MSDS 420

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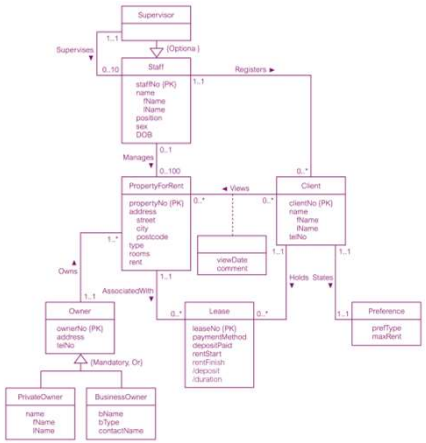
Agenda

- The Rational and Objectives for the Normalization Process
- 1NF, 2NF, 3NF
- Assignment #1 Walkthrough and Deliverable

How to build Database Application?

1

- ER Diagram
- UML



Conceptual Data Model

2

- Relations

Branch (branchNo, street, city, postcode, mgrStaffNo) **Primary Key** branchNo **Alternate Key** postcode **Foreign Key** mgrStaffNo **references** Manager(staffNo)	**Telephone** (telNo, branchNo) **Primary Key** telNo **Foreign Key** branchNo **references** Branch(branchNo)
Staff (staffNo, fName, lName, position, sex, DOB, salary, supervisorStaffNo, branchNo) **Primary Key** staffNo **Foreign Key** supervisorStaffNo **references** Staff(staffNo) **Foreign Key** branchNo **references** Branch(branchNo)	**Manager** (staffNo, mgrStartDate, bonus) **Primary Key** staffNo **Foreign Key** staffNo **references** Staff(staffNo)
PrivateOwner (ownerNo, fName, lName, address, telNo) **Primary Key** ownerNo	**BusinessOwner** (ownerNo, bName, bType, contactName, address, telNo) **Primary Key** ownerNo **Alternate Key** bName **Alternate Key** telNo
PropertyForRent (propertyNo, street, city, postcode, type, rooms, rent, ownerNo, staffNo, branchNo) **Primary Key** propertyNo **Foreign Key** ownerNo **references** PrivateOwner(ownerNo) and BusinessOwner(ownerNo) **Foreign Key** staffNo **references** Staff(staffNo) **Foreign Key** branchNo **references** Branch(branchNo)	**Viewing** (c ientNo, propertyNo, dateView, comment) **Primary Key** clientNo, propertyNo **Foreign Key** clientNo **references** Client(clientNo) **Foreign Key** propertyNo **references** PropertyForRent(propertyNo)
Client (clientNo, fName, lName, telNo, prefType, maxRent) **Primary Key** clientNo	**Registration** (clientNo, branchNo, staffNo, dateJoined) **Primary Key** clientNo **Foreign Key** clientNo **references** Client(clientNo) **Foreign Key** branchNo **references** Branch(branchNo) **Foreign Key** staffNo **references** Staff(staffNo)
Lease (leaseNo, paymentMethod, depositPaid, rentStart, rentFinish, cl entNo, propertyNo) **Primary Key** easeNo **Alternate Key** propertyNo, rentStart **Alternate Key** c ientNo, rentStart **Foreign Key** clientNo **references** Client(clientNo) **Foreign Key** propertyNo **references** PropertyForRent(propertyNo) **Derived** depos t (PropertyForRent.rent*2) **Derived** duration (rentFinish – rentStart)	**Newspaper** (newspaperName, address, telNo, contactName) **Primary Key** newspaperName **Alternate Key** telNo
Advert (propertyNo, newspaperName, dateAdvert, cost) **Primary Key** propertyNo, newspaperName, dateAdvert **Foreign Key** propertyNo **references** PropertyForRent(propertyNo) **Foreign Key** newspaperName **references** Newspaper(newspaperName)	

Logical Data Model

3

- Tables
- SQL

Table 5.1 Result table for Example 5.1.

