Part 1 - To Remain with the Assignment after Marking

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Module Code: CI6320	**Module Name: Advanced Data Modelling**
Assignment number: 1	**ESoft Module Leader: Mr. W A D B C Goonatillaka**
Date set: 16th of March 2024	**Date due: 7th of April 2024**

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Student ID:	**Student Name:**
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Strengths (areas with well-developed answers)

Weaknesses (areas with room for improvement)

Additional Comments

ESoft Module Lecturer: **Provisional mark as %:**

ESoft Module Marker: **Date marked:**

Acknowledgement

I want to express my appreciation to those who have helped complete this report.
I have been able to complete this report because of the Academic advisor Mr. W A D B C Goonatillaka for their invaluable support, mentorship, and feedback and the faculty members of CI6320(Advanced Data Modelling).
Additionally, I would like to thank my family members for their unwilling encouragement and help throughout the report.
Thank you.

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Part A

1. Introduction

1.1 What is data modelling?

A data model is a simple visual blueprint for designing a database or software system—depicting data entities, attributes, and their relationships. It helps businesses organize their data effectively, design or re-engineer databases, and align with business and application requirements. A data model aids in creating a bridge between business and technical teams by turning real-world objects into a structure for a database. A data model is a critical first step after defining business requirements. (TechTarget, 2024; IBM, 2024; Princeton University, 2024; Coursera, 2024; LinkedIn, 2024; Upwork, 2024; DASCA, 2024; Zuci Systems, 2024)

1.2 Importance of Data Models

- Documentation
- Ensure data integrity.
- Higher Quality
- Decision Making

2. Relational Data Model (RDM)

2.1 History

The relational data model was introduced by E.F. Codd at IBM in San Jose, where a new data representation framework called the relational data model was established. It suggested that all the data could be stored in a tabular structure, in turn leading to higher productivity in the early 1980s (Newcomb and Couch, 2010). It is taken into consideration as the landmark or the start of database systems. (Khan, no date)

2.2 Core Principles

The RDM Model's main principle is that data is organized into tables with columns and rows. Every table has a relation, and each row could be considered as an instance of a relation. The columns are defined as attributes that are characteristics of the data. The model is a computer representation of mathematical theories of set theory and predicate logic. Relationships are used to store information about objects in a database. (Khan, no date.)

2.3 Characteristics

- Table based structure.
- Atomic values
- Normalization
- SQL

3. Object-Oriented Data Model (OODM)

3.1 History

The object-oriented data model (OODM) was developed to define operations for designing schemas, creating databases, retrieving objects, and navigating while supporting features such as aggregation, generalization, and particularization relationships (Zhao, 1988).

3.2 Core Principles

The object-oriented data model represents the real world as objects with its problems, attributes, and relationships. OODM was created by combing the relational data model concepts with object-oriented programming principles (GFG, 2021). This approach allows classes to be group items with comparable qualities, vacillating the organization and management of data structure while allowing for a smooth transition from the design concept to implementation in object-oriented databases (Janecatalla, 2012; Alzahrani, 2016).

3.3 Characteristics

- Objects are created from classes which are like blueprints of the structure (GFG, 2021)
- Allows for inheritance allowing subclasses to inherit attributes and methods from existing classes (GFG 2021), which allows for code reuse.
- Operations are performed on the data is encapsulated by the objects.

4. Object-Relational Data Model (ORDM)

4.1 History

With the limitations of both the relational and object-oriented data models, research in the 1990s led to the development of the object-oriented data model which takes fundamental concepts from both the relational and object-oriented data model while addressing areas where improvement were sought. (Castro, 2020)

4.2 Core Principles

The Object oriented was to combine the important features of both the relational and object-oriented data models, and it has extracted important core principles such as take Supporting objects, classes, inheritance from the Object-oriented data model and data types and tables from the Relational Data Model (Castro, 2020; Auziņš, 2018).

4.3 Characteristics

- Supports Complex Data Types such as Arrays, Nested Tables, and user defined types.
- Has Object Oriented Principles in combination to the features of the relational data model in turn allowing for the creating much more advanced objects with relational principles
- Creates a data model which has the most important features to be able to model the real world while having the flexibility to represent complex relationships and structures.

5. Summary

5.1 Comparison Table

Feature	Object Oriented Data Model (OODM)	Relational Data Model (RDM)	Object Relational Data Model (ORDM)
Data Representation	Objects with attributes and methods	Tables with rows and columns	Tables with rows, columns, and some OO concepts (inheritance, complex data types)
Relationships	Inheritance, Aggregation, and Association	Foreign Keys	Foreign Keys and some OO concepts (inheritance)
Performance	Potentially faster due to no joins	Can be efficient for specific queries	Can be efficient for specific queries but may be slower for complex relationships
Advantages	Code reuse (inheritance) and Semantic modelling easier to model complex relationships	flexible and efficient for certain queries Secure and Scalable	Combines benefits of OO and Relational models. Supports complex data types: Inheritance
Disadvantages	no strong mathematical foundation Difficulty with persistence for complex structures	can be complex to design for large data sets not ideal for complex querying	can be complex to manage; may not be as performant as pure OO for complex relationships

5.2 Critical Discussion on Which Model to use in real world application scenarios.

Selecting a data model for real world applications it relies heavily on the comprehensive understanding of the specific requirements, constraints, and characteristics of the application. Relational Data Model (RDM) is extremely effective in scenarios where data consistency, integrity are important in for example a banking system and CRM Databases. Object Oriented Data Models (OODM) has extreme rare use cases because they are useful in complex data modelling scenarios such as the natural representation of entities with a lot of behaviours and relationships in applications such as multimedia or gaming. Object Relational Data Models (ORDM) has a balance between flexibility and data integrity making them extremely useful for hybrid scenarios such as social media platforms and e commerce systems. The choice between the different data models requires careful evaluations of the advantages and disadvantages of each model, with factors such as complexity, development, and requirements.

Part B

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