Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Final Examination
Year 1, Semester II (2023)

IT1090 – Information Systems and Data Modeling

Duration: 02 Hours

November 2023

Instructions to Candidates:

- This paper has 5 questions.
- Answer all questions in the booklet provided.
- The total mark for the paper is 100 and contributes 60% for the final grade.
- This paper contains 7 pages, including the cover page.
- Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1 [Total: 20 Marks]

a) E-Tutor is an online learning platform which allows the students to pay and learn online with their preferred tutors. (15 Marks)

Students first register with the E-Tutor (hosting website) by creating a user account. Then the student should select the preferred tutor from the list of tutors. To make the payment for the session, student is directed to a payment gateway. If the payment is successful, student will receive a link to join the class. If the payment is unsuccessful, student is directed back to the E-Tutor web site to reattempt. That will introduce a delay.

Model the Business Process Map for the given scenario.

b) Explain with the aid of a diagram what the Program-Data Independence is in the database approach. (05 marks)

Question 2 [Total: 20 Marks]

Refer the following description that lists some of the requirements for a company which sells different types of items for their customers. Analyze the data requirements and model the database using the Entity Relationship (ER) model.

- There are several suppliers who supplies the items for the company.
- An item is supplied by one or more suppliers, and one supplier can supply many items.
- A supplier has a unique supplier number, name, phone, and an address.
- For each item company need to maintain data about its unique item code, name, quantity on hand and re-order level.
- When the company purchases the items from the supplier, the unit cost of an item may vary based on the supplier who supplies the item.
- However, when the company sells these items to their customers, they assign a unique unit price for each item.
- For each order placed it is important for the company to keep track of a unique order number, the order date, delivery address, contact phone number, and the total bill amount of the order.
- When scheduling the deliveries, it is convenient for the company if they can extract the delivery location data (city, state, country) separately.
- An order can contain one or more items in it. And for each order the quantity ordered from each item need to be stored.
- The quantity ordered and the unit price are used to calculate the total bill amount for each order.

Question 3 [Total: 20 Marks]

Consider the given Entity Relationship (ER) diagram designed for MediPharm-Chain which is a chain of Parmacies. Convert the ER diagram to the Relational Schema. Consider the obtained Relational Schema to answer the following questions.

Note: You need to use the exact name as given in the ER diagram. And marks are allocated only for the answers provided for the sub-questions a) and b) given below.

a) The relation names in the schema are ..... (05 marks)

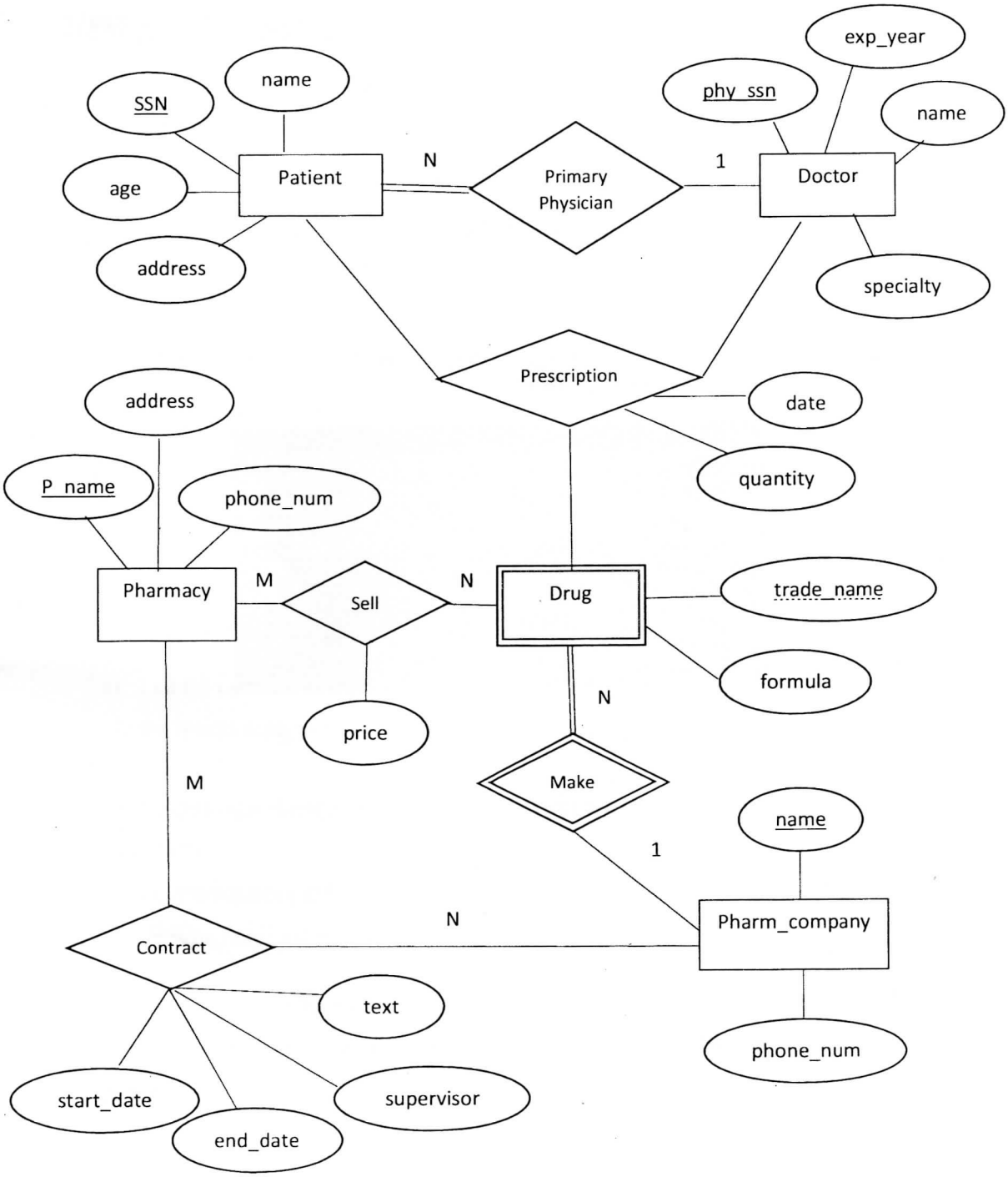
b) Complete the following relations by adding the column names. Indicate the Primary Key with an underline and any Foreign Keys as FK within brackets after the relation.

