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| INSY6112 |
| Information Systems |
| Assignment 1 |

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# QUESTION 1 – NoSQL vs RELATIONAL DB MODEL

## SCENARIO: SOCIAL MEDIA PLATFORM

### INTRODUCTION

The process of designing a database for any given application or scenario begins with identifying the data requirements set out in the system requirements. Upon careful analysis of these requirements, a conceptual data model can be developed and from this – an apt selection of what type of database would suit the scenario best (The IIE, 2025).

### KEY OBJECTIVES OF THE CHOSEN DATABASE

The chosen database model should:

1. Handle high volume of data through horizontal scaling. Millions of users performing a multitude of interactions will produce a large amount of data that grows quickly.
2. Handle complex data structures (multimedia) and diverse interactions on that data. Support is needed for variable data structures without rigid schema constraints
3. Provide real-time insights into the data and metadata. This should update instantaneously with the creating or manipulation of any data on the database
4. Have rapid turnaround with regards to data storage and retrieval to provide a seamless user experience.

### RECOMMENDATION

For a social media platform with key objectives such as those listed above, a **NoSQL** database is recommended for this scenario.

### DEFINITION

**NoSQL (Not Only SQL) Databases** are databases that store non-relational data. These databases are highly efficient and optimized for acting on unstructured or semi-structured data (The IIE, 2025). **Unstructured** **data** is any data that is vague or not-easily classified such as contents of an email or comment on a post. Unstructured data can also be of various formats such as text or multimedia (The IIE, 2025). **Semi-structured data** is merely a mix between unstructured and structured (The IIE, 2025).

### KEY STRENGTHS OF A NoSQL DATABASE AS IDENTIFIED BY MongoDB (2025)

1. Rapidly handle large volumes of data with a ‘scale-out’φ architecture.
2. Store unstructured, semi-structured, or structured data.
3. Enables simplified maintenance and design or structure updates.
4. Suited for developer’s needs.
5. Maximize cloud-architecture to minimize downtime.

φ: “Scale-out” architecture is defined by *Advantages Of NoSQL | MongoDB (2025)* as a method of scalability that is achieved through “spreading data storage and process load to other computers or servers”. This architecture is also mentioned to “add more computers to the cluster” to “increase capacity”.

### MOTIVATION

The choice of a **NoSQL Database** for the given scenario is evident when comparing the **Key** **Strengths** of a **NoSQL Database** to the **Key Objectives** listed before.

**OBJ-1** States the database should handle high-volumes of data through horizontal scaling. **STR-1** States that NoSQL Databases are suited for this. It should also be noted that ‘horizontal scaling’ is synonymous with ‘scale-out’ as stated in the sub-noteφ above. **OBJ-4** also aligns with **STR-1** as “rapid storage and retrieval” is required which is directly met by **STR-1**’s key word “rapidly”.

**OBJ-2** States the database should handle complex data structures and diverse interactions on the data. **STR-2** States that **NoSQL Databases** are suited for storage and manipulation of “unstructured, semi-structured, or structured data”. This means that, as per our definition of structured, semi-structured, or unstructured data, a **NoSQL Database** can handle data of various data types or data structures such as multimedia or variable interaction such as comments, reactions or reposts.

**OBJ-3** States that real-time, or instantaneous insights into the data or metadata are required. This is inherent in **NoSQL Databases** as, per **STR-1** and **STR-2**, they are suited for rapid delivery on various data types and as per **STR-4**, they are suited towards developer’s needs.

Finally, **OBJ-4** states that the database should “have a rapid turnaround time” to provide “a seamless user experience”. **STR-1, STR-2,** and **STR-5** see to this requirement through enabling rapid database access due to easily access data and datatypes, with minimal data transformation or complex queries. Dynamic scaling and cloud capabilities also greatly assist in this capacity as the load is always addressed and distributed resulting in healthy database operation levels.

