School: Computer Science
Institution: University of Windsor
Term: Winter 2021
Course: Comp-3150-1 : Database Management Systems
Instructor: Dr. C. I. Ezeife
Assignment #1 **Solution**: Total: 50 marks
Handed Out:Thurs. Jan. 14, 2021; Due: Thurs. Jan. 28, 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 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.

_____ _____
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.

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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 SalesRep-Worksin-SalesArea 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)

SalesRep (SRid: integer, SRname: string, SRage: integer, salary: real)
Worksin (SRid: integer, Arid: integer, hours: integer)
SalesArea (Arid: integer, Aname: string, city: string, budget: real, managerid: integer)

Note : SRid, SRname, SRage, salary are the sales rep id, name, age and salary respectively. Also, hours is the number of hours worked by sales rep in the sales area. The rest of the attributes Arid, Aname, city, budget and managerid are the area id, name, location, budget and managerid respectively. A manager is a sales rep.

i) Create a valid instance of this database containing values for its records with at least four records in each file. (3 marks)

ii) 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., SalesRep, Worksin) needed to answer each query and specify what fields (attributes) are being retrieved as the result (e.g., SRname, SRage). Please, provide your solution in the 3 column table below. (4 marks)

iii) Specify at least 3 relationships (one for each of the 3 database files) among the records of the database. For each file (e.g., SalesRep), list any relationships it has with other files through its fields (e.g., SRid). Provide your solution using the table below. (3 marks)

Solution : (10 marks for que 1)

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 SalesRep-Worksin-SalesArea database is : SalesRep SRid SRname SRage salary 10 Jobe Bata 25 50000 20 Monica Kap 29 55000 30 Peter Good 22 45100 40 Kate Lee 47 20000 50 Ted Tam 50 70000 Worksin SRid Aid hours 10 1 40 20 1 40 30 2 30 40 3 20 50 4 30 50 3 10	SalesRep Worksin SalesArea

	SalesArea Aid Aname city budget managerid 1 DownTn Windsor 600000 10 2 SouthE Essex 400000 10 3 SouthW Windsor 900000 50 4 WestW Windsor 600000 50	
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., SalesRep, Worksin) needed to answer each query and specify what fields are being retrieved as the result (e.g., SRname, SRage). (4 marks) i. List the names and salaries of sales reps in Windsor (SRname, salary). ii. Get the managerid, name of each manager and the total budget controlled by the manager (managerid, SRname, total budget)	Result of query i. SRname salary Jobe Bata 50000 Monica Kap 55000 Kate Lee 20000 Ted Tam 70000 ii. managerid SRname sum(budget) 10 Jobe Bata 1000000 50 Ted Tam 1500000	SalesRep Worksin SalesArea SalesRep SalesArea
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., SalesRep) list any relationships it has with other files through its fields (e.g., SRid). (3 marks)	Each SalesRep record is related to one Worksin record through the field SRid. Each WORKsIN record is related to one SalesRep record through eid and one SalesArea record through Aid. Each SalesArea record is related to several WORKSIN records through the field Aid.	SalesRep Worksin SalesRep Worksin SalesArea Worksin SalesArea

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 SalesRep-Worksin-SalesArea database of question 1 may be accessing and printing the details and salaries of each Sales rep frequently and thus a view for this user is created. Another view for this database is checking that Sales area has available budget before expenditure such as paying salaries.

(Total for que 2 is 10 marks)

i) Using this SalesRep-Worksin-SalesArea 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 sales reps working in each sales area

(b) A view that gives the total salary paid by each sales area.

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 SalesRep-Worksin-SalesArea database of question 1. (5 marks)

Solution : (5 marks for que 2ii)

GA : any 5 of the following can be used.

(a) The SRid should be unique for each SalesRep record (key constraint).

(b) The Aid should be unique for each SalesArea record (key constraint).

(c) A value of SRid in a WORKSIN record must also exist in SalesRep record (referential integrity constraint).

(d) A value of Aid in a WORKSIN record must also exist in SalesArea record (referential integrity constraint).

(e) The value of Aid in a WORKSIN record must be one of the values in the set {1, 2, 3, 4} (domain constraint).

(f) Every record in SalesRep must have a value for SRid (entity integrity constraint).

(g) A SalesArea cannot have the total salaries of its employees exceeding the assigned SalesArea budget (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)	`Students take courses' database schema is : Student (stuid : integer, sname : string, major : string, gpa : real) Take (stuid : integer, cid : string, grade : integer) Course (cid : string, ctitle : string) Some constraints are : A student can take many courses. A course can be taken by many students. A state of this database is : Student Stuid sname major gpa 11 John Smith CS 80 22 Mary Cane Math 67 Take Stuid cid grade 11 60-140 60 11 60-100 70 11 62-120 75 22 62-140 80 22 40-140 90 Course cid ctitle 60-140 Programming 60-100 Computer Concepts 62-120 Algebra 62-140 Calculus I 40-140 Comm Studies Intro
b. Using your database, describe the differences between logical and physical data independence	Logical data independence: 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. 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”.

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

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

i. Database contains information concerning sales representatives, sales areas and products. Each representative has a unique identifier with name, age and salary. Each area is described by a unique identifier with name, city and budget allocated to that area. Each product has a unique identifier with name, product description and price.
ii. Each representative is responsible for sales in one or more areas; and has the number of hours and revenue in dollars from sales in each area recorded.
iii. Each area has one or more responsible representatives.
iv. Similarly, each representative is responsible for sales of one or more products; and has the number of hours and revenue in dollars from sales of each product recorded.
v. Each product has one or more responsible representatives.
vi. Every product is sold in every area.

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.

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	Rep (Rid, Rname, Rage, salary) Area (Arid, Aname, city, budget) Product (Prid, Pname, Pdesc, price)
Relationships and attributes	RepArea (Rid, Arid, hours, revenue)

(5 marks) in ER	RepProd (Rid, Prid, hours, revenue) AreaProd (Arid, Prid, hours, revenue)
Interpretation of each of the constraints represented on the edge labels (5 marks) in ER	i. Each representative is responsible for sales in one or more areas. ii. Each area has one or more responsible representatives. iii. Similarly, each representative is responsible for sales of one or more products. iv. Each product has one or more responsible representatives. v. Every product is sold in every area.
Correct use of symbols in ER, etc (5 marks)	Show use of correct use of symbols for attributes, relationships, 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 Sales Rep, Sales Area and Product Database of Question 3 of Assignment 1.