COURSEWORK SUBMISSION

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COMP-1835-M01-2023-24 Graph and Modern Databases Course Leader: Dr. Margarita RazgonTutors: Dr. Hai Huang, Dilan Guruge

Contents:

Part 1. Peer review of the research paper

Summary:

The research paper highlights the distinctions between NoSQL (non-relational) and SQL (relational) databases, highlighting their unique advantages, disadvantages, and uses. While recognising the significance of SQL databases in efficiently managing structured data, it draws attention to the growing acceptance of NoSQL databases, particularly in handling huge datasets as well as tackling scalability difficulties. It emphasises how important it is to select the right kind of database for the various demands of an organisational behaviour: NoSQL databases are chosen for scalability and flexibility, while SQL databases are preferred for complicated queries and data integrity requirements. Overall, the paper offers a thorough summary of the subject, stressing important factors to take into account while choosing the appropriate kind of database.

A. Major Issues:

1. **Coherence and Structure**:

The paper's unclear clarity and organisation make it difficult to comprehend the material as it flows. A better organised outline with headings and subheadings to help the reader navigate the text would be beneficial.

- For convenience of reference, please think about numbering the sections and subsections (e.g., Section 4.1, Section 4.2).
- To help with navigation and comprehension, include page and line numbers when referencing specific points within the text.

2. **Depth of Analysis**:

Although the article briefly discusses a number of topics related to NoSQL and SQL databases, it should go into greater detail about the technical distinctions between them, including data modelling, query languages, and transaction support. More thorough explanations and examples would improve readers' comprehension, particularly for those who have little to no prior experience with database systems.

- Please make it obvious which sections of the text are meant for analysis or discussion so that input can be directed specifically towards those areas.

B. Minor Issues:

Inclusion of Sources: The article mentions the use of NoSQL databases by significant Internet organisations, but it might make a stronger case for its position by including particular case studies or research findings. Furthermore, including academic references to back up claims regarding the advantages and drawbacks of SQL and NoSQL databases will provide the conversation more authority.

Language and Clarity: The paper's overall clarity is diminished by a few cryptic and challenging-to-understand sentences. A wider readership could be achieved by simplifying complex language and making sure that technical phrases are defined or explained.

- Make sure to use the same terminology throughout the manuscript for clarity, and when needed, add clarifications or explanations.

Regarding Style and Presentation:

The purpose of the assessment is to offer helpful criticism that will enhance the paper's overall quality, organisation, and clarity. It highlights how crucial comprehensive analysis, concise communication, and appropriate citation styles are to academic writing. In order to ensure that the paper adheres to the norms of scholarly discourse and successfully conveys its most important insights to the target audience, the reviewer strongly advises the author to rework the article keeping these points in mind.

- Consider simplifying difficult language and making sure that technical phrases are defined or explained in order to increase readability and clarity.
- Understanding and modification would be aided by numbering points and using the manuscript's page and line numbers when making particular remarks.
- Indicate which sections of the article are meant for analysis or discussion so that readers can provide targeted feedback.
- To improve academic integrity, follow a standard citation format and give proper credit to all sources that are cited.

Proofreading:

The work has to be carefully proofread because it contains a number of mistakes and grammatical errors. Fixing these mistakes would raise the writing's credibility and professionalism.

- Make proofreading a top priority to get rid of grammar mistakes and enhance readability in general.

References

- All references in this document must follow Harvard style, which has been formally acknowledged and supersedes previous requirements. As such, the references have been reorganised, though not in the way I am used to.
- It was determined that the references given are either inaccurate or non-existent. Consequently, in order to maintain the criteria of credibility and dependability in academic writing, they had to be removed from the work.
- GeeksforGeeks.org is a suitable and reliable resource that discusses the distinctions between SQL and NoSQL databases (GeeksforGeeks, n.d.). This trustworthy website guarantees the integrity of your research by offering precise and perceptive information on the subject. And just to point out the correction: the website should be spelt "GeeksforGeeks.org," not "GreeksforGreeks.org." Ensuring precision spelling in referencing is crucial for preserving the professionalism and legitimacy of your work.

