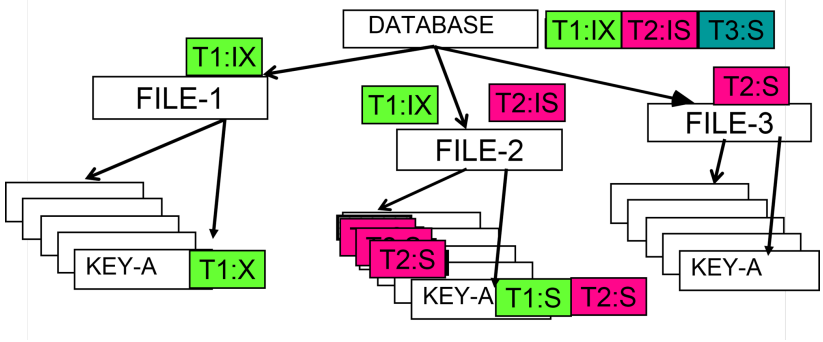
4. The following transactions are issued in a system at the same time. Answer for both scenarios.

   (a) **Scenario 1:** When the value of A is 3, which of the following transactions can run concurrently from the beginning till commit (that is, all operations and locks are compatible to run concurrently with another one) and which ones need to be delayed? Please give an explanation for the delayed transactions. Note that, the order of start of transactions can be deducted from the beginning positions of the transactions in the table given.

   (b) **Scenario 2:** When the value of A is 2, which of the following transactions can run concurrently from the beginning till commit (that is, all operations and locks are compatible to run concurrently with another one) and which ones need to be delayed? Please give an explanation for the delayed transactions. Let's assume T1 starts slightly earlier than others for this case.[1]

	T2	T3
	Lock (U,A)	Lock (IX,A)
T1	Read A	Read A
Lock (S,A)	if(A ==3) {	if(A ==3){
Read A	Lock(X,A)	Lock(X,A)
Unlock A	Write A	Write A
	}	}
	Unlock A	Unlock A

5. Review the concepts of granular locks then answer the following question. Given the hierarchy of database objects and the corresponding granular locks in the following picture, which transactions can run if the transactions arrive in the order T1-T2-T3? What if the order is T3-T2-T1? Note that locks from the same transaction are in the same colour. We assume that the transactions need to take the locks when they start to run.



6. With two-phase locking we have already seen a successful strategy that will solve concurrency problems for DBMSs. Then discuss why someone may want to invent something like Optimistic Concurrency control in addition to that locking mechanism.

[1] *There can be different versions of the compatibility matrix. Please use the compatibility matrix from the lecture slides for this exercise.