



## Assignment 2 – Further Development of an ER Diagram, Database Implementation and Queries

### Objectives:

- To analyse and comprehend a provided ER diagram
- To update the ER diagram using provided specifications
- To create and update normalized relations of the data from the provided ER
- To create and update Database Schema
- To implement a database based on the provided ER diagram
- To write required SQL statements to query the database

### Due Date:

Thursday of Week 11 at 17:00 (see Course Description for further dates and times).

### Project Specification

You have been commissioned by Barry from the *Fantastic Fireworks Company (FFC)*, a business that organises fireworks displays for individuals and organisations. He has asked you to design a database to assist FFC with managing their booking, customer and supplier information. The majority of the design has been completed, however there are some changes that they would like made to the system. Using the specifications from the previous assignment, the ER diagram and files provided, update and implement the system using the following information.

### Original Specification

FFC would like to store information regarding their customers. Customers may either be individuals or organisations. For individual customers they would like to store the contact name, address details (including their location, postal and delivery address details), email address and phone numbers (mobile, home, work). For their organisational customers they would like to store the organisation name, organisation type (e.g. corporation, government, club), a contact name, address details (including their location, postal and delivery address details), email address, website URL, and phone numbers (mobile, work). The location address and work phone number are always recorded for a customer. Postal and delivery addresses and mobile and home phone numbers are sometimes not available so these are optionally recorded.

FFC has a number of different suppliers who provide them with the products that enables them to conduct displays. For each supplier they would like to store their business name, contact name, address details (including their location, postal and delivery address details), and phone numbers (mobile, work).



Each supplier may provide a number of different products. For example a supplier may provide ready made fireworks such as rainbow skyrockets, bangers and thrillers or other items such as dispensing platforms or pontoons. They may also provide other equipment such as sound, lighting or electrical equipment. Suppliers may only provide one product or many different products. FFC would like to be able to search their database to obtain a list of suppliers who supply particular products, however, they do not need to know how many of each particular product the supplier stocks.

In the database FFC would also like to store information about their staff. Staff may be employed full-time, part-time or on a casual basis. FFC need to store contact information for the staff (address and phone), along with their TFN. They would also like to know what certifications the employees have (e.g. "Handling Explosives", "Detonations", "First Aid"). Each employee may hold a number of different skills/certifications. Some staff are supervisors of other staff members and this also needs to be stored.

For each display, FFC would like to store details such as where the display is to be held, the customer who they are organising the display for, the date and time of the display, the type of display and how many people are expected to attend. FFC specialises in organising displays for between 100 and 10,000 people. They can range from birthdays through to civic events. For each display they need to store information about the supplies that they require (eg types of fireworks, other equipment), the supplier that they will be using for the different products (they can use more than one), and how many of each product they require. FFC would also like to store details of the staff that have been assigned to each display. Each display will have one staff member who takes on the role of display manager but more than one staff member is often used.

Since it is a potentially dangerous activity, FFC needs to also know the insurance cost of each display. The insurance cost is levied in categories based on a risk assessment by the insurance underwriter. Assume there is a separate table for the categories and corresponding cost and the insurance underwriter advises the category of insurance required.

## Additional Requirements

FFC would like to be able to work out the **price and costs** of displays. The price charged to the customer is based on a **percentage markup** over the **total costs** of the display. The total costs are made up of the **products** used (negotiated in discussions with the customer), the **wages of the employees** involved (the number needed is agreed between FFC and the customer) and the **insurance premium**.

With respect to the price, a percentage markup is required to be stored. This markup is based on the type of display. To simplify our example, this markup does not change over time. FFC though want to have some flexibility to apply a **discount percentage** to customers for a particular display(s). This **discount** is included at FFC's discretion and may be a reward for returning customers, for example. It is subtracted from the markup percentage rather than applied after the markup calculation.

With respect to **costs of products** used, FFC negotiates charges for these products with each supplier and charges remain current for a **period of time**. The period of time is recorded as a **date**, which is the commencement date of its application. When FFC assign products to a display, they choose the supplier's product for the relevant period and fill in the allocated/required quantity. The supplier's charge for that period then becomes the cost of the product for the display. When the job has been completed, the actual quantity used for each product is recorded.

