

## Lab week 6 (ISYS2120 sem2 2022)

Welcome to week 6's lab. This week we are going to focus on practice with the theory of relational design, especially functional dependencies, BCNF and schema decomposition. There is also time to work on Asst2 and show your group progress to the lab demonstrator, for feedback, and show and individual progress to gain marks.

### A. Relational design theory

Look at the Suppose we have a database for an investment manager, consisting of a single relation Investments(BrokerName, Office, InvestorId, StockName, Dividend, Quantity). A tuple such as (JBWere, Darlinghurst, 324, BHP, 15.39, 120) in the relation means that an investor, with InvestorId 324, bought 120 shares of BHP stock from broker JBWere at the Darlinghurst office, and the dividend paid this year will be \$15.29 per share. Assume that by interviewing people we have discovered that the following functional dependencies hold:

- BrokerName  $\rightarrow$  Office
- StockName  $\rightarrow$  Dividend
- InvestorId  $\rightarrow$  BrokerName
- InvestorID, StockName  $\rightarrow$  Quantity

i) Express these functional dependencies in English.

ii) Consider the following collection of tuples. Why is this instance not a legal state for the database, given the functional dependency information above?

BrokerName	Office	InvestorId	StockName	Dividend	Quantity
JBWere	Melbourne	4069	BHP	1.25	35
CommSec	Sydney	5035	BHP	1.25	20
JBWere	Sydney	3772	ANZ	0.60	50
ETrade	Canberra	4069	BHP	0.60	15
CommSec	Sydney	5035	RIO	1.25	20
JBWere	Melbourne	3772	ANZ	0.60	100

iii) Give an instance that is legal for the schema and functional dependencies above.

- iv) Calculate the attribute closure of the combined columns (BrokerName, StockName). Is this combination a candidate key for the relation Investments?
- v) What are the possible choices for candidate key in this relation?
- vi) Is the relation Investments in BCNF? Explain your answer.
- vii) Consider a proposed decomposition into two relations  
R1(InvestorId, StockName, Quantity, Dividend) and R2(InvestorId, BrokerName, Office). Show the state of the decomposed relations, if the state of Investment is the one you gave in question c above.
- viii) Is the decomposition into R1 and R2, described in g) above, a lossless join decomposition? Is it a dependency-preserving decomposition? Are the resulting relations in BCNF? What problems might arise if this design were used?
- ix) Consider a proposed decomposition into  
R3(BrokerName, Office), R4(Office, InvestorId), R5(InvestorId, Stockname), R6(Stockname, Dividend), and R7(Dividend, Quantity). Is this a lossless join decomposition? Is it dependency-preserving decomposition? Are the resulting relations in BCNF? What problems might arise if this design were used?
- x) Give a decomposition that has lossless join and all the relations in BCNF. Show the instance that results on using your decomposition on the instance you choose in question A.iii) above. Is this decomposition dependency-preserving?

**B. Time to work on Assignment 2, get feedback from lab demonstrator, and show individual progress**

Please bring to lab the combined group's high-level ER diagram, showing the entity sets and relationship sets you propose to have. As well, each member should have indicated the attributes for one of the entity sets, and decided on a primary key for this entity set.. Show these to the lab demonstrator, when they speak with your group. If some member can't attend the lab, they can upload a document with their part of a diagram in Canvas for the week 6 individual contribution task, and let the demonstrator know (via other members) to find it and award marks for it.

In the time when the demonstrator is with other groups, you should make progress towards your combined submission, for example, by allocating responsibility for the other entity sets and the relationships (not yet done), and deciding on constraints for cardinality, participation, etc.

**Before the end of the week**

Before Sunday September 11, you need to finish the assessments that are due: SQL Tasks 10, 11, 12; Quiz6). Before your next lab, also complete the individual progress for week 7.