ex: *RelationName* (*PK, col1, col2, col3, col4*) *col3(FK), col4(FK)* (15 marks)

i. Drug

ii. Prescription

iii. Patient



ER Diagram for MediPharm-Chain

Question 4 [Total: 20 Marks]

Refer to the following Aircraft_1 relation, from the relational schema designed for the database of the Fun Travel Aircraft Company, which rents aircrafts for local private travels.

The relation includes the aircraft number (AC_NUM), model (AC_MODEL), rental charger per hour (AC_RENT_CHG), number of seats available (AC_SEATS) and the total time in hours the aircraft was flying to the date (AC_TOTAL_TIME). The Primay Key for the relation is AC_NUM.

AIRCRAFT_1 Table

AC_NUM	AC_MODEL	AC_RENT_CHG	AC_SEATS	AC_TOTAL_TIME
1225F	Cessna C-172 Shyhawk	$58.50	4	4512.6
205IY	Cessna C-172 Shyhawk	$58.50	4	5325.5
2087V	Cessna C-152 Commuter	$51.75	2	4889.8
226BR	Cessna C-172 Shyhawk	$58.50	4	4299.6
2867W	Piper PA28-181 Archer II	$64.00	4	3267.4
3213R	Piper PA28-181 Archer II	$64.00	4	2517.9
4112E	Piper PA28-181 Archer II	$64.00	4	5211.3
45ZU	Cessna C-152 Commuter	$51.75	2	7003.1
5725Y	Cessna C-172 Shyhawk	$58.50	4	3968.2

a) Analyze the data in the relation and identify the Functional Dependencies (FD) that exist. (06 marks)

b) In which Normal Form (NF) is the relation Aircraft_1 in? Justify your answer. (07 marks)

c) If the relation Aircraft_1 is not in the 3NF, normalize it into a relation in 3NF. Show each step of the normalization process clearly and provide any justifications. (07 marks)

Question 5 [Total: 20 Marks]

The following relations are some of the relations extracted from a database schema designed to keep track of airline flight information:

Aircraft(aid: integer, aname: string, cruisingrange: integer)

Certified(eid: integer, aid: integer)

Employees(eid: integer, ename: string, salary: integer)

The Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL.

a) List the certified aircrafts of each pilot. Print the pilot name and the aircraft name. sort the results accoridng to the ascending order of the pilot name. (06 marks)

b) Find the number of employees who are not pilots. (07 marks)

c) Find the names of pilots who are certified with more than 2 aircrafts, each with a cruising range value above 300. (07 marks)