

CSG1207/CSI5135 Systems and Database Design

Assignment 1: Normalisation and E-R Modelling
Assignment Marks: Marked out of 40, (20% of unit)
Due Date: 3 April 2017, 9:00AM

Background Information

This assignment tests your knowledge and understanding of the two data modelling techniques we have covered in this unit – Normalisation and Entity Relationship Modelling. Both techniques aim to identify and organise a set of data in an efficient manner that minimises redundancy and establishes the structure of related groups of data. These are important first steps in constructing databases.

The assignment consists of **four tasks**, focusing on **normalisation** and **entity-relationship modelling**. Attempt all questions, and be sure to show all relevant stages/working and state any assumptions.

A small amount of marks are dedicated to **presentation, correct notation** and **advanced solutions**.

A Note Regarding Assumptions

It is not possible to define every single aspect of all systems in the assignment brief, nor is it beneficial to attempt this. Part of the process of completing the assignment tasks is making (and declaring) assumptions that define any grey areas or unspecified details in the scenarios. It is up to you to make these assumptions, but feel free to discuss them with your tutor if you are uncertain of their validity. The tutorial of Module 1 (recording available in Blackboard) discusses assumptions.

There is no “universally correct” set of assumptions for the tasks. Think about the problem, and make assumptions as you encounter the need for them. All assumptions should affect or be enforced/implemented by your database design, and they should not contradict something that is specified in the assignment brief. Some assumptions may make a task easier, but avoid *always* making assumptions that make the task easier, as this is a questionable practise and is likely result in an assignment that does not demonstrate a deep understanding. Always remember to **clearly state all assumptions you make**.

The most common assumptions are likely to regard irrelevant or derived data (Tasks 1 and 2) or the cardinality of relationships between entities (Tasks 3 and 4).

Task 1 – Normalisation (9 marks)

The table below shows part of a spreadsheet used by an electronics store to keep track of jobs.

Job ID	Client ID	Client Name	Staff ID	Staff Name	Job Date	Job Notes	Hours Billed
413	18	Patrick Walker	41	Caesar Wilkins	2017-02-18	Computer running slow	4
414	147	Aline Weaver	24	Paula Head	2017-02-18	Backup photos/data	2
415	323	Cassidy Spratt	19	Lucius Peters	2017-02-19	Laptop virus removal	3
416	323	Cassidy Spratt	37	Shelley Watson	2017-02-19	Phone virus removal	1
417	18	Patrick Walker	19	Lucius Peters	2017-02-21	Computer still too slow	2
418	218	Kim Langton	11	Hamish Wyatt	2017-02-22	Install Windows, etc.	3

Normalise this table to the third normal form, clearly showing the stages of 0NF, 1NF, 2NF and 3NF. State any **assumptions** you make. **Use relational symbolic notation** as indicated in the second lecture, and **name your resultant data sets** upon reaching 3NF.

Take heed of the following two tips:

- There are several correct ways to normalise this data, leading to almost identical solutions
- You only need to identify one repeating group, e.g. R1 = (Outer Group {Repeating Group})

CSI5135 Additional Requirement

If you are in CSI5135, the following additional requirements apply. If you are in CSG1207, you do not need to do this (but you are welcome and encouraged to do so if you want).

Once you have normalised the table to 3NF and named your data sets, convert your results into a **physical E-R diagram**. Remember to indicate all cardinality, attributes, primary and foreign keys. Remember to state any assumptions that are relevant to the E-R diagram.

Task 2 – Advanced Normalisation (9 marks)

The form below depicts an invoice from an electronics store.

www.tracer-electronics.com.au 288 Artos Road, Subiaco, WA, 6008		Tracer <i>ELECTRONICS</i>		ABN: 38 021 124 255 Tel: 9295 5411	
<u>Tax Invoice</u>					
Invoice Details					
Invoice Num:		Date		Order Type	
154724		2017-02-11		Pickup	
Salesperson Num:		Salesperson Name:			
241		John McClane			
Purchases					
Item Code	Item	Cost	Qty	Subtotal	
SKU5531	PS4 PlayStation 4 1 TB Pro Console	\$559.00	1	\$559.00	
SKU6845	Final Fantasy XV	\$79.00	1	\$79.00	
SKU7936	Samsung KU6000 70" 4K UHD HDR TV	\$3496.00	1	\$3496.00	
SKU4522	Wharfedale Atlantic AT-400 Speakers	\$699.00	2	\$1398.00	
SKU4523	Wharfedale Atlantic AT-500 Speakers	\$939.00	1	\$939.00	
SKU6825	Wharfedale Diamond SW150BAV 10" Sub	\$167.00	2	\$334.00	
SKU3621	Wharfedale Xarus XR Centre Speaker	\$239.00	1	\$239.00	
SKU8754	Pioneer VSX1131 7.2 Channel AV Receiver	\$1399.00	1	\$1399.00	
Keep this invoice as proof of purchase for any warranty claims. Delivery fee of \$75 applies to all delivered orders.		Delivery Cost:		\$0.00	
		Total Cost:		\$8443.00	

