**Computer Science**

**ATAR Year Twelve**

# Task 6: Database and Programming Project

## Assessment type:

Project

## Conditions:

Period allows for the completion of the task: 5 weeks

Recommended time allocation  
Part 1: 2 weeks for the completion of the investigation and design of the project

Part 2: 3 weeks for the development and evaluation of the project

## Task weighting:

25% of the school mark for this pair of units

## Scenario

The school catering team are available to meet requests of staff when planning events, providing food and beverage services. Staff at the school are able to request catering for events and would typically indicate the name and date of the event, the budget area to charge, the ability to select from a range of pre-determined menu items, and the meal that is being catered for (i.e. breakfast, morning tea, lunch, afternoon tea, or dinner). Other data that is relevant includes location and time to be delivered.

Currently the catering manager takes requests through an online form (source provided). This form contains a series of checkboxes and text fields, but this does not reference any data sources to provide accurate or timely information to users.

Essentially, the school would like to upgrade this form to a database application that includes more information to guide requirements. You should conduct appropriate research and investigation into a potential system and develop a list of detailed requirements. From the list of requirements, you are to design a solution and develop the software using a suitable development framework.

In creating your software solution, you should use a combination of Python and SQLite. At this stage, there is no requirement for a graphical user interface. If you would like top use a different framework or programming language (for example, development of a web-based front end) only limited technical support will be provided.

This task has been separated into two parts:

* Part 1 – Investigate and Design (40% of the overall mark)
* Part 2 – Develop and Evaluate (60% of the overall mark)

## Overview:

Your task is to use the software development framework to design and create a simple software application in Python with integration to a database created with SQLite.

Your final project needs to be complex enough to demonstrate your understanding of software development and database design and implementation.

A screenshot of a computer

Description automatically generated

### Part 1 (40%)

#### Investigate

* Analyse the steps required to produce your software project and develop a timeline for when each of these steps needs to be completed. You may like to use Trello or any other suitable method.
* Problem outline
  + Write a brief outline of the purpose of the software solution and its objectives.
* Problem description
  + Write a detailed description of the application that includes:
    - A written description of the scenario you will need to develop a solution.
    - A list of requirements that your solution needs to include to be useful, including programming requirements – for example your solution should be able to accept catering bookings, or your solution needs to be able to display all catering bookings for the past month.
    - Discussion of any ethical, legal, and security implications for development of the program.
    - Description of any factors that may impact the quality of the data stored in your solution.

#### Design

Once you have clearly established the requirements of the scenario and the problem, you should design a software solution that includes an appropriate database. In designing a solution, you should:

* Develop an appropriate entity-relationship (ER) diagram with a minimum of 5 entities. Your diagram should include all primary and foreign keys.
* Relational notation included for the database you have designed.
* Create a data dictionary that will describe the data you need to store. As part of your data dictionary, you should include a brief overview to describe what information is being stored in each table.
* Describe in plain English several queries that could be used in your database (note: you do not need to write SQL statements at this point).

### Part 2 (60%)

#### Develop

You are to create a working software solution based on the design that you have produced. Your system should include a database back end and any necessary software features to make it useful.

* An SQL script to create an initial empty database, including the enforcing of referential integrity.
* A script to insert sample data into the database that provides enough data to allow the system to be thoroughly tested.
* Data validation to ensure the integrity of the database. This should be done using constraints within SQL for each table and within the code to ensure there are no runtime errors and any user data entry is valid.
* A number of different queries that will allow the user to extract useful information from the database. When developing your queries, you should develop different queries to fulfil the following criteria:
  + Use of aggregate functions such as COUNT, SUM, AVG, MIN, MAX
  + Use of clauses such as GROUP BY and ORDER BY
  + Use of JOINS to retrieve data from a number of related tables
  + Use of calculated and concatenated fields with aliases
  + Ability to INSERT, UPDATE, and DELETE records
* You should ensure that you use a sufficient number of queries to use data from all the tables in your database. Your queries should be complex enough to demonstrate your understanding of SQL.
* Any other software features you feel may improve your software solution. For example, you could:
  + Provide a suitable method to present the results of queries to the user.
  + Allow query results to be exported to a formatted text file.
  + Provide an interface for the user to insert, update, and delete records.

#### Evaluate

* Reflect on the success of your solution and how well it meets the system requirements.
* Consider:
  + How well your solution meets the requirements you outlined in Part 1.
  + If the ER diagram you developed in Part 1 compares to the structure of your finished database. Discuss any differences and explain why you have made these changes.
  + What extra features you implemented and what aspects of the solution could be improved.
  + Documentation for any known bugs and/or limitations in the solution and explain how they impact the performance of the solution.
* Perform a developer retrospective and reflect on the process you followed to develop your solution and how you could improve this process. Some aspects you should consider:
  + What worked well.
  + What didn’t work well.
  + What would you do differently next time to improve the development process.
* Document the sources you have used to get information about how to develop your solution, including all websites and textbooks in an appropriate format.

