UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* SCIENCE *and* ENGINEERING

**Department of Computer Science and Information Systems**

**End-of-Semester Assessment Paper**

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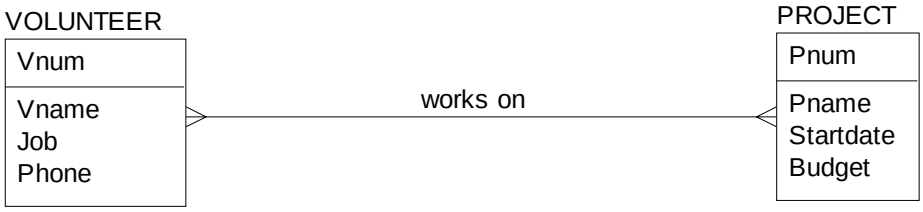
| Academic Year: | **2008/09** | Semester: | **Semester 1** |
| Module Title: | **Introduction to Systems Analysis** | Module Code: | **CS4513** |
| Duration of Exam: | **2½ Hours** | Percent of Total Marks: | **80** |
| Lecturer(s): | **Norah Power** | Paper marked out of : | **100** |

**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.**

***Community Projects***

*The E-R diagram represents a system that is being developed to support an extensive Community Development programme in city near you. There are several Projects in the programme, each with a Budget and a Start date. Projects include: community playgrounds, restoration of historic buildings, website development, tree planting/landscaping. etc. Volunteers work on the specific Projects in different roles, such as Leader, Secretary or Public Relations. Volunteer information includes their Job and Phone number. 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.

[5 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.

[8 marks]

**Q3**

(a) Write the State schema in Z for the *Community Projects* database. Include the existential and referential integrity constraints.

(b) Write the referential integrity constraints in SQL.

[12 marks]

**Q4**

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

i) List the names of all the Projects
ii) List all the details of each Project that began on 1st June 2007
iii) List the name and Budget of each Project that started during 2005
iv) List all the details of Projects that have no Volunteers assigned to them
v) Get the Phone number of the Secretary of Project 1032

[15 marks]

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

[6 marks]

**Q6**
Write **Relational Calculus** expressions for the following queries:

i) How many different Projects are there?
ii) Which Projects have Volunteer number 301 as their Leader?
iii) How many Projects does Volunteer number 303 work on?
iv) Name the Volunteers that work on the Playgrounds project.
v) Name the Projects that have Volunteers who are Software Engineers.

[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 name and Budget of each Project that is led by a Teacher. Do not use a join query.
ii) What is the number and Budget of the Project that has been running the longest time?
iii) How much money is managed by each Volunteer who is a Project Leader?

[15 marks]

**Q9**
Write a Z schema to delete a Volunteer identified by the number **v?** from the Volunteers table on condition that he or she is not the Leader of any Project. Any related facts about that Volunteer being involved in Projects must also be deleted.

[10 marks]

**Q10**
Write a Z schema to insert into the database a tuple **w?** representing the new fact that a particular Volunteer (who must be already in the database) is assigned to the role of Secretary of a particular Project (which must be already in the database.)

[10 marks]