**School:** Computer Science

**Institution:** University of Windsor

**Term:** Fall 2023

**Course:** Comp-3150-1 : Database Management Systems

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

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

**Handed Out:Thurs. Sept. 14, 2023; Due: Thurs. Sep. 28, 2023**

**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://brightspace.uwindsor.ca>

**Marking Sheme** : 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)

\_11010278\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_2023-09-25\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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.**

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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 Farmer-growscrops-inRegions database schema, which contains three files as described below, answer the following questions with regards to this database.

(Total for que 1 is 10 marks)

Farmer (Ssn: integer, Name: string, Age: integer, Regionid: integer)

Growscrops (Ssn: integer, Regionid: integer, Crop: string, Revenue: real)

Region (Regionid: integer, Regname: string, Cropbudget: real, managerid: integer)

Note : Ssn, Name, Age, Regionid are the social security number, name, age and Regionid of the farmer respectively. Also, Regname, Cropbudget and managerid represent the regionid (e.g., SWO for south western Ontario), all crop budget (amount) for growing in this region (e.g., 100 for $100M), and managerid (a farmer who oversees farmer affairs in this region). Revenue from grown crop can be measured in millions of dollars as well (e.g., 0.5 means half a million). A farmer may grow crop in multiple regions.

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 (not SQL) 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 files (e.g., Farmer, Grows) needed to answer each query and specify what fields (attributes) are being retrieved as the result (e.g., Name, Age). Please, provide your solution in the 3 column table below.

(4 marks)

1. Specify at least 3 relationships (one for each of the 3 database files) among the records of the database. That is, for each file (e.g., Farmer), list any relationships it has with other files through its fields (attributes) (e.g., Ssn). Provide your solution using the table below.
2. (3 marks)  
   Solution : (10 marks for que 1)

|  |  |  |
| --- | --- | --- |
| Query | Answer | Files involved or used to answer this question |
| 1. Create a valid instance of this database containing values for its records with at least four records in each file.   (3 marks) | Farmer   |  |  |  |  | | --- | --- | --- | --- | | SSN | Name | Age | Regionid | | ACE-02-3521 | Albert Padilla | 34 | 9391 | | ACE-02-2535 | Dale Collier | 59 | 4962 | | ACE-02-4758 | Clifford McKay | 42 | 8753 | | ACE-02-9756 | Gerard Brashaw | 28 | 5224 |   Growscrops   |  |  |  |  | | --- | --- | --- | --- | | SSN | Regionid | Crop | Revenue | | ACE-02-3521 | 9391 | Strawberry | 0.5 | | ACE-02-2535 | 4962 | Potato | 0.4 | | ACE-02-4758 | 8753 | Coffee | 0.7 | | ACE-02-9756 | 5224 | Green Beans | 0.3 |   Region   |  |  |  |  | | --- | --- | --- | --- | | Regionid | Regname | Cropbudget | Managerid | | 9391 | Albert Padilla | 0.2 | 01 | | 4962 | Dale Collier | 0.1 | 02 | | 8753 | Clifford McKay | 0.3 | 03 | | 5224 | Gerard Brashaw | 0.1 | 04 | |  |
| 2. Provide 2 informal English queries (not SQL) 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 files (e.g., Farmer, Growscrops) needed to answer each query and specify what fields are being retrieved as the result (e.g., Name, Age).  (4 marks) | Result of query  i. Farmers needed to answer which crops they were planting in which region along with their manager id, (Crop, Regionid, ManagerID)    ii. The government needs a document to report the crop name and revenue from farmers to tax them properly (crop, revenue) | (i)  ii |

|  |  |  |
| --- | --- | --- |
| 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., Farmer), list any relationships it has with other files through its fields (e.g., Ssn). (3 marks) | Farmer, relationship with Growscrops through SSN  Growscrops, relationship with Farmer through RegionID  Region, relationship with Growscrops through RegionID  . |  |

1. Recall that a database has many types of users, each of whom may require a different view of the database. For example, one user of the Farmer-growscrops-inRegions database of question 1 may be accessing and printing the details and Regionid of each Farmer frequently and thus a view for this user is created. Another view for this database is checking that each region has available budget on farming equipment and resources before expenditure such as for buying such equipment like farm tractors, seeds, etc. (Total for que 2 is 10 marks)
2. Using this Farmer-growscrops-inRegions database,give 2 additional views that may be needed by other user groups for the database. (5 marks)