You have the following extra information about how the store operates:

- The store does not keep details of customers.
- The store allows orders to be picked up or delivered, with a fixed fee for delivery.

Normalise this form to the third normal form, clearly showing the stages of ONF, 1NF, 2NF and 3NF. State any **assumptions** you make. Use **relational symbolic notation** as indicated in the second lecture, and **name your resultant data sets** upon reaching 3NF.

CSI5135 Additional Requirement

If you are in CSI5135, the following additional requirements apply. If you are in CSG1207, you do not need to do this (but you are welcome and encouraged to do so if you want).

Once you have normalised the table to 3NF and named your data sets, convert your results into a **physical E-R diagram**. Remember to indicate all cardinality, attributes, primary and foreign keys. Remember to state any assumptions that are relevant to the E-R diagram.

Task 3 – Entity-Relationship Modelling (9 marks)

You have been hired to design a database system for a pizza store. The database must keep track of the details of staff, orders and pizzas (including the available types of crusts and sauces). You have the following information about the way the store operates:

- Staff details must be recorded. This includes a staff ID number, first name, last name, date of birth and phone number.
 - A staff member may be supervised by another staff member. A staff member may supervise many other staff members. Not all staff members have a supervisor.
- The details of customer orders must be recorded. This includes an order ID number, the date and time that the order was placed, the name and email address of the customer who made the order, and the ID number of the staff member who took the order.
 - The store does not record any other customer details, and all orders must be picked up from the store. A customer name is required, but the email address is optional.
 - An order can be for multiple pizzas, but must obviously contain at least one.
- The details of the types of pizza available must be recorded. This includes a pizza ID number, the pizza's name, a description and the price.
- The database also needs two tables to store the details of different crust types and sauce types that can be chosen when ordering a pizza.
 - These tables must contain an ID number and a name for each crust/sauce.
 - When ordering a pizza, a customer must choose which crust and sauce they want.
- The database must track the pizzas ordered in each order. This will involve:
 - An auto-incrementing ordered pizza ID number.
 - A foreign key identifying the order that this pizza is part of.
 - A foreign key identifying which pizza was chosen.
 - A foreign key identifying which crust was chosen.
 - A foreign key identifying which sauce was chosen.
 - A "ready" column containing a "Y" or "N" to indicate whether the pizza has been made and cooked yet (default of "N").

Based on the details above, you are required to draw both a **logical E-R diagram** for this database and then a **corresponding physical E-R diagram**. Clearly show all cardinality, primary and foreign keys, attributes and relationships as appropriate.

Adhere to the distinctions between logical and physical E-R diagrams defined in Lecture 3. Use enhanced E-R model notation where/if appropriate.

Remember to state any assumptions you make.



Task 4 – Advanced Entity-Relationship Modelling (9 marks)

The pizza store from Task 3 now requires you to update and expand the previous database you designed for them, in order to record some additional information. You must update and expand your E-R diagrams from Task 3 in order to incorporate these new requirements:

- To simplify the pricing of their pizzas, the store has divided their pizza types into ranges, e.g. “traditional”, “gourmet”, etc. All of the pizzas in a range have the same price.
 - The database must store an ID, name and price for each range.
 - The pizza table should contain a foreign key identifying the range that the pizza is in, rather than containing a price column.
- While previously the crust and sauce chosen for a pizza did not influence the price, the store has now introduced some crust and sauce options that result in a surcharge.
 - The crust and sauce tables now require a column to store the surcharge cost.
- The store has started selling sides such as garlic bread and soft drinks. Details of these sides and their inclusion in orders must be recorded.
 - The database must store an ID, name and price for each side.
 - The database must keep track of which sides have been ordered in which orders, and the quantity ordered.

