ECON485 Fall 2024
Midterm Exam 29.11.2024

Student Number		**Grading**	
Name and Surname		**Questions 1-4**	…... out of 20
Student Signature		**Question 5**	…... out of 20
		Question 6	…... out of 20
Notes: 1. Part 1 is composed of Questions 1-4 (Multiple choice) 2. Part 2 is composed of Questions 5-8 (Applied) 3. Please write your name on the corner of each page. Also if you need more space, feel free to use the back of pages.		**Question 7**	…... out of 20
		Question 8	…… out of 20.
		Total	…… out of 100.

PART 1
Questions 1-4 are multiple choice (Each 5 points)

Question 1
Using databases helps in a lot of business applications. Which one the following is not one of those?
(a) Storing and managing customer information
(b) Keeping track of inventory in a warehouse
(c) Monitoring the physical performance of athletes in real-time
(d) Drawing and editing digital images

Question 2
What is the main purpose of normalization in database design?
(a) To minimize redundancy and dependency
(b) To increase the speed of query execution
(c) To reduce the number of tables in the database
(d) To allow storage of multimedia files

Question 3
What is the main difference between First Normal Form (1NF) and Second Normal Form (2NF)?
(a) 1NF ensures that all data is stored in a single table, while 2NF requires multiple tables.
(b) 1NF removes duplicate columns, while 2NF removes partial dependencies.
(c) 1NF allows redundant data, while 2NF eliminates all redundancy.
(d) 1NF focuses on unique keys, while 2NF focuses on foreign keys.

Question 4
Which of the following is NOT a valid data type in MySQL?
(a) VARCHAR
(b) BOOLEAN
(c) IMAGE
(d) DECIMAL

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PART 2 (APPLIED)
Quesitons 5 to 8 are based on the following case study. You might want to take notes on the text. Therefore it is double spaced on the paper.

Chinese Train Authority (CTA) Ticket Sales

CTA has been selling tickets through various online channels for some time. Usually some stations located in lager cities sell all tickets, exhausting smaller cities on the train route. For a Turkish comparison, think about Ankara and İstanbul buying all tickets so that people from Eskişehir cannot buy any tickets on the Ankara to İstanbul line with a stop in Eskişehir.

They come up with an innovative solution. **They keep the tickets for a particular train cart reserved for the smaller cities.** This of course requires a systems change in the existing software and related database.

Each train set (i.e. actual physical train) is separated by others by an unique identifier called a Set ID (i.e. Train 11). However, when we talk about a train ticket, it is actually one run made by that physical train. So a train making back and forth runs would have several instances of a run. The way to identify these runs is therefore based on a Route ID, and the starting date time. Again for a Turkish comparison, think about Ankara to İstanbul (say Route 12), starting at 23.11.2022 at 06:45. So we need the set ID and the set of data route ID, date, and time as the unique identifier.

When a passenger wants to but a train ticket, they are used to state class: First, second, or third .

- First class tickets have a single cart, so there is no need to identify between carts. However, for traditional reasons the first class cart is numbered as 1.The first class tickets also have seat numbers assigned to them. One could express a first class ticket as “Cart:1, Seat: 1.” There are at most 40 seats in a first class cart.
- Second class tickets do have cart numbers and ticket numbers. The cart numbers start from 2 but they end up with any number. If a train has many carts, there could be a large number of

second class carts. A smaller train has 6 carts (5 of which are second class), whereas a large train has more than 10 carts. There are at most 60 seats in a second class cart.

- Third class tickets do not exist in some trains, because their carts are not attached. Therefore they are optional. Moreover, seats on third class carts do not have numbers. However they are limited by the number of seats in a cart. There are at most 80 seats in a third class cart.

A particular train run is planned well ahead with the number of carts available. For example, for Train 11 running Route 12, starting at 23.11.2022 at 06:45, we would have 1 first class cart, 5 second class carts and 0 third class carts. This would mean 1x40 first class tickets (numbered), 5x60 second class tickets (numbered) and 0 third class tickets.

Train routes include the cities they visit and the boarding times. Therefore for each run on a particular route the same stops occur again and again. Trains never skip a stop even when there are no passengers. There are tables for each route stating the city names in order. For a Turkish comparison think of “Ankara, Eskişehir, Gebze, İstanbul” shown in a table with corresponding times (not including dates).

The new system would have these carts initially reserved for a particular stop. Therefore there would be a denominator in the plan, usually the name of the city. For example: Train 11 running Route 12, starting at 23.11.2022 at 06:45 Cart 2 reserved for “Shenzen”. The reservation holds until 3 hours to the train run. Then that particular cart is open for all cities. They decided to reserve the keyword “All” for carts not reserved for a particular city.

Question 5 (20 points)
One of your seniors is assigned this project as a project manager. As you know about databases you are her first choice in team building. She discusses with you for a while and decides that there is need for an analyst, a subject matter expert, and two programmers, one more experienced in database queries and one experienced in UI design. You are given the analyst role.

(a) (5 points) How would be the team dynamics in this team? In particular, what would your **initial** roles and responsibilities be as an analyst here?

(b) (5 points) How would the role of an analyst **change** during analysis, design, development and test phases in this project? In particular how would you work during development and who would you work most with?

(c) (10 points) What is the definition of verification and validation (V&V) within the context of database design and development? In particular to this project, what kind of **resources** would you need to conduct V&V in this project?

Question 6 (20 points)
(a) (10 points) The table below summarizes the steps involved in how a ticket is purchased. However the data content of these steps need to be extracted. Try to list the data involved in each step of purchasing a ticket. Use the above text as guide. You should not be concerned if the process goes back and forth (i.e. passenger needs to select another train run, etc).

Step No	Description	Data Involved
1	Passenger selects train run, and the city they want to board the train.	
2	Operator states number of available tickets in each class.	
3	Passenger selects class and number of tickets.	
4	Operator selects and reserves seats.	

(b) (10 points)
Based on the table in part a, please identify and list the core business objects. You need not specify details such as properties. (Properties are part of another question).

Question 7 (20 points)
(a) (10 points) Based on your answer in Question 6, state the properties of each business object. The table below has many lines, but your design may need less.

Business Object	**Properties**

(b) (10 points) Assuming all business objects will have their individual tables in the database design, select one business object from part (a) and design the database table for that table. Fill out the following table to summarize your design. You have more than necessary rows. You do not need to fill all rows.

Table Name			
Related Business Object			
Field Name	**Type**	**Can be NULL (Yes/No)**	**Primary Key (Yes/No)**

Question 8 (20 points)
Assuming all business objects will have their individual tables in the database design, design the relationships between tables. Fill out the following table to describe each relationship. Note that there is more than necessary space below.

Table 1	**Table 2**	**Explain the relationship**	**1-1, 1-N or N-M?**	**Foreign Key**