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With respect to wages, staff members are all paid based on number of hours worked and type of qualifications held. The number of hours worked are estimated and allocated for each display and an hourly rate is applied based on the salary/staff type. The database should allow for an effective date for these rates and thus allow changes over time to the amount paid per hour. When the job has been completed, the actual hours worked are recorded. There is also a markup percentage applied to that rate based on the number and type of qualifications held. To simplify our example, this markup percentage does not change over time. FFC would also like to keep a record of when **staff started and ended their employment**. While a staff member is still employed their end date should be recorded as NULL.

The insurance premium cost is obtained from the recorded Insurance category and cost already decided and advised by the insurance underwriter.

FFC understands that they may not have provided you with sufficient information. If you need to make assumptions about their organisation please ensure that you record these.

As an example, imagine that the ABC Corporation commissioned FFC to conduct a fireworks display for their employees and families in celebration of their 50<sup>th</sup> birthday. ABC Corporation expected to have 500 people in attendance. FFC charges a 25% markup for Corporate events but ABC Corporation is a repeat customer and FFC decided to include a 5% discount. There was a shortage of products from suppliers, so FFC was forced to use the one supplier and agreed to put on a display that used:

- 1 sound system = \$1000;
- 50 strobe fireworks @ \$10 each = \$500;
- 100 rainbow skyrockets @ \$10 each = \$1000;
- 100 banging stars @ \$20 each = \$2000;
- 100 whistling comets @ \$15 each = \$1500;
- 50 humming bombettes @ \$25 each = \$1250

Total Product Costs = \$7250

Four full time employees were assigned, one with first aid qualifications, and two others with detonation certificates. The display was expected to take eight hours. The rate of pay for a full time employee is \$50.00 per hour and the markup for a first aid qualification is 10%. The markup for detonation certificates is 25%. Therefore the total wages costs were calculated to be:

- Employee with no certificates ( $\$50 * 8$ ) = \$400 +
- Employee with first aid certificate ( $\$50 * 1.10 * 8$ ) = \$440 +
- Employees with detonation certificates ( $\$50 * 1.25 * 8 * 2$ ) = \$1000

Total Wages Costs = \$1840

The insurance premium based on a low-medium risk event was assessed to be \$1000.

The price charged to ABC Corporation was therefore \$12108:

- Total Costs =  $\$7250 + \$1840 + \$1000 = \$10090$
- Price =  $\$10090 * 1.20 = \$12108$ .

You will need to incorporate the above details in the updated ER diagram and database and then use that database to generate the reports detailed below.

## Required Reports

When defining `select` queries, you are required to adhere to the following output formatting conventions:

- names of people should be printed as **GivenNameFamilyName** (e.g. John Smith) in a column labelled `NAME`
- addresses should be printed as *Street, Suburb State Postcode* (e.g. 123 Anzac Pde, Maroubra NSW 2038) in a column labelled `ADDRESS`
- You are allowed to create temporary queries to answer these queries

You must use consistent and legible formatting in laying out your SQL queries. Include (brief) comments for any query or procedure that uses an "unusual" approach. The following reports are required (**2 marks each**):

1. A list of the names and phone numbers (including description of phone type) of all customers in alphabetical order by contact name.
2. A list of all government customers and their contact details (contact name, email and all phone details).
3. List all supplier products where the product description begins with an E (either upper case or lower case).
4. A list of all customers (id and name) together with their display(s) including date, time and type of the display and the percentage markup less discount percentage for the display.
5. A list of the contact details (names, postal address and phone number) of all of the suppliers who supplied products for more than one display.
6. List each display (displayed is sufficient) and all of the details of staff who have worked on the display, including any certifications.
7. Display a list of products that have had a unit charge update in the last 12 months.
8. Provide a list of all displays, including customer name, display id, date, time, location for which actual quantities used have been greater than allocated quantities. Include details of the product to which this applies as well as the cost difference.
9. Display the itemised actual product cost of all items for displays in January 2013 (based on `DisplayDate`).
10. Increase by 5% the insurance cost for all insurance categories.