Create **updated and expanded versions of your logical and physical E-R diagrams from Task 3** that incorporate these new requirements.

You should not need to *modify* very much from your solution to Task 3 to complete this task; you mainly need to *expand* the diagrams by adding the new attributes, entities and relationships.

Remember to state any assumptions you make, use enhanced E-R model notation where/if appropriate, and show cardinality on both diagrams.

Please ensure that you submit separate solutions to Tasks 3 and 4 – a total of four E-R diagrams (a logical and a physical diagram for Task 3, and a logical and a physical diagram for Task 4).

Note: *This database design will form the basis of your second assignment, so be sure to dedicate some time to it and take any feedback you receive into account.*

Presentation, Notation and Advanced Solutions (4 marks)

There are some marks available for presentation, using correct notation, and providing advanced solutions which demonstrate a greater effort and understanding of the concepts being tested. Presentation simply involves the layout and formatting of your assignment – the consistent use of styles, neat and legible diagrams, ensuring your name and student number is in the document, etc.

Notation must be used correctly and consistently in both your normalisation and E-R diagrams. Some notation only applies to normalisation or E-R diagrams. When working through the normal forms, use correct numbering of relationships and use ~~striketrough~~ to indicate where a relationship is eliminated / split into multiple relationships.

Adhere to the notation used in the unit materials wherever possible. If unable to do so for some reason, make sure that whatever notation you use is consistently applied and clearly represents the meaning of what you are depicting. Include a key or legend if necessary.

Please submit your assignment in PDF format, and open the PDF file before submitting it to ensure that your diagrams appear as intended.

Advanced solutions can include anything from making intelligent or perceptive assumptions, to including extra (and relevant) attributes and entities, or coming up with a solution that is particularly efficient in depicting the scenario specified in the brief. There are no fixed rules or marks for advanced solutions, so do your best and it will be rewarded as deemed appropriate. If your solution deviates significantly from the brief, be sure to discuss it with your tutor before submission.

Submission of Deliverables

Please ensure that your completed assignment is in PDF format, and open the PDF file before submitting it to ensure that your diagrams appear as intended. Once your assignment is complete, submit the file to the appropriate location in the Assessments area of Blackboard.

Submissions via email or hard copies are NOT permitted, unless you are specifically instructed to do so. An assignment cover sheet is not required, but ensure that the first page of your assignment includes the unit code, assignment number/name, year and semester, your name and student number, your tutor's name, and the time and campus of your workshop session.

Referencing, Plagiarism and Collusion

The entirety of your assignment **must be your own work** (unless otherwise referenced) and produced for the current instance of the unit. Any use of unreferenced content you did not create constitutes plagiarism, and is deemed an act of academic misconduct. All assignments will be submitted to plagiarism checking software which includes previous copies of the assignment, and the work submitted by all other students in the unit.

Remember that this is an **individual** assignment. Never give anyone any part of your assignment – even after the due date or after results have been released. Do not work together with other students on individual assignments – helping someone by explaining errors in their code/logic or directing them to the relevant resources is appropriate, but doing it for or alongside them, or showing them how you did it is not. An unacceptable level of cooperation between students on an assignment is collusion, and is deemed an act of academic misconduct. If you are uncertain about plagiarism, collusion or referencing, simply contact your tutor, lecturer or unit coordinator and ask.

You may be asked to explain and demonstrate your understanding of the work you have submitted.

Assignment 1 Marking Key

Marks are allocated as follows for this assignment.

Criteria	Marks Allocated
Task 1 - Normalisation Table normalised into suitable 3NF structure. Working shown and correct notation used. All assumptions stated and final data sets named. Physical ERD of results (CSI5135 only).	9
Task 2 - Advanced Normalisation Form normalised into suitable 3NF structure. Working shown and correct notation used. Assumptions stated and final data sets named. Physical ERD of results (CSI5135 only).	9
Task 3 - Entity-Relationship Modelling Specifications translated into suitable logical and physical ERDs. Keys, attributes relationships, cardinality, etc, all clearly depicted. All assumptions stated.	9
Task 4 - Advanced Entity-Relationship Modelling Specifications translated into suitable logical and physical ERDs. Keys, attributes relationships, cardinality, etc, all clearly depicted. All assumptions stated.	9
Presentation, Notation and Advanced Solutions Assignment is well presented, uses consistent and appropriate notation, and presents advanced solutions which demonstrate deeper understanding.	4
Total:	40 (20% of unit)