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NATIONAL UNIVERSITY OF IRELAND GALWAY

SUMMER EXAMINATIONS 3000

Second University Examination in Information Technology

DATABASE SYSTEMS I (CT230)

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Time allowed: *three* hours.
Attempt *five* questions.

1. For four of the following, explain in detail the difference between each term.
   (a) Data and MetaData
   (b) Data and Information
   (c) Primary Key and Foreign Key
   (d) Entities and Attributes
   (e) Entity Integrity and Referential Integrity

2. Compare and contrast the Hierarchical and Network Data Models, giving advantages and disadvantages of each.

3. Describe (giving an example in each case) five of the following as they apply in the Relational (Data) Model.
   (a) Schema
   (b) Tuple
   (c) Degree of a Relation
   (d) Domain
   (e) Super Key
   (f) Candidate Key

4. Consider the following relations (tables).

Flight

No.	From	To	Distance	JetType
FL131	Oslo	Bilbao	2000	AB130
FL132	Bremen	Dundee	500	AB130
FL133	Bremen	Nice	1000	
FL134	Leiden	Oslo		BAE600

Jet

Model	Seats	Range	Quantity
BAE600		1000	5
AB130	180	3000	3

Write the Relation which results from four of the following Relational Algebra operations.

(a) $\sigma_{\text{Seats}>100}(\text{Jet})$

(b) $\sigma_{(\text{From}=\text{Oslo})\mathbf{OR}(\text{To}=\text{Oslo})}(\pi_{\text{No.,From,To}}(\text{Flight}))$

(c) $\rho_{(\text{capacity,distance})}(\pi_{\text{Seats,Range}}(\text{Jet}))$

(d) Flight $\times$ Jet

(e) Flight $\bowtie_{\text{Distance}<\text{Range}}$ Jet

5. For the two relations given in question (4.),

(a) Give examples to demonstrate

(i) $\sigma_{C1}(\sigma_{C2}(R)) = \sigma_{C2}(\sigma_{C1}(R))$

(ii) $\pi_{L1}(\pi_{L2}(R)) = \pi_{L1}(R)$

for Relation R with conditions C1, C2 and attribute lists L1, L2.

(b) State the primary keys for each relation and list all alternate keys.

6. Considering the relations given in question (4.), write SQL commands to carry out each of the following.

(a) Delete all flights from Bremen.

(b) Delete all flights involving jets with seat capacity greater than 150.

(c) List seat capacity and range of all jets whose destination is Bilbao.

(d) Double the quantity of jets we have whose range is less than 500.

(e) List all departure cities of jets whose range is greater than 2000.

7. Starting from an Entity Relationship Diagram, explain in detail four steps one might carry out in Logical Database Design for the Relational (Data) Model.

8. In Physical Database Design, explain

(a) how indexes are used and their advantages

(b) what is a B+ tree

(c) how collisions occur in hashing