

CSG1207/CSI5135 Systems and Database Design

Assignment 1: Normalisation and E-R Modelling
Assignment Marks: Marked out of 40, (20% of unit)
Due Date: 6 April 2015, 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.

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 (8 marks)

The table below shows part of a spreadsheet used by a tavern which allows customers to book rooms for events and functions. Each row represents a booking.

Booking #	Booking Date	Duration	Room #	Room Name	Room Capacity	Customer Phone	Customer Name
1241	12-08-21 18:30	4	3	Side Bar	15	0432514658	Sam Crocker
1242	12-08-21 18:30	4	1	Function Room 1	30	0432514658	Sam Crocker
1243	12-08-23 16:00	8	2	Function Room 2	50	0425748641	Joe Pardy
1244	12-08-24 17:00	5	2	Function Room 2	50	0485475265	Cameron West
1245	12-08-26 15:00	3	1	Function Room 1	30	0428654854	Jimbo Lawkins
1246	12-08-26 19:30	4	1	Function Room 1	30	0438924565	Pattie Forbes
1247	12-08-27 17:30	3	4	Garden Area	25	0425748641	Joe Pardy

You have the following extra information about the scenario:

- The pub currently identifies customers by their phone number
- A room cannot have multiple bookings at the same time

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 may add columns to serve as primary keys, but remember to state that you have done this in your assumptions and include the column from the very beginning of your working
- You only need to identify one repeating group, e.g. R1 = (Outer Group {Repeating Group})

CSI5135 Additional Requirements

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 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.

Task 2 – Advanced Normalisation (9 marks)

The form below depicts an invoice for an order from a store.

<i>Tax Invoice</i>	Pakoko 112 St. Georges Terrace, Perth, WA 6000 Ph: 9325 2458 • ABN: 658475896	<i>Tax Invoice</i>
Invoice #: 24130 Invoice Date: 23-04-2012 Delivery Address: 52 Brook Street, Noranda, 6062, WA Delivery Instructions: Knock on side door not front door	Email: p.ford@gmail.com Name: Patrick Ford Phone: 0425874569	

Item Code	Item Name	Cat. Code	Cat. Name	Cost (each)	Qty	Subtotal
SKU8789	Hunter x Hunter, volume 31	CMGN	Comics & Graphic Novels	\$9.99	1	\$9.99
SKU6927	Watchmen (Hard Cover)	CMGN	Comics & Graphic Novels	\$29.99	1	\$29.99
SKU3305	Final Fantasy Master Creatures - Kefka	AFIG	Action Figures	\$34.99	1	\$34.99
SKU6421	Serenity Movie Poster	PSTR	Posters	\$9.80	2	\$19.60
SKU3312	Final Fantasy Master Creatures - Ifrit	AFIG	Action Figures	\$34.99	1	\$34.99
SKU7899	Angry Birds 9" Plushies (Birds)	PLSH	Plush Toys	\$35.00	2	\$70.00
SKU7898	Angry Birds 9" Plushies (Pigs)	PLSH	Plush Toys	\$25.00	1	\$25.00
Grand Total						\$214.57

Thank you for shopping with Pakoko! Please see our return policy at www.pakoko.com.au/returns for any missing, incorrect or damaged items.

You have the following extra information about the scenario:

- The store identifies customers by their email address
- Each item is only in one category
- Item Codes are unique per item, even if the items are in different categories

Normalise this form to the third normal form, clearly showing the stages of 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 Requirements

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 to do so if you want).

Once you have normalised the form 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.

Task 3 – Entity-Relationship Modelling (10 marks)

You have been hired to design a database system for a pizza store. The database must encompass the customers, staff, pizza details, and the pizza orders made by customers. You have the following information about the way the store operates:

- Customer details must be recorded. This includes a customer ID number, name, address and email. Customer details are recorded when they make their first order.
- Staff details must be recorded. This includes a staff ID number, first name, last name, date of birth and phone number.
- The details of pizza orders must be recorded. This includes an order ID number, the date and time that the order was placed, the ID number of the customer who made the order, and the ID number of the staff member who took the order.
 - Each order can contain multiple pizzas.
- 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 which pizzas were ordered in which orders. 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:

- Each staff member may have a supervisor, which is another staff member. A staff member may supervise many other staff members. Not all staff members have a supervisor.
- The database now needs to keep track of which staff member delivered each order. To implement this, add another staff member foreign key to the “order” table. Since the pizza order will be recorded *before* the pizzas are delivered, this value will originally be empty.
- 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, and the pizza table should contain a foreign key identifying the range rather than containing a price.
- 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.

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, appropriate use of colour to convey/categorise information, 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. As numerous conventions exist for notation, some of which are difficult or time-consuming to produce in a word processor, *consistency* and *appropriateness* is of high importance. Your notation should be consistently applied, and be an appropriate representation of your meaning.

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 also 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.

Do not work too closely with other students on individual assignments, and *never* give someone a copy of your assignment – even after the due date or after results have been released. 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 email your tutor, lecturer or unit coordinator and ask.

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).	8
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.	10
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)