**School:** Computer Science

**Institution:** University of Windsor

**Term:** Winter 2019

**Course:** 03-60-315-1 : Database Management Systems

**Instructor:** Dr. C. I. Ezeife

**Assignment #**1 : Total: 50 marks

**Handed Out:Thurs., Jan. 10, 2019; Due: Thurs., Jan. 24, 2019**

**Objective of Assignment**: To test on knowledge of database concepts and its 3-level architecture necessary for designing databases and their applications as well as practice on use of entity-relationship (ER) model to design databases.

**Scope**: Assignment covers materials from Chapters 1, 2 and 3 of book discussed in class.

**Electronic Assignment Submission:** Done through <http://blackboard.uwindsor.ca>

**Marking Scheme** : The mark for each of the questions is indicated beside each question.

**Academic Integrity Statement**: Remember to submit only work that is yours and include the following confidentiality agreement and statement at the beginning of your assignment.

**CONFIDENTIALITY AGREEMENT & STATEMENT OF HONESTY**

**I confirm that I will keep the content of this assignment/examination confidential.**

**I confirm that I have not received any unauthorized assistance in preparing for or doing this assignment/examination. I confirm knowing that a mark of 0 may be assigned for copied work.**

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Student Signature Student Name (please print)

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Student I.D. Number Date

**Marking Scheme: The mark for each question and sub question is shown with the question below. Place your solutions in tables provided for answers where possible.**

**For office Use only**

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| **Question** | **Mark** |
| **1** | **/10** |
| **2** | **/10** |
| **3** | **/10** |
| **4** | **/20** |
| **Total** | **/50** |

**CHAPTER 1: DATABASES AND DATABASE USERS**

1. Given the simple Customer-Subscribesto\_phonecompany database schema which contains three files describing information about telephone company subscribers as follows, answer the following questions with regards to this database. (Total for que 1 is 10 marks)

Customer (SSN: integer, CName: string, Caddress: string, balance: real)

Subscribesto (SSN: integer, CompId: string, phonetype: string, month: string, billamt: real)

PhoneCompany (CompId: string, CompName: string, Address: string, Numproducts:integer)

Note : SSN, CName, Caddress and balance stand for the customer’s social security number, name, address and phone bill balance owing respectively. Also, CompId, phonetype, month and billamt stand for the phone company identifier, the phone type the customer subscribes to, the month of subscription and the phone bill amount for that month. The rest of the attributes are for the company’s name, their address and the number of phone products they provide to customers.

1. Create a valid instance of this database containing values for its records with at least four records in each file. (3 marks)
2. Provide 2 informal English queries for this database with their answers. Each query should involve at least 2 of the files in the database and your answer should indicate the files (e.g., Customer, Subscribesto) needed to answer each query and specify what fields are being retrieved as the result (e.g., CName, balance). Please, provide your solution in the 3 column table below. (4 marks)
3. Specify at least 3 relationships (one for each of the 3 database files) among the records of the database. For each file (e.g., Customer), list any relationships it has with the other files through its fields (e.g., SSN). Provide your solution using the table below.   
    (3 marks)  
   Solution : (10 marks for que 1)