### APPLICABLE DATA

As previously mentioned, NoSQL Databases are suited for data that is structured, unstructured, or semi-structured. This can mean data that is not easily classified or has a variance in its type or format. Data such as multimedia (photos, videos, GIFs), or complex application interaction such as comments, likes, or reposts, are suitable candidates for being stored in a NoSQL database as these data types fall into various categories that are indeterminate (The IIE, 2025).

### TYPES OF NoSQL DATABASES

There are four different types of NoSQL databases (The IIE, 2025).

* **Document store:** Document store databases store data in documents such as those seen in JSON objects. These documents contain pairs of attributes and values of varying types. Representation of complex relationships or hierarchy within data and entities is made simple by the support of nested structures within these documents. Example of a Document Store DB: *MongoDB* (*What Is NoSQL? NoSQL Databases Explained | MongoDB*, 2025).
* **Key-value store:** Key-value store databases store data as individual items with unique keys and assigned, singular values. These databases are well suited for caching and session management and offer high efficiency in storage and retrieval operations. This is due to their tendency to utilize memory for storing items. Example of a Key-value Store DB: *Amazon’s DynamoDB* (*What Is NoSQL? NoSQL Databases Explained | MongoDB*, 2025).
* **Colum store:** Column store databases are somewhat similar to traditional SQL databases in that they store data in tables. However, the difference here is that the rows in these databases can have different sets of columns from one another and are flexible as opposed to being uniform and of a predefined size. These databases are able to perform column compression techniques to optimize storage space and performance. Example of a Column Store DB: *Apache’s Cassandra* (*What Is NoSQL? NoSQL Databases Explained | MongoDB*, 2025)*.*
* **Graph store:** Graph store databases store data in the form of ‘nodes’ or ‘vertices’ that typically represent or store information about certain entities. ‘Edges’ or ‘connectors’ represent or store information about the relationships between these nodes or entities. These types of databases are well suited for densely or complexly related data. Example of Graph Store DB: *Neo4J* (*What Is NoSQL? NoSQL Databases Explained | MongoDB*, 2025)*.*

After making the distinction between the four types of NoSQL Databases above, it follows that a **Graph Store NoSQL Database**, or some combination of Graph Store and another type,would best suit the scenario here as the data will be dense and contain complex relational webs between entities.

### THREE V’S OF BIG DATA

The “**Three V’s of Big Data**” refers to the ‘**Variety’**, ‘**Volume’**, and ‘**Velocity’** of data within exceptionally large datasets such as those produced on platforms akin to the one described in this scenario (The IIE, 2025).

* **Variety:** refers to the variance of types of data within the dataset. The different types of data have been previously discussed and described as ‘structured’, ‘unstructured’, or ‘semi-structured’. The ‘structure’ of data simply describes its ability to be easily classified or not. Structured data is easily classified and can be pre-determined. An example of structured data would be a user’s name and email address. This is always of the same data type and expected and therefore can be stored as such. Unstructured data is indeterminate and can take on various forms, sizes or functions. An example of unstructured data would be the contents of someone’s interaction with another user’s post. It could be a text reply, a GIF, or nothing at all. Furthermore, the contents of a text reply could have contain data that could provide information on for any purpose – but that purpose is not known until after the data is created (The IIE, 2025).
* **Volume:** refers to the sheer quantity of data produced and stored within ‘big data’ applications. With millions of users on the platform in this scenario, the amount of data being produced through their posts and interactions and the metadata or analysis on that information grows exponentially with each action (The IIE, 2025).
* **Velocity:** refers to the speed at which data is created within ‘big data’. Data is created at unprecedented rates in ‘big data’ applications as there is simply so much happening and every action is being analyzed and stored. Data is created through user activity as well as automatically by analysis running on the activity taking place (The IIE, 2025).

# QUESTION 2 – BOOK STORE UML

Link to git repository: <https://github.com/tristan-brand/insy6112assign01.git>

# REFERENCES

*Advantages Of NoSQL | MongoDB* 2025. [Online]. Available at: <https://www.mongodb.com/resources/basics/databases/nosql-explained/advantages> [Accessed: August 26, 2025].

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