Part2.

Assignment A: Redis

Generating a book store data base and accomplish the evidence. Summaries of numerous data type counting hashes, sets, strings, sorted sets signify diverse features of the book store functionality and lists.

A. Books information. (Fig.1)

- We'll use hashes to store information about each book.
- Each book will have its own key.
- Hashes will contain details like title, author, publication year, and price.

```
127.0.0.1:6379> hmset book:1 title "Ironopolis" author "Glen James Brown" year 2024 price 10.99
OK
127.0.0.1:6379> hmset book:2 title "Melmoth" author "Sarah Perry" year 2022 price 8.99
OK
127.0.0.1:6379> hmset book:3 title "Trinity" author "Louisa Hall" year 2024 price 9.85
OK
127.0.0.1:6379> hmset book:3 title "Folk" author "Zoe Gilbert" year 2021 price 10.95
OK
127.0.0.1:6379> hmset book:4 title "Tales of the City" author "Zoe Armistead Maupin" year 2020 price 11.55
OK
127.0.0.1:6379> hmset book:5 title "The Trouble with the Goats" author "Joanna Cannon" year 2022 price 12.85
OK
127.0.0.1:6379> hmset book:6 title "The Silent Patient" author "David Balddaci" year 2018 price 11.99
OK
127.0.0.1:6379> hmset book:7 title "The List of Suspicious Things" author "Jennie Godfrey" year 2022 price 10.99
OK
127.0.0.1:6379> hmset book:8 title "Trinity" author "Louisa Hall" year 2024 price 9.85
OK
127.0.0.1:6379> hmset book:9 title "First Among Seuels" author "Jasper Ford" year 2021 price 9.99
OK
127.0.0.1:6379> hmset book:10 title "Mending" author "Matt Willis" year 2023 price 10.99
OK
```

Fig.1

B. Book Categories. (Fig.2.)

- Sets to represent book categories.
- Where each set will contain book ID.
- Belonging to that category.

```
127.0.0.1:6379> sadd category:fiction book:1 book:3 book:5
(integer) 3
127.0.0.1:6379> sadd category:drama book:2 book:4
(integer) 2
127.0.0.1:6379> sadd category:sf book:6 book:7 book:9
(integer) 3
127.0.0.1:6379> sadd category:action book:8 book:10
(integer) 2
```

Fig.2.

C. Shopping Cart. (Fig.3.)

- Hash to represent the user shopping cart.
- Book ID will be the field.
- Quantity will be the value.

```
127.0.0.1:6379> hmset cart:George book:4 2 book:5 1 book:9 1
OK
127.0.0.1:6379> hmset cart:Elena book:6 2 book:2 3
OK
127.0.0.1:6379> hmset cart: Aurelia book:9 2 book:5 1
(error) ERR wrong number of arguments for 'hmset' command
127.0.0.1:6379> hmset cart:Aurelia book:9 2 book:5 1
OK
```

Fig.3.

D. Bestseller List. (Fig.4.)

- Sorted set to maintain a list of bestsellers.
- The score will be the number of copies sold.
- Book ID will be the member.

```
127.0.0.1:6379> zadd bestseller 300 book:6
(integer) 1
127.0.0.1:6379> zadd bestseller 200 book:9
(integer) 1
127.0.0.1:6379> zadd bestseller 500 book:4
(integer) 1
```

Fig.4.

E. Recent Orders. (Fig.5.)

- List to maintain a record of recent orders.
- Each item in the list will represent an order.

```
127.0.0.1:6379> lpush recent_order "Order ID:George - Total: £33.09"
(integer) 1
127.0.0.1:6379> lpush recent_order "Order ID:Elena - Total: £50.95"
(integer) 2
127.0.0.1:6379> lpush recent_order "Order ID:Aurelia - Total: £32.83"
(integer) 3
```

Fig.5.

