Sample Exam Paper

Choose any three questions

Time: 2 hours

Question 1: Enhanced ER Modelling

a) Draw an Enhanced Entity Relationship Modelling diagram for the following fictional scenario. The diagram should include all relevant entities, relationships, cardinalities, constraints, super-classes, sub-classes, etc.

Scenario: The Overlook Hotel

The Overlook Hotel is a hilltop, snow-covered retreat located in the Rocky Mountains. The hotel requires an automated booking system to help manage its growing visitor numbers. The hotel needs to store the following data on all of their hotel rooms: room number, room purpose, room size, whether or not Wi-Fi is available, and price per night. The room purpose must be either bedroom, conference room or dining room. The room size must be either small, medium or large. Each bedroom has the following extra data: bed type which can be either single or double. Each conference room has the following extra data: number of seats and whether or not a projector is available. Each dining room has the following extra data: number of tables.

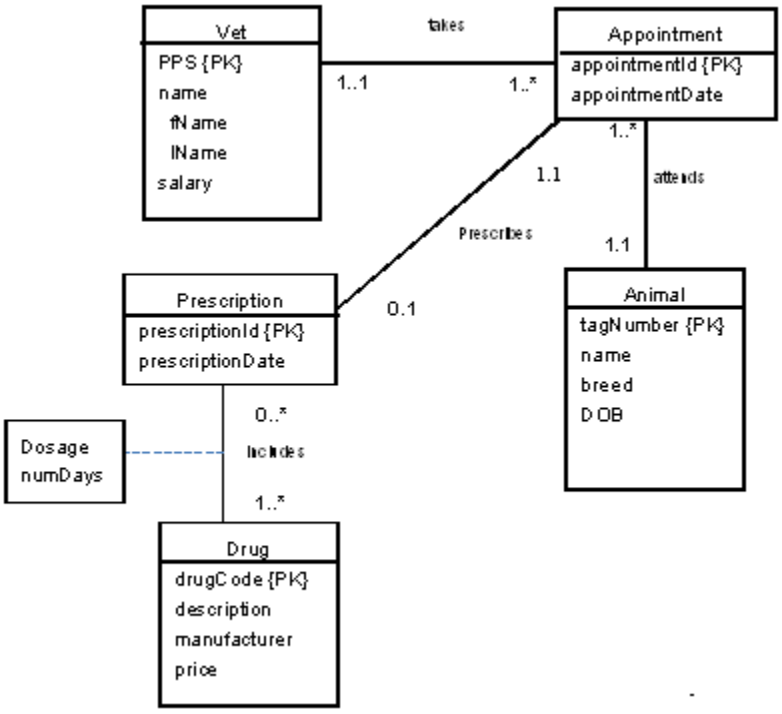
Information is recorded about guests for promotions etc.. Guest information includes their name, address, and contact number. A unique id is also assigned to each guest. When a guest makes a booking, the start and end dates for the booking are recorded. Each booking is automatically assigned a unique booking number. A booking can refer to one and only one room, and one and only one customer.

(18 marks)

b) Explain what a multivalued attribute is, and provide an example. How is a multivalued attribute represented inside an entity type?

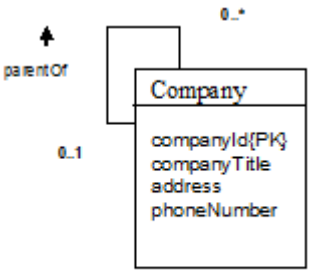
(8 marks)

c) Map the following EER Diagram into a set of relations.



(18 marks)

d) Map the following EER Diagram into a set of relations.



(6 marks)

(Total for Question 1: 50 marks)

Question 2: Normalisation

a) State the three rules that govern whether or not a table is in first, second and third normal forms.

(10 marks)

b) Convert the following table of data into first normal form, then second normal form, and then third normal form:

Cinema Name	Location	Number of Seats	Year Founded	Owner Name	Owner Phone	Movie Name	Movie Category	Number of Shows	Director Name
Deja View	Waterford	100	1995	Jon Marks	051 1234567	Psycho	Horror	50	Alfred Hitchcock
						Planet of the Apes	Sci-Fi	25	Franklin Schaffner
The Diamond	Cork	150	2000	Mia Vaughan	021 9876543	2001: A Space of Odyssey	Sci-Fi	100	Stanley Kubrick
						Psycho	Horror	70	Alfred Hitchcock
						2001: A Space of Odyssey	Sci-Fi	150	Stanley Kubrick

Note: For the purposes of this question, you can assume that the cinema names, owner names, movie names and director names are unique.

(30 marks)

c) The relation CourseTutorBook lists the courses (course) in a college. For a course, there are any number of tutors and any numbers of books. A book can be used for any number of courses and a tutor can teach any number of courses. There is no link between the tutors and the books.

CourseTutorBook (CourseTitle, TutorName, BookTitle)
Primary key CourseTitle, TutorName, BookTitle

i. Describe why the relation CourseTutorBook is not in 4NF.
ii. The CourseTutorBook violates normalisation principles. What are the problems users are likely to face?
iii. Describe how you would normalise the relation CourseTutorBook to 4NF.

(10 marks)

(Total for Question 2: 50 marks)

Question 3: Transaction management; backup and recovery

a) What are the objectives of concurrency control? In your answer, discuss the properties that transactions should adhere to.

(10 marks)

b) "Locking is a pessimistic concurrency control method."

Discuss this statement. In your answer, describe how locking works, and compare locking with an optimistic concurrency control method.

(20 marks)

c) Compare logical and physical database backups, and discuss the difference between carrying out an online backup vs. an offline backup.

(20 marks)

(Total for Question 3: 50 marks)

Question 4: NoSQL Databases

a) Examine both the advantages and challenges of NoSQL databases.

(20 marks)

b) Using examples differentiate between three types of NoSQL databases.

(15 marks)

c) "The CAP Theorem states that it is impossible for a distributed system to simultaneously provide all three of the following guarantees: Consistency, Availability and Partition tolerance." Discuss this statement.

(15 marks)

(Total for Question 4: 50 marks)