

School: Computer Science
Institution: University of Windsor
Term: Fall 2021
Course: Comp-3150-1 : Database Management Systems
Instructor: Dr. C. I. Ezeife
Assignment #1 Solution: Total: 50 marks
Handed Out: Thurs. Sept. 16, 2021; **Due:** Thurs. Sep. 30, 2021

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.

Student Signature

Student Name (please print)

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

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

CHAPTER 1: DATABASES AND DATABASE USERS

- Given the simple Person-vaccinatedin-Centre database schema that contains three files described as follows, answer the following questions with regards to this database.

(Total for que 1 is 10 marks)

Person (Ssn: integer, Name: string, Age: integer, jobtype: string)

Vaccinatedin (Ssn: integer, Cntid: integer, , vacdate:date, dose: integer, vactime: real)

Centre (Cntid: integer, Cntname: string, city: string, budget: real, managerid: integer)

Note : Ssn, Name, Age, jobtype are the social security number, name, age and job type respectively. Also, Cntid, vacdate, dose and vactime represent centre id, vaccination date (e.g., in dd-mon-yy), which dose (1 or 2) and vaccination time (e.g., 0.00 is 12.00am and 12.00 is 12.00pm at noon). The rest of the attributes Cntname, city, budget and managerid are the centre name (eg. WFCU, St Clair, DownTown, Other), city, budget for running the centre (eg. \$80,000) and managerid respectively. A manager is a Person.

Note that with the Vaccinatedin, each person needs to vaccinate a different dose in a different centre with the primary key as on (Ssn, Cntid). To be able to create an instance where people can take their second dose in the same centre, we need to create a unique primary key as: (Ssn, Cntid, Vacdate).

- Create a valid instance of this database containing values for its records with at least four records in each file.
(3 marks)
- 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., Person, Vaccinatedin) 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)
- Specify at least 3 relationships (one for each of the 3 database files) among the records of the database. For each file (e.g., Person), list any relationships it has with other files through its fields (e.g., Ssn). Provide your solution using the table below.
(3 marks)

Solution : (10 marks for que 1)

Query	Answer	Files involved																													
<p>1. Create a valid instance of this database containing values for its records with at least four records in each file.</p> <p>(3 marks)</p>	<p>An instance of the Person-vaccinatedin-Centre database is :</p> <p><u>Person</u></p> <table><tr><th>Ssn</th><th>Name</th><th>Age</th><th>jobtype</th></tr><tr><td>10</td><td>Jobe Bata</td><td>65</td><td>nurse</td></tr><tr><td>20</td><td>Monica Kap</td><td>80</td><td>retiree</td></tr><tr><td>30</td><td>Peter Good</td><td>22</td><td>retailer</td></tr><tr><td>40</td><td>Kate Lee</td><td>47</td><td>teacher</td></tr><tr><td>50</td><td>Ted Tam</td><td>50</td><td>doctor</td></tr></table> <p><u>Vaccinatedin</u></p> <table><tr><th>Ssn</th><th>Cntid</th><th>vacdate</th><th>dose</th><th>vactime</th></tr></table>	Ssn	Name	Age	jobtype	10	Jobe Bata	65	nurse	20	Monica Kap	80	retiree	30	Peter Good	22	retailer	40	Kate Lee	47	teacher	50	Ted Tam	50	doctor	Ssn	Cntid	vacdate	dose	vactime	<p>Person Vaccinatedin Centre</p>
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<p>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., Person, Vaccinatedin) needed to answer each query and specify what fields are being retrieved as the result (e.g., Name, Age). (4 marks)</p> <p>i. List the names and job types of persons who have received dose 2 of the vaccine (Name, Jobtype).</p> <p>ii. Get the managerid, name of each manager and the total budget</p>	<p>Result of query</p> <p>i.</p> <table><tr><td>Name</td><td>Jobtype</td></tr><tr><td>Jobe Bata</td><td>nurse</td></tr><tr><td>Ted Tam</td><td>doctor</td></tr></table> <p>ii.</p> <table><tr><td>managerid</td><td>Name</td><td>sum(budget)</td></tr><tr><td>10</td><td>Jobe Bata</td><td>1000000</td></tr><tr><td>50</td><td>Ted Tam</td><td>1500000</td></tr></table>	Name	Jobtype	Jobe Bata	nurse	Ted Tam	doctor	managerid	Name	sum(budget)	10	Jobe Bata	1000000	50	Ted Tam	1500000	<p>(i) Person Vaccinatedin Centre</p> <p>ii Person Centre</p>																																													
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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., Person), list any relationships it has with other files through its fields (e.g., Ssn). (3 marks)	<p>Each Person record is related to one Vaccinatedin record through the field Ssn.</p> <p>Each Vaccinatedin record is related to one Person record through Ssn and one Centre record through Cntid.</p> <p>Each Centre record is related to several Vaccinated records through the field Cntid.</p>	<p>Person Vaccinatedin</p> <p>Person Vaccinatedin Centre</p> <p>Centre Vaccinatedin</p>

2. 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 Person-vaccinatedin-Centre database of question 1 may be accessing and printing the details and job types of each Person frequently and thus a view for this user is created. Another view for this database is checking that centre has available budget before expenditure such as for buying supplies.