F. User Reviews. (Fig.6.)

```
127.0.0.1:6379> hmset reviews:book:6 user:Aurelia "I am still dipping my toes in the literally fiction pool" user:Elena " Great book"
OK
127.0.0.1:6379> hmset reviews:book:1 user:Aurelia "5 stars book" user:George "I think ... not really for me"
OK
```

Fig.6

G. Total Sales. (Fig.7.)

```
127.0.0.1:6379> get total_sales
"116.87"
```

Fig.7.

H. Retrieve Book Information. (Fig.8.)

```
127.0.0.1:6379> hgetall book:6
1) "title"
2) "The Silent Patient"
3) "author"
4) "David Balddaci"
5) "year"
6) "2018"
7) "price"
8) "11.99"
127.0.0.1:6379>
```

Fig.8

I. Retrieve Books in a Category. (Fig.9.)

```
127.0.0.1:6379> smembers category:sf
1) "book:9"
2) "book:6"
3) "book:7"
```

Fig.9.

J. Retrieve User's Shopping Cart. (Fig.10)

```
127.0.0.1:6379> hgetall cart:Aurelia
1) "book:9"
2) "2"
3) "book:5"
4) "1"
```

Fig.10.

K. Retrieve Bestselling Books. (Fig.11)

```
127.0.0.1:6379> zrevrange bestseller 0 2
1) "book:4"
2) "book:6"
3) "book:9"
```

Fig.11.

L. Retrieve Recent Orders. (Fig12.)

```
127.0.0.1:6379> LRANGE recent_order 0 -1
1) "Order ID:Aurelia - Total: \xc2\xa332.83"
2) "Order ID:Elena - Total: \xc2\xa350.95"
3) "Order ID:George - Total: \xc2\xa333.09"
```

Fig.12

M. Retrieve Book Reviews. (Fig.13)

```
127.0.0.1:6379> hgetall reviews:book:6
1) "user:Aurelia"
2) "I am still dipping my toes in the literally fiction pool"
3) "user:Elena"
4) " Great book"
```

Fig.13.

N. Add Book to Shopping Cart. (Fig.14.)

```
127.0.0.1:6379> hset cart:Aurelia book:2 1
(integer) 1
```

Fig.14.

O. Increment Book Sales Count. (Fig.15)

```
127.0.0.1:6379> zincrby bestsellers 1 book:6
"1"
```

Fig.15.

P. Remove Book from Shopping Cart. (Fig.16)

```
127.0.0.1:6379> hdel cart:Aurelia book:2
(integer) 1
```

Fig.16.

Implementation /Discussion

Architecture:

Books Details:

- Hashing effectively stores organised book details.

Book Classifications:

- Sets classify books so that category-based queries are simple to do.

Customer Shopping Cart:

- The user's cart is maintained using a hash, making cart administration easier.

Bestselling List:

- To aid in popularity analysis, a sorted set keeps track of the best-selling books.

Current Orders:

- To help with order history management, a list keeps track of recent orders.

Customer Reviews:

- Reviews can be retrieved thanks to the hashes that are used to store them for each book.

Whole Revenue:

- This figure gives financial information and is kept as a string.

Aspects of an online bookstore's operations such as inventory management, sales monitoring, user interaction, and data analysis are all covered by the installed database and queries. Redis's databases are efficiently used to improve both speed and scale by modelling various features of the bookstore's data. The efficient and user-friendly queries are made to support internal operations and user-facing features. Overall, the design demonstrates flexibility in data modelling and query execution and shows how Redis can be used to provide a solid and scalable backend for an online bookshop application.

Assignment B: Cassandra

1.Create a schema

```
CREATE KEYSPACE eMagic
WITH replication = {'class': 'SimpleStrategy', 'replication_factor': 1};
USE ecommerce;
CREATE TABLE products (
   product_id UUID PRIMARY KEY,
   name TEXT,
   category TEXT,
   price DECIMAL,
   brand TEXT,
   stock INT,
   description TEXT
);
```