### Submission requirements

#### Part 1

For Part 1, you are required to produce a single, well-formatted Word document. This document should include:

* A cover page
* Suitable headings to make each section clear
* Headers and footers
* Appropriate terminology, explanations, and written expression
* Diagrams created using appropriate software

#### Part 2

* A single folder that includes your entire project.
* A well-formatted Word document as per the points above for your evaluation.

Ideally, submit all documentation including all files required to run your program as part of a GitHub repository, ensuring permissions are set correctly.

This task requires authentication to ensure students complete the work themselves. Some methods of authentication that are recommended:

* Use of GitHub to demonstrate regular updates to code.
* Screenshots of code taken on a regular basis.
* Providing verbal explanations of the project and how it works.

**Marking Key:**

| **Investigate** | **Marks** |
| --- | --- |
| **Development Schedule** | |
| Breaks down the project planning into a series of meaningful steps and a realistic timeline for completing each step has been included | 2 |
| Breaks down the project into a limited series of steps with some attempt at showing a timeline. | 1 |
| **Subtotal** | **/2** |
| **Problem Outline** | |
| Accurately outlines of the purpose of the software based on the design brief/scenario. | **1** |
| **Subtotal** | **/1** |
| **Problem Description** | |
| Provides a clear and detailed explanation of the application, its structure, how it will handle different requests, and user interactions. | 2 |
| Gives a limited description of application with some reference to how it is structured/user interaction. | 1 |
| **Subtotal** | **/2** |
| **Requirements** | |
| Provides a clear and detailed list of requirements that fully meet the needs of the problem description. Suitably classifies requirements. | 3 |
| Provides a list of requirements that mostly meet the needs of the problem description. Partially classifies requirements. | 2 |
| Provides an incomplete list of requirements that meet some of the needs of the problem description. Makes a limited attempt at classifying requirements | 1 |
| **Subtotal** | **/4** |
| **Ethical/Legal/Security Issues** | |
| Provides a clear and detailed discussion of appropriate ethical, legal, and security issues that are relevant to the development of the software solution. | 4 |
| Discusses legal, ethical, and security issues regarding the development of the software solution. | 3 |
| Limited discussion of some legal, ethical, or security issues regarding the development of the software solution. | 2 |
| Has identified a legal, ethical, or security issue regarding the development of the software solution. | 1 |
| **Subtotal** | **/4** |
| **Data Quality** | |
| Describes all relevant factors that will affect the quality of the data in the solution | 3 |
| Describes some relevant factors that will affect the quality of the data in the solution. | 2 |
| Identifies factors that may affect the quality of the data in the solution | 1 |
| **Subtotal** | **/3** |
| **Total Investigate** | **/15** |

| **Design** | **Marks** |
| --- | --- |
| **ER Diagram** | |
| All necessary entities have been included, named appropriately and any many-to-many relationships have been resolved | 4 |
| Most entities have been included and named appropriately, or all included but not named appropriately | 3 |
| Some entities have been included | 2 |
| Limited entities have been included | 1 |
| **Subtotal** | **/4** |
|  |  |
| All relationships between tables have been included with correct cardinality indicated on each relationship | 4 |
| All relationships have been included although cardinality may be incorrect, or most relationships have been included with correct cardinality | 3 |
| Most relationships have been included although cardinality may not be correct | 2 |
| Some relationships have been included | 1 |
| **Subtotal** | **/4** |
| All primary and foreign keys have been included and have been placed in the correct entities | 3 |
| Most primary and foreign keys have been included in the correct entities | 2 |
| Some primary and foreign keys have been included in the correct entities | 1 |
| **Subtotal** | **/3** |
| **Relational Notation** | |
| All entities have been included with all primary and foreign keys indicated appropriately. All necessary non-key fields have been included and the correct notation conventions have been followed | 5 |
| All entities have been included, although some key fields have not been identified correctly or some non-key fields are missing | 4 |
| Most entities have been included with all necessary key and non-key fields indicated appropriately | 3 |
| Most entities have been included, although some key and non-key fields are missing | 2 |
| Some entities have been included | 1 |
| **Subtotal** | **/5** |
| **Data Dictionary** | |
| All entities have been included with a brief overview of each entity. All primary and foreign keys have been included for each entity with appropriate details included for each field | 6 |
| All entities and key fields but some details not included for each field | 5 |
| Most entities and key fields for all included entities with appropriate details | 4 |
| Most entities and key fields however some details not included for each field | 3 |
| Some entities and key fields with appropriate details for fields | 2 |
| Some entities and key fields however some details not included for each field | 1 |
| **Subtotal** | **/4** |
| All necessary non-key fields have been included for each entity, with appropriate details included for each field | 4 |
| All included but missing details, or most included with all details | 3 |
| Most included but missing some details | 2 |
| Some included | 1 |
| **Subtotal** | **/4** |
| **Total Design** | **/24** |