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11. List the product with the highest quantity of actual usage in the database. (**2 marks**)
12. Provide a list of all displays, including customer name, display id, date, time, location for which actual hours worked have been greater than allocated hours. Include details of the cost difference and total change in cost for the display for the difference in hours. (**3 marks**)
13. Find and list any displays (include details of the display id, date and time) where the actual price charged to the customer is below the total actual costs of the display. If you choose to use more than one query, justify this choice. (**5 marks**)
14. Provide details of the display that has made the most money for FFC. You may use more than one query but you must justify this choice. (**5 marks**)



15. Provide some ideas on how you might improve the efficiency of complicated queries such as 13 and 14. (5 marks)

## Implementation of the Database

### Create, insert and query statements

You are required to use SQL statements to create the database, the tables and insert sufficient data to test the required reports. You will be given two files to commence with (reflecting the database at the end of Assignment1) and these must be updated to include the changes detailed above.

1. Create a text file called YourStudentId-Create.sql (format xxxxxx-Create.sql) for example 2225991-Create.sql that will:
  - a. Create a database called ABCYourStudentID (eg ABC30011111)
  - b. Creates all of the required tables including primary keys, foreign keys and their relationships.
2. Create a text file called YourStudentId-Insert.sql (format xxxxxx-Insert.sql) for example 2225991-Insert.sql that will:
  - a. Insert **sufficient** data into each table you have created to test the queries. Sample data has been provided, however, you will need to include further data to test all of the required reports.
  - b. You **are required** to include your name as one of the customers; you can provide fake details for the address but you are required to include your full name and use your student number as the phone number for this customer.
3. Create a text file called YourStudentId-Queries.sql (format xxxxxx-Queries.sql - for example 2225991-Queries.sql) that contains all of the queries to display the required reports.

### What to submit

An electronic copy of your assignment should be submitted through Moodle and should include a copy of your report, completed according to the University of Ballarat Guide for the Presentation of Academic Work (available <http://www.ballarat.edu.au/generalguide>) and the **three** files described in *Create, insert and query statements* above.

Your document should include:

- 1) A copy of the SITE Assignment Coversheet that includes a copy of the plagiarism statement.
- 2) Details of any changes that you have made to the design of the database including:
  - a) A description of all changes made and a rationale as to why the change was necessary; and
  - b) an updated ER diagram.
- 3) A relational data structures that translates the provided E-R diagram which includes:

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- a) relation names;
- b) attribute names;
- c) primary and foreign keys identified; and
- d) for each relation the level of Normalisation achieved, and for any not to Third Normal Form, explain why.

The data structures should be shown using the standards of this course.

- 4) A relational database schema that translates your relational data structures which includes:
  - a) table names;
  - b) column names and field types including any formatting; and
  - c) primary and foreign keys identified.
- 5) A copy of the SQL statements required to:
  - a) create the database and tables;
  - b) insert sufficient sample data into the tables; and
  - c) display the required reports listed above including sample output.
- 6) A bibliography containing a list of all resources used to complete the assignment. If no resources, apart from the course materials, have been used please indicate this.

## Assessment Criteria

1. How clear and well organised your presentation is. On the front page of your report you should include a list of acknowledgements of all people who have assisted you with this assignment including fellow students, along with a statement of completion.
2. Adherence to our standards, details of changes that have been made to the design and appropriate reasons for these changes.
3. Please refer to the provided marking guide (below) to see the distribution of marks.
4. Normalisation - appropriate interpretation of each normal form, arguments for leaving the schema in the normal form you consider optimal.
5. JOINS are not to be used within any of the SQL statements. Use of JOINS will result in **0 (zero)** marks being allocated for each SQL statement that utilizes them. Joining of data from multiple tables should be completed using a WHERE statement only.

## Assignment 2 – Marking Overview

|                                     | ITECH1006  | ITECH5006  |
|-------------------------------------|------------|------------|
| <b>Database Design</b>              | <b>/10</b> | <b>/10</b> |
| <b>Create and insert statements</b> | <b>/5</b>  | <b>/5</b>  |
| <b>Queries</b>                      | <b>/20</b> | <b>/40</b> |
| <b>Documentation</b>                | <b>/5</b>  | <b>/5</b>  |
| <b>Total: (Worth 20% overall)</b>   | <b>/40</b> | <b>/60</b> |

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