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000.00	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000.00	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000.00	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000.00	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000.00	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000.00	B005

Implementation Model

Table with multivalued attributes, not in 1st normal form

INVOICE data (Pine Valley Furniture Company)

OrderID	Order Date	Customer ID	Customer Name	Customer Address	ProductID	Product Description	Product Finish	Product StandardPrice	Ordered Quantity
1006	10/24/2015	2	Value Furniture	Plano, TX	7	Dining Table	Natural Ash	800.00	2
					5	Writer's Desk	Cherry	325.00	2
					4	Entertainment Center	Natural Maple	650.00	1
1007	10/25/2015	6	Furniture Gallery	Boulder, CO	11	4–Dr Dresser	Oak	500.00	4
					4	Entertainment Center	Natural Maple	650.00	3

Note: This is NOT a relation.

Table with no multivalued attributes and unique rows, in 1st normal form

INVOICE relation (1NF) (Pine Valley Furniture Company)

OrderID	Order Date	Customer ID	Customer Name	Customer Address	ProductID	Product Description	Product Finish	Product StandardPrice	Ordered Quantity
1006	10/24/2015	2	Value Furniture	Plano, TX	7	Dining Table	Natural Ash	800.00	2
1006	10/24/2015	2	Value Furniture	Plano, TX	5	Writer's Desk	Cherry	325.00	2
1006	10/24/2015	2	Value Furniture	Plano, TX	4	Entertainment Center	Natural Maple	650.00	1
1007	10/25/2015	6	Furniture Gallery	Boulder, CO	11	4–Dr Dresser	Oak	500.00	4
1007	10/25/2015	6	Furniture Gallery	Boulder, CO	4	Entertainment Center	Natural Maple	650.00	3

Normalization Process

- Objective is to ensure that each table conforms to the concept of well-formed **relations**
  - Each relation/table represents a single subject
  - No data item will be unnecessarily stored in more than one relation/table
  - All nonprime attributes in a relation/table are dependent on the primary key
  - Each relation/table is void of insertion, update, and deletion anomalies

Normalization Process

- Ensures that all tables are in at least 3NF
- Higher forms are not likely to be encountered in business environment
- Works one relation at a time
- Starts by:
  - Identifying the dependencies of a relation (table)
  - Progressively breaking the relation into new set of relations

Normal Forms

NORMAL FORM	CHARACTERISTIC
First normal form (1NF)	Table format, no repeating groups, and PK identified
Second normal form (2NF)	1NF and no partial dependencies
Third normal form (3NF)	2NF and no transitive dependencies
Boyce-Codd normal form (BCNF)	Every determinant is a candidate key (special case of 3NF)
Fourth normal form (4NF)	3NF and no independent multivalued dependencies

Functional Dependence Concepts

FUNCTIONAL DEPENDENCE CONCEPTS	
CONCEPT	**DEFINITION**
Functional dependence	The attribute *B* is fully functionally dependent on the attribute *A* if each value of *A* determines one and only one value of *B*. Example: PROJ_NUM SPROJ_NAME (read as *PROJ_NUM functionally determines PROJ_NAME*) In this case, the attribute PROJ_NUM is known as the determinant attribute, and the attribute PROJ_NAME is known as the dependent attribute.
Functional dependence (generalized definition)	Attribute *A* determines attribute *B* (that is, *B* is functionally dependent on *A*) if all (generalized definition) of the rows in the table that agree in value for attribute *A* also agree in value for attribute *B*.
Fully functional dependence (composite key)	If attribute *B* is functionally dependent on a composite key *A* but not on any subset of that composite key, the attribute *B* is fully functionally dependent on *A*.

