## Question 3.

### 3(A)

#### a.

Minimal Basis:  
RegNo 🡪 Make  
RegNo 🡪 Model  
RegNo 🡪 Commission  
RegNo 🡪 SalesPerson  
BuyerName 🡪 Address

The key for this relation is {RegNo, BuyerName}.

b.  
After doing the minimal basis and determining the key we are left with the following FD’s:  
FD1. RegNo 🡪 Make, Model, Commission, SalesPerson  
FD2. Buyername 🡪 Address  
Unfortunately this is not in BCNF. For this to be in BCNF both FD1 and FD2 need to be superkeys, in this instance neither is a Superkey as RegNo on it’s own cannot determine Address or BuyerName, and BuyerName alone can only determine Address.

c.  
**Constructing Relations:**  
R1 (RegNo, Make)  
R2 (RegNo, Model)  
R3 (RegNo, Commission)  
R4 (RegNo, SalesPerson)  
R5 (BuyerName, Address)  
  
**Combining Relations:**CarSales1 (RegNo, Make, Model, Commission, SalesPerson)  
CarSales2 (BuyerName, Address)  
CarSales3 (RegNo\*, BuyerName\*)

### (B)

To prove this decomposition is incorrect we will complete the 3NF decomposition.

**Minimal Basis:**Make, Model 🡪 Engine\_Size  
Registration\_No 🡪 Make  
Registration\_No 🡪 Colour  
Registration\_No 🡪 Model  
Engine\_Size 🡪 Tow\_Load

Using inference rules we can determine that {Registration\_No} is the key as it can determine all other values.

**Constructing Relations:**R1 (Make, Model, Engine\_Size)  
R2 (Registration\_No, Make)  
R3 (Registration\_No, Colour)  
R4 (Registration\_No, Model)  
R5 (Engine\_Size, Tow\_Load)  
  
**Combining Relations:**CAR\_DETAILS1 (Registration\_No, Make, Model, Colour, Engine\_Size\*)  
CAR\_DETAILS2 (Engine\_Size, Tow\_Load)  
At this point we have ended with the same decomposition as specified however there is an issue with an FD contained within CAR\_DETAILS1 as follows:  
Make, Model 🡪 Engine\_Size is not a valid key and as such this fails BCNF.  
To correct this we can combine the relations as follows:  
CAR\_DETAILS1 (Registration\_No, Colour, Make, Model)  
CAR\_DETAILS2 (Engine\_Size, Tow\_Load)  
CAR\_DETAILS3 (Make, Model\*, Engine\_Size\*)