1. What is the ANSI/SPARC three-schema architecture? Explain the details of each schema. (6%)  

2. Give the relation schema below: (10%)  
   
   Book(Book_ID, Title, Publisher_Name)  
   
   (a) Give a relation instance, or relation, of the relation schema show above.  
   (b) Give a tuple of the relation in (a).  
   (c) What is the degree of the relation?  
   (d) What are the attributes of the relation?  
   (e) Give the domain of "Publisher_Name" of the relation.  

3. Answer the following questions with respect to the normalization for relational databases. (16%)  
   (a) What is the normalization in relational database management systems?  
   (b) What is the third normal form (3NF)?  
   (c) What is the Boyce-Codd normal form (BCNF)?  
   (d) What is the major difference between 3NF and BCNF?  

4. Explain the meaning for the following statement in SQL on the follow Company database tables. (18%)  
   
   EMPLOYEE(SSN, ENAME, SALARY, SUPERVISOR_SSN, DNO)  
   DEPARTMENT(PNO, DNAME, MANAGER_SSN)  
   PROJECT(PNO, PNAME, DNO)  
   WORK-ON(SSN, PNO)  
   DEPENDENT(SSN, DEP_NAME)  
   
   (a) SELECT ENAME  
       FROM EMPLOYEE E  
       WHERE EXISTS(SELECT *  
                     FROM DEPENDENT D  
                     WHERE E.SSN = D.SSN)  
       AND  
       EXISTS(SELECT *  
                FROM DEPARTMENT  
                WHERE SSN = MANAGER_SSN);  
   
   (b) SELECT COUNT(*)  
       FROM EMPLOYEE E, DEPARTMENT D  
       WHERE E.DNO = D.DNO AND DNAME = 'Research';  
   
   (c) SELECT A.ENAME, B.ENAME  
       FROM EMPLOYEE AS A, B  
       WHERE A.SUPERVISOR_SSN = B.SSN;  

5. DB transactions often have the so-called ACID properties: atomicity, consistency, isolation, durability. Please explain each of the four properties. (16%)  

6. What is a data warehouse? What is metadata? (4%)  

7. List five major advantages of using a database system comparing to using a traditional file management system. (20%)  

8. What are insertion anomaly, deletion anomaly, and update (modification) anomaly? Give an example for each type of anomaly. (10%)