UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	**2006/07**	Semester:	**Semester 1**
Module Title:	**Introduction to Systems Analysis**	Module Code:	**CS4513**
Duration of Exam:	**2½ Hours**	Percent of Total Marks:	**80**
Lecturer(s):	**Norah Power**	Paper marked out of :	**100**

Instructions to Candidates:

- **Please attempt all 10 questions.** They are all related and are best answered in the order in which they are presented.
- **Leave space between your answers, in case you need to revise or correct anything later.**

Tillage Farming System

The E-R diagram represents a system used by a large tillage farmer. The Price (per ton) of a Crop is the current price. Each Crop that has been planted in the different Fields over the years is recorded, along with the Yield of that crop in that field for that year. The Yield is expressed in tons per acre. The Size of a Field is expressed in acres. Other attributes are shown in the E-R diagram. Typical values of the Attributes are indicated in Questions 4 - 10.

Q1
Convert the Many-to-Many relationship shown in the ER diagram into an entity. Name the new entity and show its attributes. Indicate the identifying attribute(s) of this entity.

[8 Marks]

Q2
Write the Z record schemas for the Relations implied by the E-R diagram and the description above, consistent with your answers to Q1.
All your **Domains** should be declared beforehand.

[10 marks]

Q3
(a) Write the State schema in Z for the Tillage Farming database. Include the existential and referential integrity constraints.

(b) Write the referential integrity constraints in SQL.

[15 marks]

Q4
Write **Relational Algebra** operations for the following queries, using Union or Intersection operations where needed.

i) List the name and Price of each Crop
ii) List all the details of each Crop priced between €500 and €600
iii) List the names of any Crops that have not been planted
iv) List all the details of Fields that have not been planted
v) Get the Yield of each Field that has been planted with Wheat or Barley.

[15 marks]

Q5
Write **Relational Calculus** expressions for the three odd-numered queries in Q4

[6 marks]

Q6

Write **Relational Calculus** expressions for the following queries:

i) How many Fields are there?
ii) How many Fields were planted with Oats in 2003?
iii) Which Crops have been planted in Fields larger than 10 acres?
iv) How many different Crops have been planted in Fields with Acid Soil?
v) Name the Fields that grew Sugar beet in 2005.

[15 marks]

Q7

Re-write the two even-numbered queries in Q6 in SQL

[4 marks]

Q8

Express the following queries as SQL, writing each clause on a separate line.

i) Using sub-queries, find out the Category of each Crop that has been planted in Loamy Soil. Do not use a join query.
ii) What is the Price and Category of the Crop that has been planted most frequently?
iii) How much money (Revenue) has been generated for each Field over the years represented in the database?

[9 marks]

Q9

(a) Write a Z schema to delete a Crop identified by **c?** from the Crops table on condition that the Yield from **c?** has never been greater than 100 (tons per acre), but keeping the details of when **c?** has been planted.

(b) Write the SQL syntax for the deletion.

[10 marks]

Q10

Write a Z schema to insert the following new fact into the database:

In 2006 a Crop named Willow has been planted in the Field identified by 88 with a Yield of 60 tons per acre.

The operation must check that the Crop and the Field already exist in the database.

[8 marks]