

# Information and Computer Science Department ICS 324 –Database Systems

**Fall 171 Midterm Exam**

**Tuesday, November 7, 2017**

**Time: 100 minutes**

**Name:**

**ID#:**

|  |  |  |  |  |  |  |  |  |
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**Section#:**

|  |  |  |
| --- | --- | --- |
| **Question #** | **Max Score** | **Score** |
| **1** | 10 |  |
| **2** | 12 |  |
| **3** | 18 |  |
| **4** | 20 |  |
| **5** | 20 |  |
| **6** | 20 |  |
| **Total** | **100** |  |

## Question # 1 [10 points]

Match each definition in the second table with its corresponding term in the first table.

|  |  |  |
| --- | --- | --- |
| **Terms** | | |
| 1. Degree | 2. Logical data independence | 3. Conceptual schema |
| 4. Database | 5. Data model | 6. External schema |
| 7. DBMS | 8. Physical data independence | 9. Database schema |
| 10. Cardinality | 11. Metadata | 12. Database state |

|  |  |
| --- | --- |
| **Definition** | **Term** |
| The capacity to change the internal schema without having to change the conceptual  schema. | Physical data independence |
| Changes when we insert or update or delete data from a database. | Database state |
| The capacity to change the conceptual schema without having to change the  external schemas and their associated application programs. | Logical data independence |
| a group of related objects in a database. Includes descriptions of the database  structure, data types, and the constraints on the database | Database schema |
| is a software package that enables user to create and maintain databases | DBMS |
| is a set of concepts to describe database structure, operations, and constraints | Data model |
| Number of columns in a table | Degree |
| The information such as the structure of each file, the type and storage format of each data item, and various constraints on the data that is stored in the system  catalog | Metadata |
| Number of rows in a table | Cardinality |
| Describes part of the database that a particular user group is interested in | External schema |

## Question # 2 [12 points]

The following table matches database constraints and database operations. Tick each cell where a constraint can be violated by the corresponding operation.

|  |  |  |  |
| --- | --- | --- | --- |
|  | INSERT | DELETE | UPDATE |
| Referential integrity | here | Here | here |
| Entity integrity | here |  | here |
| Key constraint | here |  | here |
| Domain constraint | here |  | here |

## Question # 3 [18 points]

Answer the following questions using the relational schema below.

COURSE (COURSE\_NO, COURSE\_NAME)

STUDENT (STUDENT\_ID, LNAME, FNAME, MAJOR) FACULTY (FACULTY\_ID, LNAME, FNAME, DEPARTMENT) TAKEN\_BY (STUDENT\_ID, COURSE\_NO, GRADE) TAUGHT\_BY (FACULTY\_ID, COURSE\_NO, SEMSTER, YEAR)

1. Can more than one student take a specific course? Why or why not?
2. Can a faculty member teach more than one course? Why or why not?
3. Can a student have more than one grade for the same course? Why or why not?

## Question # 4 [20 points]

Assume that the schema has entity types **AA**, **BB**, and **CC**

|  |  |  |  |
| --- | --- | --- | --- |
| **Entity Type** | **Type of Entity** | **Attribute** | **Attribute type** |
| AA | Strong | A1 | key |
| A2 | Single valued |
| A3 | derived |
| BB | Strong | B1 | key |
| B2 | Complex, consists of B3 and B4 |
| B3 | Single valued |
| B4 | Multi valued |
| CC | weak | C1 | Partial key |
| C2 | Single valued |

The relationships are:

* An entity of type **AA** has 0 or more dependent entities of type **CC** (weak).
* An entity of type **AA** owns at least one entity of type **BB**, but each entity of type **BB** is owned by one entity type of **AA**.

Draw the ER diagram of the above schema.

## Question # 5 [20 points]

Use the following table to answer the following question:

|  |  |  |
| --- | --- | --- |
| **Entity Type** | **Attribute** | **Attribute type** |
| XX | X1 | key |
| X2 | Single valued |
| X3 | Single valued |
| YY | Y1 | Single valued |
| ZZ | Z1 | Single valued |

Draw the EER diagram of each of the following.

1. **XX** is a superclass of **YY** and **ZZ** and its relationship with them is complete and overlapping
2. **XX** is a superclass of **YY** and **ZZ** and its relationship with them is partial and disjoint

## Question # 6 [20 points]

Consider an entity type SECTION in a UNIVERSITY database, which describes the section offerings of courses. The attributes of SECTION are Section\_number, Semester, Year, Course\_number, Instructor, Room\_no (where section is taught), Building (where section is taught), Weekdays (domain is the possible combinations of weekdays in which a section can be offered {‘UTR’, ‘MW’ and so on}), and Hours (domain is the possible time periods during which sections are offered {‘0700-0750’, ‘0800-0850’, …., ‘1400-1640’ and so on}). Assume that Section\_number is unique for each course within a particular semester/year combination (that is, if a course if offered multiple times during a particular semester, its section offerings are numbered 1, 2, 3, and so on.). There are several composite keys for SECTION, and some attributes are components of more than one key. Identify two composite keys.