Solution : (5 marks for que 2i)

|  |
| --- |
| (a) create a view for SSN since you can access/print the farmers name, age, what crop they grow and revenue.  (b) create a view for Name since you can access/print the farmers mangerid, age, crop, and cropbudget |

ii) Give 5 examples from many of the different types of key, domain, foreign key, entity and semantic integrity constraints that you think can apply to the Farmer-growscrops-inRegions database of question 1. (5 marks)

Solution : (5 marks for que 2ii)

|  |
| --- |
| GA : any 5 of the following can be used. (a) Domain Constraint on Farmer->name since it cannot have a null name, because every person must have a name.  (b) Key Constraint on Farmer->SSN to ensure each farmer has their own unique SSN so no duplicates happen.  (c) Foreign Key Constrain on Growscrops->SSN & Regionid to make sure each crop can be linked to the respective farmer and region.  (d) Domain Constraint on Growcrops->Revenue to set the value of revenue to 0.0 since if it was null the irs would be very mad and it wouldn’t make sense if there was null revenue    (e) Domain Constraint on Region->Cropbudget to also set to 0.0 to ensure there is a valid budget for the year/quarter/whatever timeframe instead of null  (f) Key Constraint on all of them for regionID so there can be no two or more regions with the same id  (g) |

**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)

|  |  |
| --- | --- |
| 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   |  |  |  | | --- | --- | --- | | Name | StudentID | Major |   Course   |  |  |  |  | | --- | --- | --- | --- | | CourseName | CourseID | CreditHours | Department |   Section   |  |  |  |  | | --- | --- | --- | --- | | SectionID | CourseID | Semester | Instructor |   Transcript   |  |  |  | | --- | --- | --- | | StudentID | SectionID | Grade |   **Database State**  Student   |  |  |  | | --- | --- | --- | | Name: | StudentID: | Major: | | Spondon | 110101278 | CS |   Course   |  |  |  |  | | --- | --- | --- | --- | | CourseName: | CourseID: | Credits: | Department: | | Database Management Systems | COMP3150 | 3.00 | CS |   Section   |  |  |  |  | | --- | --- | --- | --- | | SectionID: | CourseID: | Semester: | Instructor: | | 2235 | Comp3150 | Fall | Dr. C. I. Ezeife |   Transcript   |  |  |  | | --- | --- | --- | | StudentID: | SectionID: | Grade: | | 110101278 | 2235 | B | |
| 1. Using your database, describe the differences between logical and physical data independence | Logical data independence:  i.  Logical data independence allows altering the database's conceptual schema without impacting external applications. For example, changing "Database Management Systems" to "DBMS" in the CourseName maintains functionality for users without requiring updates from applications.  ii. Physical data independence:  Physical data independence enables changing the database's physical storage or schema without affecting the logical schema or external applications. For instance, an access path could be implemented to improve file speeds of studentID records without affecting the databases logic. |

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

4 You have been hired to design a database for another version of the Farmer-growscrops-inRegion database world and your first job now is to design an ER model for this database using the following description of that world.

1. farmers are identified by their SSN and have other attributes as names, ages and Regionid.
2. regions are identified by their region id and have other attributes as region names, cropbudget and manager id.
3. Each crop is identified by the crop id, name, and crop type.
4. Each farmer can grow crops in more than one region.
5. Each region can have several farmers growing crops.
6. Each region can have several crops growing in it.

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 ER

(5 for entities with attributes and 5 for relationships with attributes), 5 marks for correct cardinality/participation constraints interpretations on the edge labels, 5 marks for correct verbal interpretations of the database being represented by the ER digram through use of correct symbols etc.). If all components above are presented with NO ER DIAGRAM, LOSE 15 MARKS. If only the correct ER diagram is presented with no conceptual design information about it as given in the table below, lose 10 marks.

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

|  |  |
| --- | --- |
| Specific Requrieement/Constraint Type | Requirements and Constraints from the ER diagram |
| Entities and attributes  (5 marks) in ER |  |
| Relationships and attributes  (5 marks) in ER |  |
| Interpretation of each of the constraints represented on the edge labels (5 marks) in ER |  |
| 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.

The ER model Diagram for the Farmer-growscrops Database of Question 3 of Assignment 1 is:.

A diagram of a company

Description automatically generated