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| --- | --- | --- |
| Query | Answer | Files involved |
| 1. Create a valid instance of this database containing values for its records with at least four records in each file.   (3 marks) | An instance of the Customer-Subscribesto\_phonecompany database is :  Customer   |  |  |  |  | | --- | --- | --- | --- | | SSN | CName | CAddress | Balance | | 1 | Kolby | Riverside Dr. | 100 | | 2 | John | Wyandotte St. | 50 | | 3 | Rick | University Ave. | 75 | | 4 | Sarah | College Ave | 200 |   Subscribesto   |  |  |  |  |  | | --- | --- | --- | --- | --- | | SSN | CompId | Phonetype | Month | Billamt | | 1 | 1000 | iPhone XS | Jan | 75 | | 2 | 2000 | Pixel 3 | Feb | 60 | | 3 | 3000 | Galaxy S9 | Mar | 80 | | 4 | 4000 | LG G7 | Apr | 95 |   Phonecompany   |  |  |  |  | | --- | --- | --- | --- | | CompId | CompName | Address | Numproducts | | 1000 | Telus | Huron Church Rd. | 1258 | | 2000 | Rogers | Dominion Rd. | 1584 | | 3000 | Bell | Ouellette Ave. | 954 | | 4000 | Koodo | Walker Rd. | 1951 | |  |
| 2. Provide 2 informal English queries from this database with their answers. Each query should involve at least 2 of the files in the database and your answer should indicate the (e.g., Customer, Subscribesto) needed to answer each query and specify what fields are being retrieved as the result (e.g., CName, balance). (4 marks) | Queries are :  Get all CName who are with the company having CompId 2000  (Using Customer & Subscribeto)  Returns  CName: John  Get all SSN that are with Telus  (Using Subscribeto & Phonecompany)  Returns  SSN: 1 |  |
| 3. Specify at least 3 relationships (one for each of the 3 database files) among the records of the database. For each file (e.g., Customer), list any relationships it has with the other files through its fields (e.g., SSN).  (3 marks) | Customer: Related to one Subscribeto record through SSN  Subscribeto: Related to one Phonecompany record through CompId  Phonecompany: Related to multiple Subscribeto records through CompId  . |  |

1. Recall that a database has many types of users, each of whom may require a different view of the database. For example, Customer-Subscribesto\_phonecompany database schema of question 1 may be accessing and printing the details and balances owing of each customer frequently and thus a view for this user is created. Another view for this database is checking each uncleared customer’s monthly subscription phone bill amounts so they can be added to the balance owing. (Total for que 2 is 10 marks)
2. Using this Customer-Subscribesto\_phonecompany database,give 2 additional views that may be needed by other user groups for the database. (5 marks)

Solution : (5 marks for que 2i)

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| --- |
| Grouping all customers by phone brand for customer support purposes  Grouping all customers by their provider company for intercompany comparisons |

ii) Give 5 examples of integrity constraints that you think can apply to the Customer-Subscribesto\_phonecompany database of question 1. (5 marks)

Solution : (5 marks for que 2ii)

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| 1. SSN needs to be unique 2. CompId needs to be unique   (Key Constraints)   1. A given SSN should appear in both Customer and Subscribeto 2. A given CompId should appear in both Customer and Subscribeto   (Referential Integrity Constraints)   1. CompId in Phonecompany must have an integer value (cannot be null)   (Entity Integrity Constraint) |

**CHAPTER 2: DATABASE SYSTEM CONCEPTS AND ARCHITECTURE**

3.a. Design a simple database schema with 4 or less files for a University database system indicating all applicable constraints and information. In this University, students have majors and take courses which they receive grades for. These grades are used to compute the student grade point average at any point in time. As the database designer, you should decide the necessary attributes for students and courses. Also, show a sample database state for the database. (5 marks for a)

b. Using your database, describe the differences between logical and physical data independence.

(5 marks for b)

(Total for que 3 is 10 marks)

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| Question | Answers |
| 1. Design a simple database schema with 4 or less files for a University database system indicating all applicable constraints and information. Also, show a sample database state for the database.  (5 marks) | Student (sID: integer, sName: string, major: string, gpa: real, numCredits: integer)  Take (sID: integer, cID: string, grade: integer)  Course (cID: string, cName: string, credits: integer)  Student   |  |  |  |  |  | | --- | --- | --- | --- | --- | | sID | sName | major | gpa | numCredits | | 1 | Kolby | CS | 95.0 | 6 | | 2 | Ricky | ENG | 81.0 | 9 |   Take   |  |  |  | | --- | --- | --- | | sID | cID | grade | | 1 | COMP3150 | 100 | | 1 | COMP3400 | 90 | | 2 | ENG2250 | 85 | | 2 | ENG2500 | 77 |   Course   |  |  |  | | --- | --- | --- | | cID | cName | credits | | COMP3150 | Databases | 3 | | COM3400 | C++ | 3 | | ENG2250 | Practicum | 6 | | ENG2500 | Architecture | 3 |   Constraints  One sID can have multiple entries in “Take” (One student can take multiple courses)  One cID can be associated with more than one sID (A course can be taken by multiple students) |
| 1. Using your database, describe the differences between logical and physical data independence | Logical Independence:  The ability to change the conceptual schema (e.g. get names of students with GPA>85%; and get names and address of students in CS or ENG) without having to change the external schema or application program (when student has an addition attribute “address” for example)  Physical Data Independence:  It has the ability to change the internal schema without having to change the conceptual schema. For example, an access path to improve retrieval speed of TAKE records shouldn’t require TAKE or its relations to be changed. Ex. The query “All students who have taken each course” |

