Database Assignment 1

Question 3

(i)

Scenario 1: creditCardNum → custNum → custName, custAddress, custContact

creditCardNum → custNum and custNum → custName, custAddress, custContact, then creditCardNum → custName, custAddress, custContact (transitive rule)

ordNum, ordLineNum → itemDesc, quantity, totItemPrice, then ordNum, ordLineNum, custNum → itemDesc, quantity, totItemPrice, custNum (augmentation rule)

ordNum, ordLineNum, custNum → itemDesc, quantity, totItemPrice, custNum and ordNum, ordLineNum, custNum → deliveryPerson, expectedDeliveryDate, then ordNum, ordLineNum, custNum → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate (union rule)

ordNum, ordLineNum, custNum → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate and creditCardNum → custName, custAddress, custContact, then ordNum, ordLineNum, custNum, creditCardNum → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact (union rule)

ordNum, ordLineNum, custNum, creditCardNum → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact, then ordNum, ordLineNum, custNum, creditCardNum, deliveryPersonContact, totOrdPrice → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact, deliveryPersonContact, totOrdPrice (augmentation rule)

If ordNum, ordLineNum, custNum, creditCardNum, deliveryPersonContact, totOrdPrice → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact, deliveryPersonContact, totOrdPrice is valid and it covers the entire relational table, then the left hand side of the functional dependency (ordNum, ordLineNum, custNum, creditCardNum, deliveryPersonContact, totOrdPrice) is a minimal super key.

(ii)

Scenario 1:

In the functional dependency ordNum, ordLineNum, custNum, creditCardNum, deliveryPersonContact, totOrdPrice → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact, deliveryPersonContact, totOrdPrice, there exist the following:

- Partial dependency creditCardNum → custNum This partial dependency is a violation of the 2NF requirement.
- Transitive dependency custNum → custName, custAddress, custContact. This transitive dependency is a violation of 3NF requirement.
- Non-trivial dependency $deliveryPerson \rightarrow deliveryPersonContact$. This non-trivial dependency is a violation of BCNF requirement.

Hence the relational table is in 1NF.

(iii)

In the functional dependency ordNum, ordLineNum, custNum, creditCardNum, deliveryPersonContact, totOrdPrice → itemDesc, quantity, totItemPrice, custNum, deliveryPerson, expectedDeliveryDate, custName, custAddress, custContact, deliveryPersonContact, totOrdPrice, we need to remove the transitive dependency creditCardNum → custNum and split the table into 7 relational tables,

T1 = (custNum, custName, custAddress, custContact),
T2 = (ordNum, ordDate, toOrdPrice),
T3 = (deliveryPerson, deliveryPersonContact),
T4 = (ordNum, ordLineNum, itemDesc, quantity, totItemPrice),
T5 = (ordNum, ordLineNum, custNum, deliveryPerson, expectedDeliveryDate),
T6 = (custNum, ordNum, creditCardNum),
T7 = (creditCardNum, custNum),

In T1 = (custNum, custName, custAddress, custContact), the minimal super key is (custNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.
In T2 = (ordNum, ordDate, toOrdPrice), the minimal super key is (ordNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.
In T3 = (deliveryPerson, deliveryPersonContact), the minimal super key is (deliveryPerson) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.

In T4 = (ordNum, ordLineNum, itemDesc, quantity, totItemPrice), the minimal super key is (ordNum, ordLineNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.
In T5 = (ordNum, ordLineNum, custNum, deliveryPerson, expectedDeliveryDate), the minimal super key is (ordNum, ordLineNum, custNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.
In T6 = (custNum, ordNum, creditCardNum), the minimal super key is (custNum, ordNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.
In T7 = (creditCardNum, custNum), the minimal super key is (creditCardNum) and the relational table has no paritial, transitive or non-trival dependncy, hence it is in BCNF.