Types of Functional Dependencies

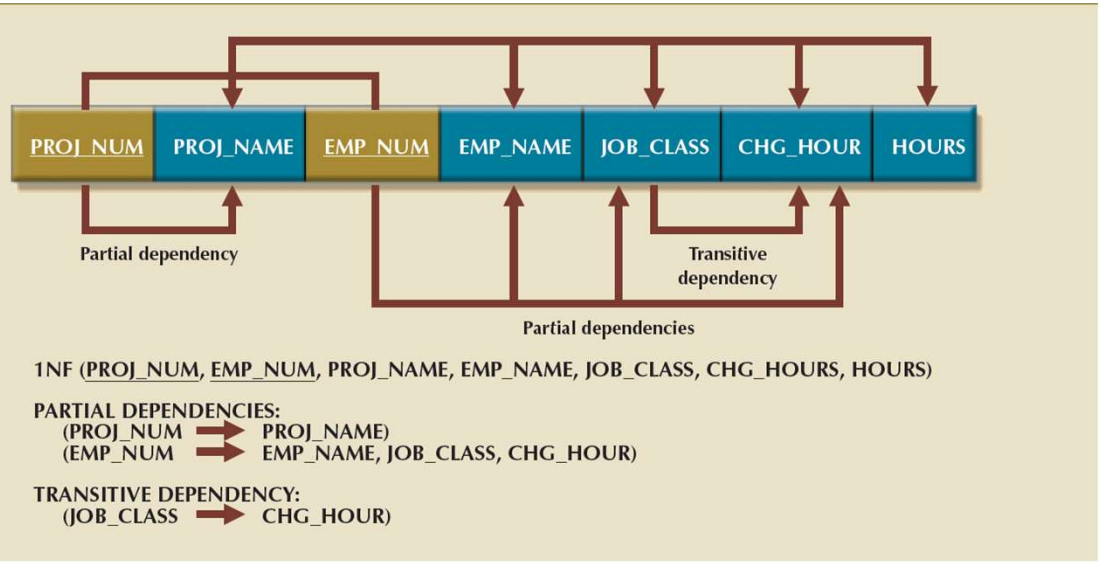
1. **Partial dependency**: Functional dependence in which the determinant is only part of the primary key

2. **Transitive dependency**: An attribute functionally depends on another nonkey attribute

Conversion to First Normal Form

- 1NF describes tabular format in which:
  - All key attributes are defined
  - There are no repeating groups in the Relation/table
  - All attributes are dependent on the primary key
- All relational tables (Relarions) satisfy 1NF requirements
- Some Relations/tables contain partial dependencies
  - Subject to data redundancies and various anomalies

First Normal Form (1NF) Dependency Diagram

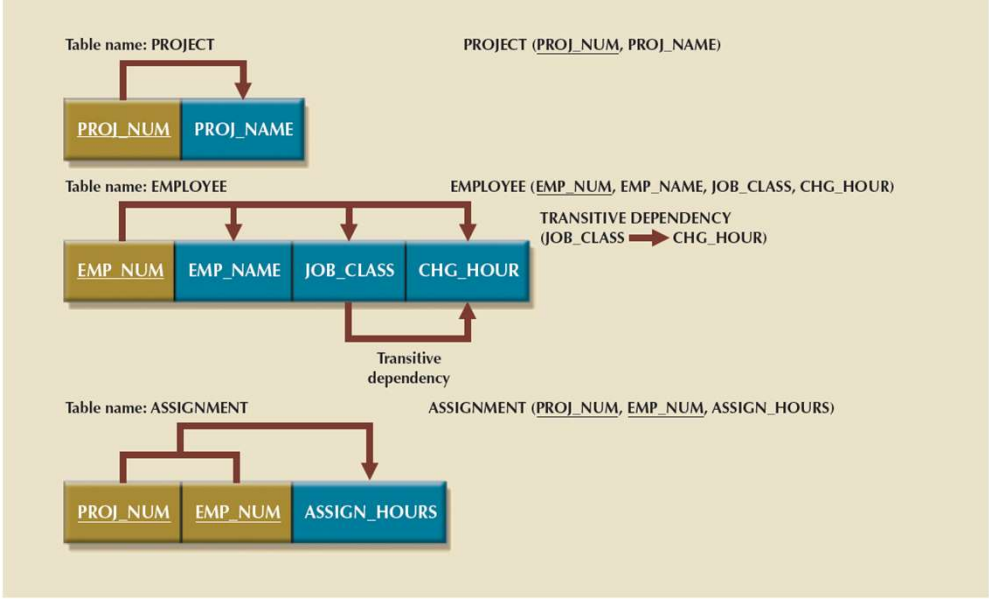


Conversion to Second Normal Form

- Steps
  - Make new relations/tables to eliminate partial dependencies
  - Reassign corresponding dependent attributes

