Exercise 6

1. If we use the following comments to lock and unlock access to objects then: Which transactions below are in deadlock if they start around the same time?

T1	T2	T3	T4
Begin	Begin	Begin	Begin
LOCK(C)	LOCK(A)	LOCK(C)	LOCK(B)
Write C	Write A	Write C	Write B
UNLOCK(C)	LOCK(B)	UNLOCK(C)	LOCK(A)
End	Write(B)	End	Write A
	UNLOCK(A)		UNLOCK(A)
	UNLOCK(B)		UNLOCK(B)
	End		End

2. What are the dependencies in the following history (a sequence of tuples in the form (Ti, Oi, Tj))? Draw the dependency graph mapping to this dependency set as well.

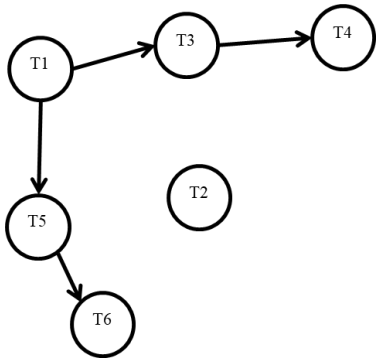
$$H =< (T1, R, O1), (T3, W, O5), (T3, W, O1), (T2, R, O5), (T2, W, O2), (T5, R, O4), (T1, R, O2), (T5, R, O3) >$$

3. Given the solution above for question 2, can we say the history is equal to a serial history. If yes, show one such history. If not, show that there is a wormhole.

4. Repeat questions 2 and 3 with history:

$$H =< (T3, W, O5), (T3, W, O1), (T2, R, O5), (T2, W, O2), (T5, R, O4), (T1, R, O1), (T1, R, O2), (T5, R, O3) >$$

5. Given the graph below for six transactions we can see the dependency between the transactions. If we add a link from T6 to T3, the graph becomes more complicated. Please in that case list After(T6) and Before(T6). Does this link cause a wormhole to appear, in otherwise a set of dependencies where there were no wormholes in the original version of the graph? Instead, if we have a link added from T4 to T1, please list After(T4) and Before(T4). Does this link cause a wormhole? Which one of the two modifications represents dependencies for a history that we can call isolated?



6. Given the operations for a transaction T1 below, please list the lines that this transaction is executing that cannot happen with two-phase locking. Briefly explain.

```
1   Slock(A)
2   Read(A)
3   Unlock(A)
4   Slock(B)
5   Read(B)
6   Unlock(B)
7   Xlock(C)
8   Write(C)
9   Unlock(C)
10  Xlock(A)
11  Write(A)
12  Unlock(A)
```