2. Create Database. (Fig.B1.)

```
|  99.99 |    25
35558e40-8c6f-4d10-bf41-736652903d15 |  George Foreman | Home & Kitchen |                George Foreman 15-Serving Indoor/Outdoor Electric Grill |        Indoor
| 149.99 |    25
7a30f71c-6bbe-4497-b552-53afcf299121 |       Cuisinart | Home & Kitchen |                      Cuisinart CPT-180P1 Metal Classic 4-Slice Toaster |             To
|  49.99 |    40
e2c206f9-75f9-4075-86f1-d63ca138ea0f |       FoodSaver | Home & Kitchen |                                 FoodSaver FM2000 Vacuum Sealer Machine |       Vacuum S
|  59.99 |    30
e45d79bc-1bfc-4a87-b2d6-9d3e03546cfe |        Cangshan | Home & Kitchen |                                  Cangshan S1 Series 12-Piece Knife Set |           Knif
|  99.99 |    35
d81dfd4e-e436-4756-a5ae-ad74d5ceb5e9 |         Samsung |    Electronics |                                 Samsung Galaxy S21 with 128GB storage |          Smart
| 699.99 |   100
c645fa24-9d1b-4726-b111-060af6b67850 |           Dyson | Home & Kitchen |                             Dyson V8 Animal Cordless Stick Vacuum Cleaner |       Vacuum Cl
| 199.99 |    20
734801c0-ac0b-42fe-8f3b-589643fdbd78 |          iRobot | Home & Kitchen |                           iRobot Roomba 675 Robot Vacuum-Wi-Fi Connectivity |        Robot V
| 299.99 |    10
44a1710c-d791-433e-aba9-93395beb805c |     Instant Pot | Home & Kitchen |                             Instant Pot Duo 7-in-1 Electric Pressure Cooker |     Pressure C
|  99.99 |    20
4b2b87fc-b1d8-47b5-81d5-03d2d1ec1c8b |           Krups | Home & Kitchen | KRUPS F203 Electric Spice and Coffee Grinder with Stainless Steel Blades |      Coffee Gr
|  19.99 |    50
e4bbd501-e9f3-4e97-8819-caac50f152c3 |          Keurig | Home & Kitchen |                                          Keurig K-Classic Coffee Maker |        Coffee
| 129.99 |    25
b0aada81-8c78-4975-95c1-e92efce2fb16 |  Hamilton Beach | Home & Kitchen |                                  Hamilton Beach 10-Cup Food Processor |      Food Proc
| 149.99 |    20
87dac71e-c6de-4e0c-93c9-ba0bfe291323 | Western Digital |    Electronics |                              WD 2TB Elements Portable External Hard Drive | External Hard
| 129.99 |    45

(41 rows)
```

Fig.B1.

3. Retrieve all products with prices less than 500. (Fig.B2.)

```
cqlsh:emagic> SELECT * FROM products WHERE category = 'Electronics' AND PRICE < 500 ALLOW FILTERING;

 product_id                           | brand           | category    | description                                                | name              | price  | stock
--------------------------------------+-----------------+-------------+------------------------------------------------------------+-------------------+--------+-------
 e4ba37b5-5497-4cd1-abb8-f44e24ac3f50 |           Bose | Electronics |                Bose SoundLink Color Bluetooth Speaker II |           Speaker | 199.99 |    30
 492b01a9-2994-48da-8ceb-4ed1bbc15bfe |           Epson | Electronics |          Epson EcoTank ET-2720 Wireless All-in-One Printer |           Printer | 199.99 |    25
 ad977251-eb08-4551-81b3-80563ca03bc0 |           Sony | Electronics |                Sony WH-1000XM4 Noise Cancelling Headphones |         Headphones | 149.99 |    80
 ededd347-bc2c-41bf-b979-44fa0432f98c |         TP-Link | Electronics |                          TP-Link Archer AX10 Wi-Fi 6 Router |            Router | 129.99 |    35
 68b5cd5c-f3a2-41c7-aecc-2e2ef69e68f7 |           LG | Electronics |                          LG UltraGear 27" Gaming Monitor |           Monitor | 349.99 |    40
 fc79a48b-7ffd-4a34-8976-deeb053c693c |          Oculus | Electronics | Oculus Quest 2 Advanced All-In-One Virtual Reality Headset |         VR Headset | 299.99 |    10
 49deaa54-253c-4294-8683-91ef970bf34a |         Fitbit | Electronics |                                Fitbit Versa 3 Smartwatch |         Smartwatch | 299.99 |    60
 fb5b0ae8-4410-4fe5-a395-ba7a9e40bae0 |          Apple | Electronics |                          Apple iPad Pro with 11" display |            Tablet | 399.99 |    30
 43151428-4a4d-4da3-910f-1bd0cd0079b6 |        Logitech | Electronics |                  Logitech G Pro Mechanical Gaming Keyboard |          Keyboard |  79.99 |    90
 9dfa3ee8-9c22-4074-85f2-ae2081dbb3a0 |          Razer | Electronics |                        Razer DeathAdder V2 Gaming Mouse |             Mouse |  49.99 |    70
 00301cc0-5606-4927-9b06-23015a27e4db |           Sony | Electronics |                              Sony PlayStation 5 Console |   Gaming Console | 499.99 |    15
 89919f0c-77f0-4ea8-86d8-6fcb68f5fbb7 |          Apple | Electronics |                                    Apple AirPods Pro |   Wireless Earbuds | 129.99 |    55
 ef091f5a-99c5-4c24-9db8-59827b3a6320 |           Blue | Electronics |                             Blue Yeti USB Microphone |        Microphone |  99.99 |    25
 87dac71e-c6de-4e0c-93c9-ba0bfe291323 | Western Digital | Electronics |              WD 2TB Elements Portable External Hard Drive | External Hard Drive | 129.99 |    45

(14 rows)
```