- Relation/Table is in 2NF when it:
  - Is in 1NF
  - Includes no partial dependencies

Second Normal Form (2NF) Conversion Results

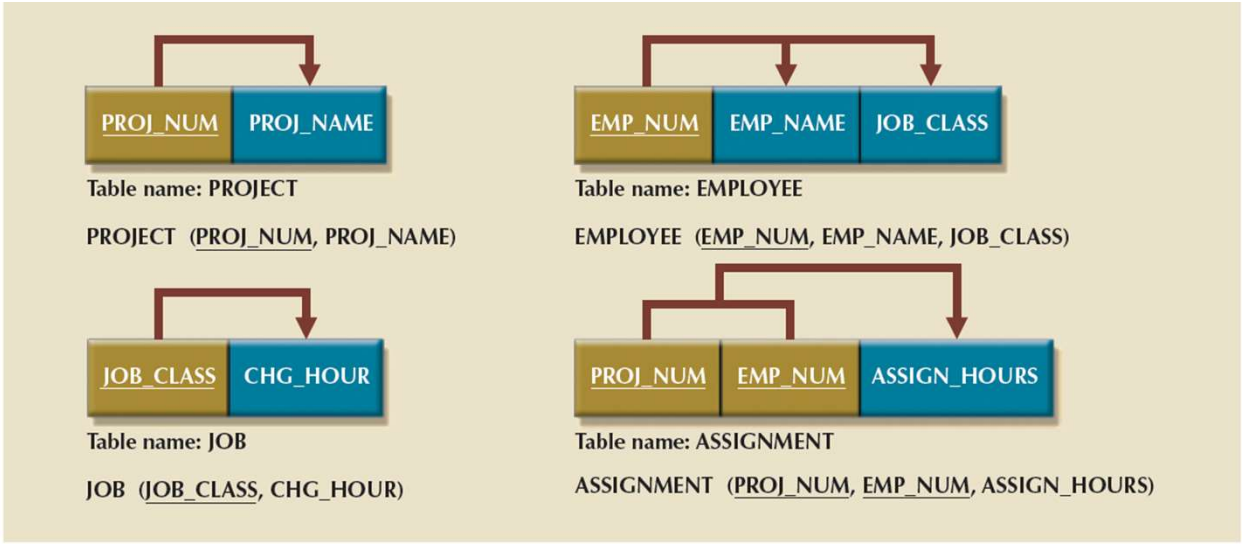


Conversion to Third Normal Form

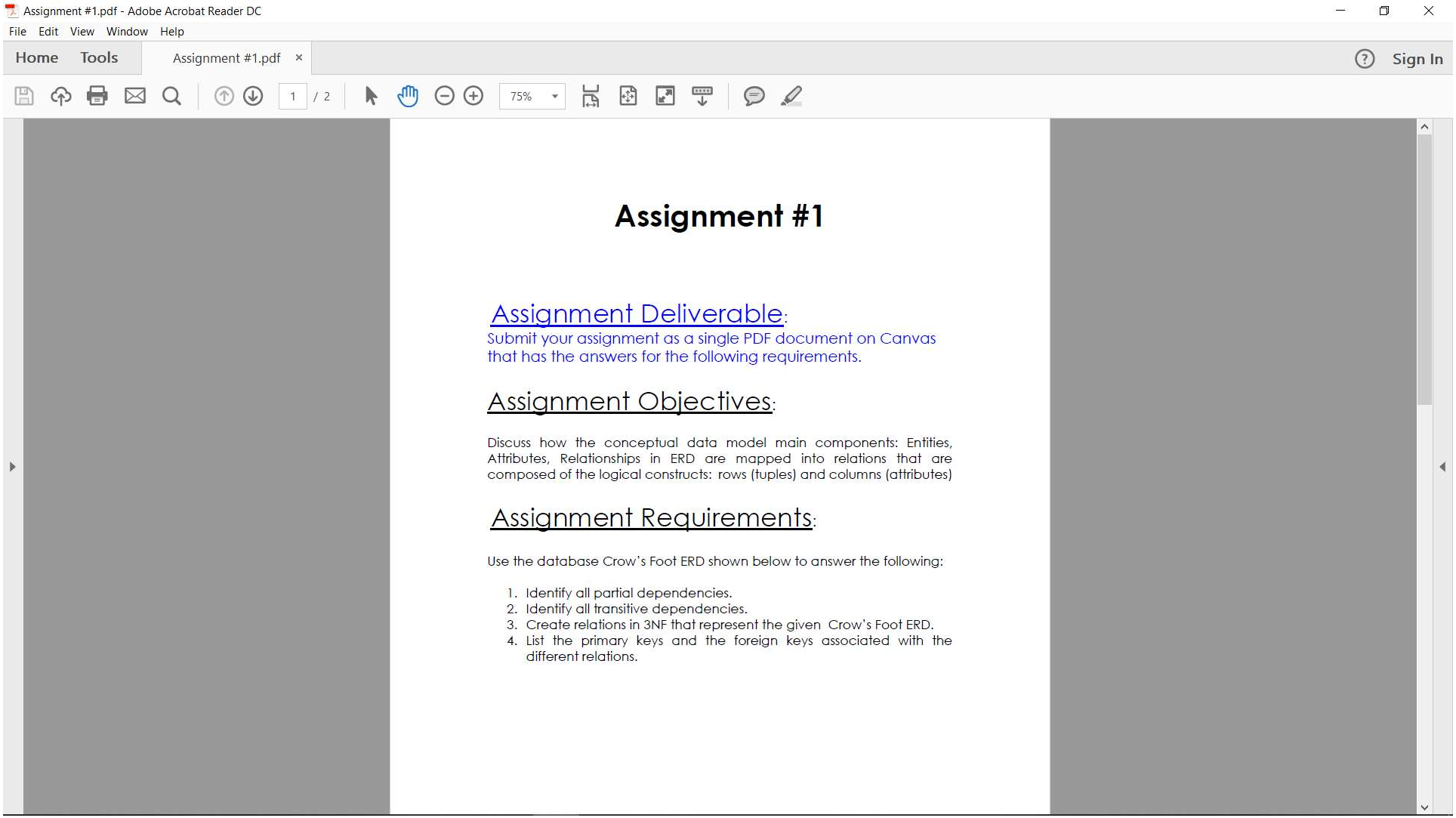
- Steps
  - Make new Relations/Tables to eliminate transitive dependencies
    - **Determinant**: Any attribute whose value determines other values within a row
  - Reassign corresponding dependent attributes

- Relation/Table is in 3NF when it:
  - Is in 2NF
  - Contains no transitive dependencies

