Write the name of the course, the date of exam, your name clearly, your student number and your signature on each separate answer paper.

1. Explain briefly the following concepts (6 p.)
   a) referential integrity
   b) database transaction

2. Consider the following tables of a travel agency system:
   Traveller (travellerID, name, address, city, zipcode, phone)
   Ticket (customerID, Traveller, TripID, Trip, dateOfPayment)
   Trip (TripID, dateOfDeparture, duration, hotelID, Hotel, rate)
   Hotel (hotelID, name, floors, rooms, yearBuild, category, destination, Destination)
   Destination (name, averageTemperature, inhabitants, description, location, countryID, Country)
   Country (countryID, countryName, populationSize, continent)

   a) Table Country has 20 rows and table Destination has 500 rows. How many rows there are in the result table of the natural join of Country and Destination? (2 p.)

   b) How are the cardinalities (amounts of rows) of \( \pi_{\text{TripID}}(\text{Trip}) \) and \( \pi_{\text{TripID},\text{hotelID}}(\text{Trip}) \) related to each other? Motivate your answer. (2 p.)

   c) Table destination has 500 rows. How many rows there are in the result table of the selection \( \sigma_{\text{averageTemperature}<25 \text{ and averageTemperature}>30}(\text{Destination}) \). (2p)

3. The following tasks are based on the tables of task 2. Solve the following questions with SQL.

   a) A customers wants to know what is the warmest destination available and how warm it is there (find out the name and the average temperature). (4 p.)

   b) Agency management wants a list of destinations having more than 1000 rooms. The report should contain the name of the destination, its location and the number of rooms (in column ROOMS) (4 p.)

   c) Find out how many destinations do not have a description. (4 p.)

   d) The structure of the table Past_trip is similar to the structure of the table Trip, and the structure of table Past_ticket is similar to the structure of the table Ticket. On the 20\(^{th}\) day of each month the data about the trips of the previous month as well as their tickets should be moved from Trip and Ticket to the corresponding Past tables. Give the SQL operations needed. You may assume that the function first_of_month(p: date) gives the first day of the month in which the parameter date p belongs to. (4 p.)

Turn the paper for tasks 4 and 5
4. The diagram below describes the data of a recipe archive.

Define the relational schema to represent this data. Use the technique of task 2 to represent the schema. Include the keys and foreign keys in your representation. (10p)

5. Consider the relation

Student (studentID, firstName, lastName, majorTopicID, majorTopicName, creditUnitsCollected)

a) What are the interpretations of the following functional dependencies:
   majorTopicID $ majorTopicName and majorTopicName $ majorTopicID? (3 p.)

b) In addition to the dependencies listed above the attribute studentID functionally determines all attributes of the relation. Is the relation in the Boyce-Codd normal form? Motivate your answer. (3 p.)

*Turn the paper for tasks 1, 2, and 3.*