Fig.B2.

4. Retrieve all products where stock more than 10. (Fig.B3.)

```
cqlsh:emagic> SELECT * FROM products WHERE stock > 10  ALLOW FILTERING;

 product_id                           | brand           | category       | description                                                | name
 | price  | stock
--------------------------------------+-----------------+----------------+------------------------------------------------------------+--------------------
+--------+-------
 a00dac70-28b6-4793-9fa7-840068a94df2 |     NutriBullet | Home & Kitchen |                          NutriBullet NBR-0601 Nutrient Extractor |            Blender
 |  79.99 |    30
 f4e108a4-c41e-4958-bcba-7249ccbf20d2 |      KitchenAid | Home & Kitchen |                        KitchenAid Artisan Series 5-Qt. Stand Mixer |         Stand Mixer
 | 399.99 |    15
 e4ba37b5-5497-4cd1-abb8-f44e24ac3f50 |            Bose |    Electronics |                Bose SoundLink Color Bluetooth Speaker II |            Speaker
 | 199.99 |    30
 492b01a9-2994-48da-8ceb-4ed1bbc15bfe |           Epson |    Electronics |          Epson EcoTank ET-2720 Wireless All-in-One Printer |            Printer
 | 199.99 |    25
 065a2099-5e97-485f-ab03-5676e8fad643 | Hamilton Beach | Home & Kitchen |                    Hamilton Beach 6-Slice Countertop Toaster Oven |        Toaster Oven
 |  79.99 |    30
 c95406f6-2603-4771-bd8f-2927385c4aa3 |           Ninja | Home & Kitchen |                       Ninja Professional 72 Oz Countertop Blender |            Blender
```

Fig.B3.

5. Retrieve all products with the specified id. (Fig.B4.)

```
cqlsh:emagic> SELECT * FROM products WHERE product_id = 4b2b87fc-b1d8-47b5-81d5-03d2d1ec1c8b  ALLOW FILTERING;

 product_id                           | brand | category       | description                                                                | name           | price | stock
--------------------------------------+-------+----------------+----------------------------------------------------------------------------+----------------+-------+-------
 4b2b87fc-b1d8-47b5-81d5-03d2d1ec1c8b | Krups | Home & Kitchen | KRUPS F203 Electric Spice and Coffee Grinder with Stainless Steel Blades | Coffee Grinder | 19.99 |    50

(1 rows)
```

Fig.B4.

6. Retrieve the average price from all product. (Fig.B5.)

```
cqlsh:emagic> SELECT AVG(price) FROM products;

 system.avg(price)
-------------------
            233.65

(1 rows)
```

Fig.B5.

