UNIVERSITY *of* LIMERICK

O L L S C O I L   L U I M N I G H

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science
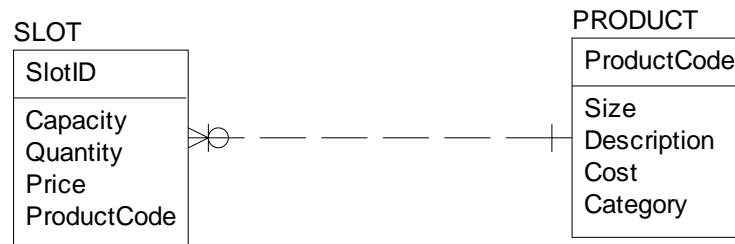### and Information Systems

Repeat Assessment Paper

Academic Year:	**2007/08**	Semester:	**Semester S**
Module Title:	**Introduction to Systems Analysis**	Module Code:	**CS4513**
Duration of Exam:	**2½ Hours**	Percent of Total Marks:	**100**
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.**
- **Ensure that you Tables are named consistently for all questions.**

The E-R diagram represents information that will be used by the software in a vending machine. The Capacity of a Slot in the machine is the number of units of a Product it will hold. Products come in S(mall), M(edium) and L(arge) sizes. Each different Size has a different Product Code, but the same Description. The Slotid is a code consisting of a letter (in the range A-G) followed by a number (in the range1-9). The Price associated with a Slot is independent of the Product that is currently stocked in it, for the purposes of this exam. Other attributes are shown in the E-R diagram. Typical values of the Attributes are indicated in Questions 4 - 10.

```
SLOT                              PRODUCT
┌─────────────┐                   ┌─────────────┐
│ SlotID      │                   │ ProductCode │
├─────────────┤                   ├─────────────┤
│ Capacity    │>○─ ─ ─ ─ ─ ─ ─ ─┼│ Size        │
│ Quantity    │                   │ Description │
│ Price       │                   │ Cost        │
│ ProductCode │                   │ Category    │
└─────────────┘                   └─────────────┘
```

Q1
Using examples, explain the notation used to represent the relationship in the diagram above.

[5 Marks]

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

[8 marks]

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

(b) Write the referential integrity constraint in SQL.

[12 marks]

Q4
Write **Relational Algebra** operations for the following queries, using Union or Intersection operations where needed.
  i)   List the Product Codes of all Products that are sold in the machine
  ii)   List the Product Code and Price of each Slot that is priced at 85c or 95c
  iii)   What is the difference between the Price for each Slot and the Cost of the Product in it?
  iv)   List the Product Codes, along with their size and description, for each Slot that contains a Quantity less than 2.
  v)   List the Product Codes of Slots that have a Capacity of 7 or greater and a Price of 60c or less.

[15 marks]

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

Q6
Write **Relational Calculus** expressions for the following queries:
  i)   How many Drink Category Products cost more than 95c?
  ii)   For each Slot list the total value of the Product stocked in that Slot
  iii)   How may units are there of each Drink Category Product costing over 85c?
  iv)   How many Slots contain a Quantity less than 2?
  v)   For each Slot containing a Quantity less than 3, list the Category of the Product
                                                                                        [10 marks]

Q7
Re-write the two even-numbered queries in Q6 in SQL
                                                                                        [4 marks]

Q8
Express the following queries in SQL, writing each clause on a separate line.
  i)   What is the biggest difference between the Cost and the Price charged ?
  ii)   List the average Cost to the nearest cent of each Size of each Product
          (Hint: use Description instead of Product Code.)
  iii)   What is the minimum, the average (to the nearest cent) and the maximum Price
          for Slots in the machine?
  iv)   List the minimum cost of each Size of each Product except Products in the Sweets
          Category. (Hint: use Description instead of Product Code.)
                                                                                        [20 marks]

Q9
Write an operation schema to change the Product associated with a Slot. Make sure you
check that the Product exists.

                                                                                        [10 marks]

Q10
Write an operation schema to delete from the database any Drink category Products that are
not currently stocked in any Slot.
Write the SQL code for the deletion.
                                                                                        [10 marks]