Assignment #01 – Database Systems

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Session	**Fall 2022**

Instructions:

- All the questions are to be attempted on **A4 blank pages**. You are required to submit this assignment in **hard form.** Questions not done on A4 blank pages will not be considered.
- Keep the questions in order. Not following the proper order will result in marks deduction.
- Plagiarism will not be tolerated, either done from the internet or from any fellow classmate and **will lead to zero or negative marks in the assignment.**

Answer the following questions.

Question 01

1. Define the following models
    - Network Model
    - Hieratical Model
    - Object Oriented Model
    - Relational Data Model
    - Object Relational Data Model

2. Explain the levels of three schema architecture and process of mapping between them (with diagram). Why is mapping needed between these levels?
3. If you were designing a Web-based system to make airline reservations and sell airline tickets, which DBMS architecture would you choose (2 tier or 3 tier architecture)? Why? Why would the other architectures not be a good choice?
4. Discuss the differences between database systems, information retrieval systems and file systems. Discuss which one is better.
5. Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system?

Draw an ER diagram for the problems given below(1 to 6). Make sure that you indicate all cardinality constraints, and your E/R diagram should not contain redundant entity sets, relationships, or attributes. If you need to make any assumptions, include them in your answer.

Question 1

Given a following Scenario:

1. FAST NU has five Campuses; each campus has mailing address and known by abbreviation title such as KHI, PWR etc. You can analyze FAST NU structure through its web site: www.nu.edu.pk.

2. There are different Schools of various disciplines such as School of Computing, School of Engineering etc., each school has its head with job title Dean and mailing address. Each school has its subordinates' departments and programs of campuses.

3. There are various departments (for example, Electrical Engineering FSD) existing in each campus, each has mailing address, managed under Schools with HOD. Although, departments are administratively managed under their Campuses.

4. There are many programs (e.g., Computer Science BS, Computer Science MS, Computer Science PhD etc.), supervised by the Schools and execute in departments. Any department may offer multiple programs such as abbreviated with CS, SE, AI etc. in specific campus for each of levels BS, MS, PhD. Some departments of campus may not offer all programs, and some are restricted to levels.

5. Every campus has its own Semester schedule for all its departments and programs.

Draw an ER diagram for FAST NU (**to manage centralized system for all campuses**) with all possible valid attributes of this scenario. Do not forget to underline the keys and to mention the cardinalities.

Question 2

Wally Los Gatos, owner of Wally's Wonderful World of Wallcoverings, has hired you as a consultant to design a database management system for his chain of three stores that sell wallpaper and accessories. He would like to track sales, customers, and employees. After an initial observation of organization, you observed and noted following things in organization. These observations will help you to make initial database model known as ERD for further database development. You observed that every customer have to place an order through a branch of Wally's Wonderful World of Wallcoverings. We know that there are total of three stores in that chain but they can expand in future. Customer provide his Name, Address, City, State, Zip Code, Telephone, Date of Birth, and Primary Language at the time of registration or first order. At one time a customer can place several orders at any store. Customer is not fixed with branch, means that a person who is customer at any branch of Wally's Wonderful World of Wallcoverings can shop from any other shop of Wally's Wonderful World of Wallcoverings chain. Customers may have one or more accounts, although they may also have no accounts. If someone has account some attributes are also collected for accounts like, Balance, Last payment date, Last payment amount, and Type. Every branch can serve many customers at a

time. Each of Wally's Wonderful World of Wallcoverings chain branch some information is stored in database which are Branch Number, Location (Address, City, State, Zip Code), and Square Footage. Every branch can have all the items in Wally's Wonderful World of Wallcoverings catalog or may have only a subset of these item available. A customer can order these items. Each order may contain many items. At each order from customer some data is needed for the completion of transaction like Order Date and Credit Authorization Status. An item can be sold at many branches of Wally's Wonderful World of Wallcoverings. A new item can be created by filling some attributes as given Description, Color, Size, Pattern, and Type. Each item may further contain multiple items. This company involves 56 employees. Name, Address (Street, City, State, Zip Code), Telephone, Date of Hire, Title, Salary, Skill, and Age are collected for each employee. An employee serve only one branch. Each employee may have one or more dependents. We wish to record the name of the dependent as well as the age and relationship. Employees may have a skill set. On the basis of these collected information your next task is to create an ERD for further process. Kindly specify Assumption you made during modeling.

Question 3

ABC Electronics is an electric retail store that deals in electrical home and office appliances. It has multiple stores in different cities of Pakistan. Each branch has a branch code, Telephone numbers and address.

All the employees working on different stores are employees of a branch of ABC electronics. Each employee's data is stored in the database that includes Employee code, First Name, Second Name, Date of Birth, sex, CNIC, Joining Date, Degrees' details, Designation, marital status, salary.

Each Employee can have dependents. Details of their Name, Relationship, date of birth, sex is to be stored in the database.

Each employee is attached to at most one branch and must be attached to a branch. Each branch has multiple departments namely Sales, Customer Support, Accounts, Marketing, Administration, R&D. An employee can be a member of only one department at a time. Each department has a department manager as well.

Each store sells a wide range of electronic equipment. Each equipment is purchased from some vendor. Company needs to store the details of vendors as well including vendor code, name, address, contact numbers and items provided. Orders to the vendors must be trackable having the details of items, date ordered, quantity ordered and unit price. One item is only offered by one vendor. Each vendor can sell items to multiple branches and vice versa.

Stores need to keep track of the sales made to clients and the quantity of the appliances available. The client's data may include Client ID, Name, Contacts. Against each purchase an invoice is generated containing Client ID, Items ID, Item name, quantity, and unit price.

Employees in sales department will get a salary and 5% incentive of their monthly sales as well. So, you need to keep track of the employee who sold some item to a client.

Question 4

A farmer owns and operates a 640-acre farm for several generations. Since the farm business id growing , the farmer is thinking to build a database that would make easier the management of the activities in the farm. He is considering the following requirement of the activities in the farm. He is considering the following requirements for the database

1. For each livestock classification group (For example cow, horse etc.), the farmer keeps track of the following information : identification number, classification, total number of livestock's per classification group (for example number of cows, number of horses etc.)

2. For each crop the following information is recorded: crop identification number and Classification
3. Farmer has recorded the yield of each crop classification group during the last ten years. The records consist of the year, yield, sales, price of the crop and the amount of money earned.
4. The farmer has recorded the yield of each livestock classification group during the last ten years. The record consists of the following historical data: the year (historical), Selling price per head, number of livestock in the end of the year, number of livestock sold during one-year period, and the total amount of money earned.

Question 5

Suppose you are given the following requirements for a simple database for the Fast Cricket League (FCL):

- The NHL has many teams,
- Each team has a name, a city, a coach, a captain, and a set of players,
- Each player belongs to only one team,
- Each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
- A team captain is also a player,
- A game is played between two teams (referred to as host_team and guest_team) and has a date and a score.

Construct a clean and concise ER diagram for the NHL database.

Question 6

Suppose that you are designing a schema to record information about reality shows on TV. Your database needs to record the following information:

- For each reality show, its name, genre, basic_info and participants name. Any reality show has at least two or more participants.
- For each producer, the company name, company country. A show is produced by exactly one producer. And one producer produces exactly one show.
- For each television, its name, start year, head office. A television may broadcast multiple shows. Each show is broadcasted by exactly one television.
- For each user, his/her username, password, and age. A user may rate multiple shows, and a show may be rated by multiple users. Each rating has a score of 0 to 1