UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, DECEMBER 2009

Title of Paper	:	**Databases and their Design I**
Course Number	:	**CS 345**
Time Allowed	:	**Three (3) Hours**
Instruction	:	**Answer ANY FIVE questions**

This paper should not be opened until permission has been granted by the invigilator.

1. a) Define the following terms:
   i) database
   ii) data model
   iii) DBMS
   iv) data independence
   [4]

   b) Discuss the three main categories of data models. [7]

   c) Differentiate between a DBA and a database designer. [3]

   d) What is the difference between controlled and uncontrolled redundancy? Illustrate with examples. [4]

   e) Name and discuss two different types of database end users. [2]

2. a) Draw an ER diagram to illustrate a portion of a university database where instructors are considered to offer or teach some course. Courses are offered during some semester. Hence there are three entities: instructor, course and semester but each one is associated with the next by at least two relationships. Allocate appropriate attributes and relationships to these entities and draw this ER diagram. [7]

   b) Composite and multivalued attributes can be nested to any number of levels. Suppose we want to design an attribute for a student entity type to keep track of previous college education. Such an attribute will have one entry for each college previously attended, and this entry is composed of college name, start and end dates, degree entries (degrees awarded at that college, of any), and transcript entries (courses completed at that college, if any). Each degree entry is formed of degree name and the month and year the degree was awarded, and each transcript entry is formed of a course name, semester, year and grade. Design and draw an ER diagram to display these entities and attributes. [7]

   c) A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate (some are reserves) in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER diagram for this application, stating any assumptions made. Choose your favorite sport (netball, soccer, baseball, etc) [6]

3. a) What is meant by integrity as used in database systems? [2]
   b) Why should DBMS be large? How can the size of a DBMS be a disadvantage? [3]
   c) How does consistency result from controlling or eliminating redundancy? [3]
   d) How does a DBMS increase productivity in an enterprise (an advantage) [4]
   e) Why can a failure in a database environment be more serious than one in a traditional file system? [4]
   f) Discuss the strength and weakness in terms of security of a DBMS [4]

4. a) How is the term attribute used in a relational database? What is the common name for it? [3]
   b) Define a relation. [3]
   c) Describe an un-normalized relation. Is it a relation considering the definition of a relation? [3]
   d) Describe how a network that is not a hierarchy can be implemented by means of a hierarchical model DBMS. [6]
   e) What are the advantages of the hierarchical model as compared to the other two models? What are the disadvantages? [5]

5. a) Explain why database design is important. [3]
   b) Discuss the difference between data and information. [3]
   c) What is metadata and how could it be important? [3]
   d) Discuss the potential costs of implementing a database system. [4]
   e) Drawn Art (DA) is a broker for not-so-famous painters. DA maintains a small network database to track painters, paintings, and galleries. Draw the network structure and identify appropriate sets for the DA database (Note: A painting is painted by a particular artist, and that painting is exhibited in a particular gallery; A gallery can exhibit many paintings but each painting can be exhibited in only one gallery; similarly a painting is painted by a single painter but each painter can paint many paintings) [7]

6. a) Discuss the importance of data modeling. [3]
   b) Explain how the ER model helped produce a more structured relations design environment. [4]
   c) What is structural independence, and why is it important? [3]
   d) Discuss the lack of data independence in traditional file systems. [3]
   e) The MTS company wants to track each part used in each piece of equipment; each part is bought from a specific supplier. Draw a network structure and identify the sets for the MTS database. (Note: A piece of equipment is composed of many parts but each part is used in only one specific equipment. A supplier can supply many parts but each part is supplied by one supplier) [7]