Q1:

Sol.

NULLs should be avoided because:

1. Memory space will be wasted at storage level
2. Result will be incorrect for aggregate operations.
3. JOIN operations values are unpredictable

Problem with Spurious Tuples:

1. Spurious tuples are seen when JOIN operation is implemented on 2 relations and the resulting realation has more tuples.

Avoiding Spurious tuples:

When JOIN operation is implemented the primary key in one relation should be foreign key of the other.

Q2:

Sol.

1NF: Every column in the table must be unique. Separate tables must be created for each set of related data and each table must be identified with a unique column or concatenated columns called the primary key.

2NF: If a relatioin obeys 1NF and every non-pime attribute is fully functionaly dependent on Primary Key.

3NF: When a relation obeys 2NF and no non-prime attribute in relation is transitively dependent on primary key.

Q3:

Sol. 2NF removes all partial dependencies of nonprime attributes A in R on key and ensure that all nonprime attributes are fully functionally dependent on the key of R.

Q4:

Sol. 3NF removes all transitive dependencies on key of R and ensures that no non prime attribute is transitively dependent of key

Q5:
Sol.

A	B	C	Tuple#
10	b1	c1	1
10	b2	c2	2
11	b4	c1	3
12	b3	c4	4
13	b1	c1	5
14	b3	c4	6

B —> C is the only functional dependency possible as for every repeating values of particular tuple in B the values of C are same. b1 always corresponds to c1, b3 always corresponds to c4. Howerver, this does not hold true for other tuple relations.

Q6:
Sol:
Definition of 1 NF: The relational table should contain only atomic values. Since, by the given info there will be no repeating groups in the relation it is saif to be in 1NF.
Definition of 2 NF: The relation table should be in 1NF and each non-key must depend on primary key without any partial dependency. Given relation is in 1NF but non-key is partially dependent on key attribute(commission% partially dependent on Salesperson#) the relation will not be in 2NF.
Definition of 3NF: The relation table should be in 2NF and non-key attribute should not be functionally dependent on other non-key attribute. However, given relation is not in 2NF and non-key attribute Date_sold is functionally dependent on Discount_amt whih is again a non-key attribute.

Changes in relation to make them satisfy 2NF, 3NF
For 2NF:
CAR_SALES (Car_id, Date_sold, Salesperson_id, Discount_amt)
SALES_COMM (Salesperson_id, Commission_percent)

For 3NF:
DATE_DIS(Date_sold, discount_amt)
CAR_SALE_DATE (car_id, salesperson_id, Date_sold)
SALES_COMM (Salesperson_id, Commission_percent)