| **Develop and Evaluate** | **Marks** |
| --- | --- |
| **Create database** | |
| A database has been produced that accurately reflects the ERD and data dictionary. Any changes from the original design have been documented | 2 |
| A database has been produced with some errors | 1 |
| **Subtotal** | **/2** |
| Database effectively enforces entity, domain and referential integrity through use of constraints in the CREATE queries | 3 |
| Database partially enforces data integrity through the use of constraints | 2 |
| Database attempts to enforce some data integrity | 1 |
| **Subtotal** | **/3** |
| **Insert data** |  |
| Appropriate data inserted into database to allow database to be tested thoroughly | 3 |
| Some data entered into database although insufficient to thoroughly test all aspects of the database | 2 |
| Limited data entered into database | 1 |
| **Subtotal** | **/3** |
| **Data validation** | |
| Database solution uses Python to thoroughly check the validity of data entered by the user. The database solution provides suitable error messages to the user to explain errors | 3 |
| Database solution uses Python to check the validity of most data entered by the user | 2 |
| Database solution uses Python to check the validity of some data entered by the user | 1 |
| **Subtotal** | **/3** |
| **SQL Queries** Note: It is possible for a query to earn marks across more than one of the categories below | |
| An appropriate number of working queries have been written that demonstrate a sufficient level of complexity and covers all tables in the database. All queries extract meaningful information from the database | 3 |
| An appropriate number of working queries have been written that cover most tables in the database | 2 |
| Some working queries have been written | 1 |
| **Subtotal** | **/3** |
| Queries demonstrate use of multiple aggregate functions to extract meaningful information | 3 |
| Multiple aggregate functions have been used to produce working queries | 2 |
| Attempts to use aggregate functions | 1 |
| **Subtotal** | **/3** |
| Queries demonstrate use of both GROUP BY and ORDER BY to extract meaningful information | 3 |
| GROUP BY and ORDER BY clauses have been used to create working queries | 2 |
| Attempts to use GROUP BY and ORDER BY clauses | 1 |
| **Subtotal** | **/3** |
| Queries use JOINS across multiple tables to extract meaningful information | 3 |
| Joins are used to create working queries | 2 |
| Attempts to use JOINS across a minimum of two tables | 1 |
| **Subtotal** | **/3** |
| Queries make use of calculated and concatenated fields to manipulate the results of the query. Queries use aliases to make the results of the query more meaningful | 3 |
| Uses calculated and concatenated fields to create working queries | 2 |
| Attempts to make use of calculate or concatenated fields in a query | 1 |
| **Subtotal** | **/3** |
| Queries have been written that allow the user to insert, update and delete records from the database |  |
| Queries have been written that allow the user to do two of the insert, update or delete records from the database |  |
| Attempts to create an insert, update or delete query |  |
| **Subtotal** | **/3** |
| **Other Features** | |
| Suitable extra features have been implemented effectively as part of the solution that allow the user to better interact with the database | 5 |
| Suitable extra features have been implemented that allow the user to interact with the database | 4 |
| Some extra features have been implemented | 3 |
| Implemented an extra feature as part of the solution | 2 |
| Attempted to implement some extra features as part of the solution | 1 |
| **Subtotal** | **/5** |
| **Product Evaluation** | |
| Demonstrates a detailed evaluation of how the solution meets the requirements identified in Part 1, including discussion of the user experience and changes to the database design | 5 |
| Evaluates how the solution meets the system requirements, with discussion of the user experience and changes to the database design. | 4 |
| Completes a partial evaluation of how the solution meets the requirements, with a superficial discussion of the user experience or database design. | 3 |
| Completes a limited evaluation of how the solution meets the system requirements. | 2 |
| Completes a superficial evaluation of the solution and how it meets the system requirements. | 1 |
| **Subtotal** | **/5** |
| Provides a detailed discussion of how the final product could be improved and documents any bugs and/or limitations. | 5 |
| Describes bugs and/or limitations with reference to how the final product could be improved. | 4 |
| Identifies bugs and/or limitations, without reference to their impact on the final product. | 3 |
| Attempts to identify bugs and/or limitations, with limited discussion. | 2 |
| Superficial identification of bugs and/or limitations with no discussion. | 1 |
| **Subtotal** | **/5** |
|  |  |
| **Retrospective** | |
| Completes a detailed and comprehensive evaluation of the development process and suggests future impacts. | 5 |
| Completes a detailed evaluation of the development process that was used including suggested future impacts. | 4 |
| Completes an evaluation on the development process with some suggested future impacts. | 3 |
| Completes a minimal evaluation of the development process with limited comments on development process used and suggested future impacts. | 2 |
| Completes a superficial evaluation with superficial or no suggested future impacts. | 1 |
| **Subtotal** | **5** |
| **Total Develop** | **/47** |

|  |  |
| --- | --- |
| **Total Investigate** | **/15** |
| **Total Design** | **/24** |
| **Total Develop and Evaluate** | **/49** |
| **Total** | **/88** |