



FACULTY OF INFORMATION TECHNOLOGY
END OF SEMESTER EXAMINATION
MST8202 – ADVANCED DATABASE & ENTERPRISE SYSTEMS

DATE: 16th May 2023

Time: 2 Hours

Instructions

1. This examination consists of **SEVEN** questions. You can get up to **50 points**.
2. Answer **all** the questions.
3. For each question, provide the answers according to the **instructions in brackets** (the instructions describe a style of the answers and how long each should be).

Questions

1. Describe the purpose of domain constraints, entity integrity and referential integrity, and multiplicity constraints in relational databases. Provide one or several examples of relations (or relational database tables) to demonstrate each of these constraints. (6 points)
2. Let R be a relation of the following schema for computers identified by “model” number, $R = \{\text{model} : \text{number}, \text{ram} : \text{number}, \text{price} : \text{number}\}$. Let O be a relation of the following schema for owners of the computers, $O = \{\text{name} : \text{text}, \text{room} : \text{text}, \text{model} : \text{number}\}$ where “number” is a foreign key of an owned computer for each owner. Using suitable operations of the relational algebra, write a correct expression in the relational algebra to answer the following query: get names of owners located in room “A123” who own (one or more) computers with a price greater than \$1000. (8 points)
3. Let STAFF be a table of employees with columns NAME (primary key), DEPARTMENT (text) and SALARY (number). Make a SQL SELECT query to get average salary for each department which has less than 10 employees. (8 points)
4. Explain the type (is-a) hierarchy between entities. What are super-classes, sub-classes, generalization and specialization relationships between entities? Demonstrate on a simple example (about four entities in the hierarchy). (6 points)
5. Explain when is a relation in the second normal form (2NF; one sentence)? Provide a simple example of two relation (or two entities of an entity-relationship model) – the first which is not in 2NF (it is just in 1NF), and the second which is in 2NF (it is the first relation after its normalization to 2NF). (6 points)
6. Provide at least three rules for query restructuring (recommendations what should be done to get more optimal relational algebra trees in a query processing). (6 points)

7. What is a star (or snowflake) schema? Why do we need this schema in data modelling of data marts (data warehouses)? Provide a simple example of a star (or snowflake) schema and correctly label its components by the following terms: “dimension table”, “fact table”, and “individual fact”. (8 points)