**CHAPTER 3: DATA MODELING USING THE ENTITY-RELATIONSHIP (ER) MODEL**

4. Windsor Records company has hired you as a database designer. One of your first jobs is to design a conceptual schema for Windsor records and draw an ER diagram for your schema using the following information. The database stores information about musicians who perform on Windsor Records albums and also stores other company data.

i. Each Windsor Records musician has a unique social security number (SSN), a name, an address and a phone number.

ii. Each instrument used in recorded songs has a unique name (e.g., guitar, flute, drum, etc.) and a musical key (e.g., C, B-flat, E-flat).

iii. Each album on their label has a unique album identifier, an album title, a copyright date, a format (e.g. CD, vinyl, MP3, etc.).

iv. Each song recorded has a unique song title and an author.

v. Each musician may play several instruments, and a given instrument may be played by several musicians.

vi. Each album has a number of songs on it, but no song may appear on more than one album.

vii. Each song is performed by one or more musicians, and a musician may perform a number of songs.

viii. Each album has exactly one musician who acts as its producer. A musician may produce several albums.

Indicate all key and cardinality constraints and any assumptions that you make.

Design the Entity-Relationship (ER) model diagram for this database.

(Total for que 4 is 20 marks)  
  
(Note : 10 marks for correct entity and relationship identifications with their attributes in the ER diagram. It is 0 with no ER diagram presented).

(5 for entities and 5 for relationships, 5 marks for correct constraints interpretations on the edge labels, 5 marks for correct verbal interpretations of the database being represented by the ER diagram through use of correct symbols etc.).

Hint : Present the conceptual design first, showing (1) all the entities and their attributes, (2) all the relationships and their attributes, (3) all the constraints before drawing your ER.

(Total for que 4 is 20 marks) Conceptual information in table and ER diagram next

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| --- | --- |
| Specific Requirement/Constraint Type | Requirements and Constraints for the ER diagram |
| Entities and attributes  (5 marks) in ER | Musician (SSN, mName, mAddress, phone)  Instrument (iName, musicKey)  Album (aID, aTitle, crDate, format)  Song (sTitle, author) |
| Relationships and attributes  (5 marks) in ER | Play (SSN, iName)  Contains (aID, sTitle)  Performs (SSN, sTitle)  Produces (SSN, aID) |
| Interpretation of each of the constraints represented on the edge labels (5 marks) in ER | v. Each musician may play several instruments, and a given instrument may be played by several musicians.  (M:N) Relationship on Play between Musician and Instrument  vi. Each album has a number of songs on it, but no song may appear on more than one album.  (1:N) Relationship on Contains between Album and Song  vii. Each song is performed by one or more musicians, and a musician may perform a number of songs.  (M:N) Relationship on Performs between Song and Musician  viii. Each album has exactly one musician who acts as its producer. A musician may produce several albums.  (N:1) Relationship on Produces between Album and Musician |
| Correct use of symbols in ER, etc (5 marks) |  |

**ER Diagram goes next :**

You may attach a scanned copy of your hand-drawn ER diagram here. You can also draw it digitally if possible and attach. Note that in the ER diagram, the foreign key attributes that are part of the relationship schemas are not explicitly listed with the relationship but inherited from the entity the relationships are connected to.

