Note: (a)All questions are compulsory.
(b)Marks are indicated against each question in square brackets.
(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

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Q1.   [CO4] [2+3]

   i) Discuss the problems caused due to redundancy in the database with the help of examples.
   ii) Given a relation R(P, Q, R, S, T) and Functional Dependency set FD = { PQ → R, S → T }, determine whether the given R is in 2NF? If not convert it into 2NF.

Q2. Consider the relation R and set of functional dependencies F given as under: R(A,B,C,D,E) and F: {A→BCDE, BC→ACE, D→E}. Find out the highest normal form in the relation R.   [CO4] [5]

Q3. Consider the following given schemas: [CO2] [2*2=4]

   Sailors (sid: integer, sname: string, rating: integer, age: real)
   Boats (bid: integer, bname: string, color: string)
   Reserves (sid: integer, bid: integer, day: date)
Design the following queries using TRC & DRC:

   - Find the names of sailors who have reserved boat 103
   - Find the names of sailors who have reserved a red boat

Q4. What is an unsafe query in relational calculus? Give an example and explain why it is important to disallow such queries.   [CO2] [2]

Q5. Give a set of FDs for the relation schema R(A,B,C,D) with primary key AB under which R is in 1NF but not in 2NF.   [CO4] [3]

Q6. Consider the following set F of functional dependencies and find the step-by-step canonical cover of F: [CO4] [3]
   F= { A → BC, B → C A → B, AB → C }.

Q7. Consider a relation scheme R = (A, B, C, D, E, H) on which the following functional dependencies hold: [CO4] [3]
{A→B, BC→ D, E→C, D→A}
How many candidate keys are possible? Find all the candidate keys of R?