(Total for que 2 is 10 marks)

- i) Using this Person-vaccinatedin-Centre 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) A view that groups all the persons who received their vaccination in each centre
- (b) A view that gives the total number of persons who have received all needed 2 doses.

- 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 Person-vaccinatedin-Centre database of question 1.

(5 marks)

Solution : (5 marks for que 2ii)

GA : any 5 of the following can be used.

- (a) The Ssn should be unique for each Person record (key constraint).
- (b) The Cntid should be unique for each Centre record (key constraint).

- (c) A value of Ssn in a Vaccinatedin record must also exist in Person record (referential integrity constraint).
- (d) A value of Cntid in a Vaccinatedin record must also exist in Centre record (referential integrity constraint).
- (e) The value of Cntid in a WORKSIN record must be one of the values in the set {1, 2, 3, 4} (domain constraint).
- (f) Every record in Person must have a value for Ssn (entity integrity constraint).
- (g) A person must have age greater or equal to 12 to be vaccinated (general semantic 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)

Question	Answers																														
a. 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)	<p>'Students take courses' database schema is :</p> <p>Student (stuid : integer, sname : string, major : string, gpa : real)</p> <p>Take (stuid : integer, cid : string, grade : integer)</p> <p>Course (cid : string, ctitle : string)</p> <p>Some constraints are :</p> <p>A student can take many courses.</p> <p>A course can be taken by many students.</p> <p>A state of this database is :</p> <p>Student</p> <table><tr><th>Stuid</th><th>sname</th><th>major</th><th>gpa</th></tr><tr><td>11</td><td>John Smith</td><td>CS</td><td>80</td></tr><tr><td>22</td><td>Mary Cane</td><td>Math</td><td>67</td></tr></table> <p>Take</p> <table><tr><th>Stuid</th><th>cid</th><th>grade</th></tr><tr><td>11</td><td>60-140</td><td>60</td></tr><tr><td>11</td><td>60-100</td><td>70</td></tr><tr><td>11</td><td>62-120</td><td>75</td></tr><tr><td>22</td><td>62-140</td><td>80</td></tr><tr><td>22</td><td>40-140</td><td>90</td></tr></table>	Stuid	sname	major	gpa	11	John Smith	CS	80	22	Mary Cane	Math	67	Stuid	cid	grade	11	60-140	60	11	60-100	70	11	62-120	75	22	62-140	80	22	40-140	90
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b. Using your database, describe the differences between logical and physical data independence	<p>Logical data independence:</p> <ul style="list-style-type: none"> i. The ability to change the conceptual schema (e.g. get names of students with GPA>85%; and get names and address of CS students) without having to change the external schema or application program (eg. when student has an additional attribute "address"). ii. Physical data independence: It has the ability to change the internal schema (e.g., storage model like store the files as B-tree instead of arrays) without having to change the conceptual schema such as relations. <p>For example an access path (such as B-tree) to improve retrieval speed of TAKE file records should not require the TAKE relation or file or its query to be altered much. An example query on TAKE is "list all courses taken by each student".</p>												

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

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

- i. persons are identified by their SSN and have other attributes as names, ages and job types.
- ii. centres are identified by their centre id and have other attributes as centre names, city, budget and manager id.
- iii. Each pharmaceutical company is identified by name and has a phone number.
- iv. Each vaccine is identified by the vaccine name and it also has attributes for its drug formula and company that made it.
- v. Each pharmaceutical company sells only one vaccine type for a price.
- vi. Each vaccine is sold by only one pharmaceutical company
- vii. A centre could administer one or more vaccines to several persons, and a person could obtain vaccinations from several centres. Each vaccination administration has a date time when taken and which dose (e.g., 1 or 2) it is.

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 diagram through use of correct symbols etc.). **If all components above are presented with NO ER DIAGRAM, LOSE 15 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 Requirement/Constraint Type	Requirements and Constraints from the ER diagram
Entities and attributes (5 marks) in ER	Person(<u>SSN</u> , pame, age, jobtype) Centre(<u>Cntid</u> , Cname, city, budget, managerid) Vaccine(<u>Tradename</u> , formula, madeby) PCompany(<u>Cname</u> , Cphone)
Relationships and attributes (5 marks) in ER	Vaccinates (<u>SSN</u> , <u>Cntid</u>) Sells (<u>Cname</u> , <u>Vname</u> , price) Administers (<u>SSN</u> , <u>CNTID</u> , <u>Vname</u> , date, time, dose)
Interpretation of each of the constraints represented on the edge labels (5 marks) in ER	<ol style="list-style-type: none"> 1. Each person can vaccinate in more than one centre 2. Each centre can vaccinate several persons. 3. Each centre can administer several vaccines to several persons. 4. Each centre can administer several vaccines 5. Each person can be administered several vaccines from several centres. 6. Each pharmaceutical company can sell only one vaccination type. 7. Each vaccine type is sold by only one pharmaceutical company.
Correct use of symbols in ER, etc (5 marks)	Show correct use of symbols for attributes, relationships, participations, etc.

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 Vaccination Database of Question 3 of Assignment 1.