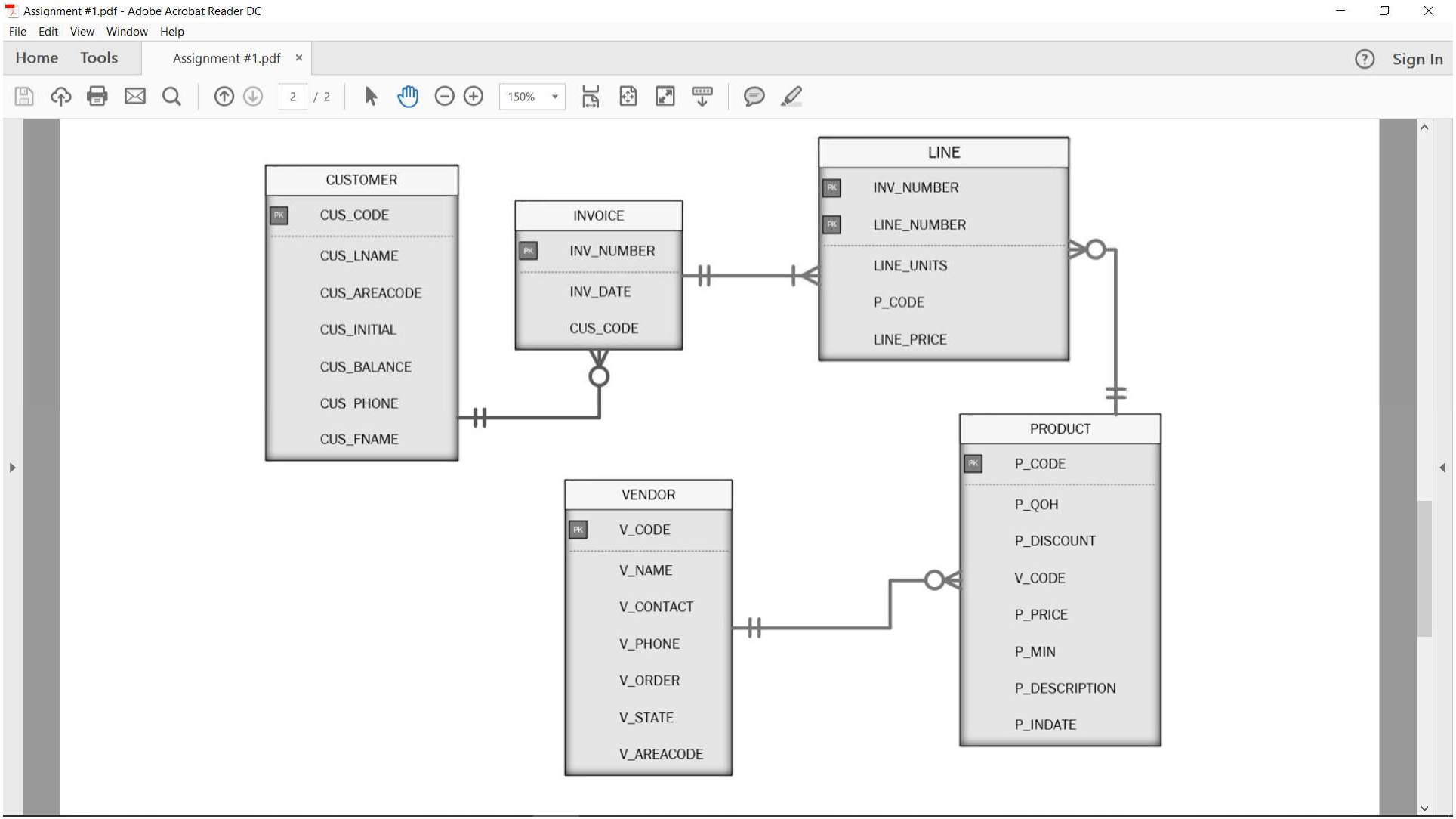
Third Normal Form (3NF) Conversion Results



Assignment #1



Assignment #1



Assignment #1 – Walkthrough & Deliverable

Based on the Given ERD, we could infer the …

Criteria	
Relations for Entities and Relationships	1. From the given ERD there are 5 entities (CUSTOMER, INVOICE, …)that need to be represented by relations 2. There are four relshioships that have different cardinalities … 3. …
Primary and foreign keys	1. The Customer relation CUSTOMER(CUS_CODE, CUS_LNAME, CUS_FNAME, CUS_INITIAL, CUS_AREACODE, CUS_PHONE, CUS_BALANCE)has the primary key CUS_CODE in the given ERD… 2. The V_CODE is a foreign key in the relation that represents the PRODUCT …. 3. …
Identify and list the partial and transitive dependencies	1. CUS_CODE functionaly determines the attributes CUS_AREACODE and CUS_PHONE but those two attributes also can be a candidate key, hence might produce transitive dependency to other customer attributes but that will not cause insert/delete/update anomalies; if a customer changes phone number that will not impact other customer attributes …. 2. …