INFDEV026B Tentamen OP2 2018
Solution

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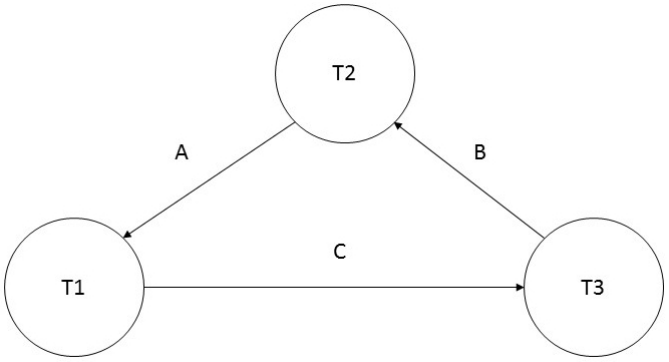
Question I: Database normalization (5 pts.)

- It is in the 1NF because all the values are atomic. The table is in 2NF because it is in the 1NF and there cannot be partial dependencies on a key in a table where the only key is made of a single column. It is not in 3NF because the right argument of the given dependency is not part of a key (transitive dependency). The decomposition in BCNF can be found below:
- Normalization:
  - The normalized tables in BCNF
    Table **Employee**: employee_code | employee_name | employee_age | factory_name
    Table **Factory**: factory_name | size

Question II - Transactions (5 pts.) The strict 2PL schedule is the following:

T1	T2	T3
X(A)		
W(A)		
	X(B)	
	W(B)	
R(A)		
	WaitLock(A)	
		S(C)
		R(C)
S(C)		
R(C)		
		WaitLock(B)
Commit		
Unlock(A)		
	S(A)	
	R(A)	
	X(A)	
	W(A)	
	Commit	
	Unlock(A)	
	Unlock(B)	
		X(B)
		W(B)
		Commit
		Unlock(B)
		Unlock(C)

There is a deadlock involving all the transactions. In order to break it, one of the transactions must be aborted. The wait graph is the following:



Question III: Map-Reduce (5 pts.)

```
//TODO1: Complete the implementation of Reduce
 result = operation(result, collection.ElementAt(i));

//TODO2: Complete the implementation of Join
 if (condition(row))
        c.Add(row);

//TODO3: Replace with the correct lambda
(c => new { Name = c.Name, Duration = c.Duration })

//TODO4: Replace with the correct call to Reduce
(0, (total, _) => total += 1)

//TODO5: Complete the code to implement the query
if (t.Item2.Month > 10)
{
    l.Add(t);
}
return l;
```

Question IV: Graph databases (5 pts.)

```
create(t1:Team{t_nr:'1', name:'Espresso'}),
        (p1:Player{p_nr:1, pname: 'Tim', position: 'center', age:23, salary: 2000}),
        (p2:Player{p_nr:2, pname: 'Thomas', position: 'defender', age:24, salary: 2050}),
        (p3:Player{p_nr:3, pname: 'George', position: 'defender', age:28, salary: 3000}),
        (tr1:Trainer{name:'Fabio Capello', salary:4000}),
        (t1)<-[pf1:PLAYS_FOR{start_date:"2016-12-01", end_date:"2019-03-01"}]-(p1),
        (t1)<-[pf2:PLAYS_FOR{start_date:"2012-12-01", end_date:"2018-03-01"}]-(p2),
        (t1)<-[pf3:PLAYS_FOR{start_date:"2009-01-01", end_date:"2020-04-02"}]-(p3),
        (t1)<-[trn:TRAIN{start_date:"2017-02-04", end_date:"2020-03-01"}]-(tr1)
return pf1,pf2,pf3,trn;
```

The queries are the following:

```
//Query1
match (p:Player)-[]-()-[:TRAIN]-(:Trainer{name:"Fabio Capello"}) return p.pname

//Query2
match (p:Player)-[pf:PLAYS_FOR]-(:Team{name:'Espresso'}) where pf.start_date > "2010-12-03"
    return p.pname, p.position, p.salary
```