7. when you want to update a product price required 3 procedures:

- If you know the range price of the product, get a list of the products range price.

```
cqlsh:emagic> SELECT * FROM products WHERE price >= 200 AND price <= 500 ALLOW FILTERING;

 product_id                           | brand      | category       | description                                                | name              | price  | stock
--------------------------------------+------------+----------------+------------------------------------------------------------+-------------------+--------+-------
 f4e108a4-c41e-4958-bcba-7249ccbf20d2 | KitchenAid | Home & Kitchen |                        KitchenAid Artisan Series 5-Qt. Stand Mixer |      Stand Mixer | 399.99 |    15
 68b5cd5c-f3a2-41c7-aecc-2e2ef69e68f7 |         LG |    Electronics |                          LG UltraGear 27" Gaming Monitor |           Monitor | 349.99 |    40
 fc79a48b-7ffd-4a34-8976-deeb053c693c |     Oculus |    Electronics | Oculus Quest 2 Advanced All-In-One Virtual Reality Headset |         VR Headset | 299.99 |    10
 49deaa54-253c-4294-8683-91ef970bf34a |     Fitbit |    Electronics |                                Fitbit Versa 3 Smartwatch |         Smartwatch | 299.99 |    60
 fb5b0ae8-4410-4fe5-a395-ba7a9e40bae0 |      Apple |    Electronics |                          Apple iPad Pro with 11" display |            Tablet | 399.99 |    30
 00301cc0-5606-4927-9b06-23015a27e4db |      Sony |    Electronics |                              Sony PlayStation 5 Console |   Gaming Console | 499.99 |    15
 734801c0-ac0b-42fe-8f3b-589643fdbd78 |    iRobot | Home & Kitchen |          iRobot Roomba 675 Robot Vacuum-Wi-Fi Connectivity |     Robot Vacuum | 299.99 |    10

(7 rows)
cqlsh:emagic>
```

Fig.B6.

- Identifies the product you want update the price and do it. (Fig.B7.)

```
cqlsh:emagic> SELECT * FROM products WHERE price >= 200 AND price <= 500 ALLOW FILTERING;

 product_id                           | brand      | category       | description                                                | name           | price  | stock
--------------------------------------+------------+----------------+------------------------------------------------------------+----------------+--------+-------
 f4e108a4-c41e-4958-bcba-7249ccbf20d2 | KitchenAid | Home & Kitchen |              KitchenAid Artisan Series 5-Qt. Stand Mixer |    Stand Mixer | 399.99 |    15
 68b5cd5c-f3a2-41c7-aecc-2e2ef69e68f7 |         LG |    Electronics |                          LG UltraGear 27" Gaming Monitor |        Monitor | 349.99 |    40
 fc79a48b-7ffd-4a34-8976-deeb053c693c |     Oculus |    Electronics | Oculus Quest 2 Advanced All-In-One Virtual Reality Headset |     VR Headset | 299.99 |    10
 49deaa54-253c-4294-8683-91ef970bf34a |     Fitbit |    Electronics |                          Fitbit Versa 3 Smartwatch |     Smartwatch | 299.99 |    60
 fb5b0ae8-4410-4fe5-a395-ba7a9e40bae0 |      Apple |    Electronics |                       Apple iPad Pro with 11" display |         Tablet | 399.99 |    30
 00301cc0-5606-4927-9b06-23015a27e4db |       Sony |    Electronics |                          Sony PlayStation 5 Console | Gaming Console | 499.99 |    15
 734801c0-ac0b-42fe-8f3b-589643fdbd78 |     iRobot | Home & Kitchen |        iRobot Roomba 675 Robot Vacuum-Wi-Fi Connectivity |   Robot Vacuum | 342.95 |    10
```

Fig.B7.

- Verifying inside the data base if the price is update. (Fig.B8.)

```
qlsh:emagic> UPDATE products SET price = 342.95 WHERE product_id = 734801c0-ac0b-42fe-8f3b-589643fdbd78;
```

Fig.B8.

8. If you want to see entire stock. (Fig.B9)

```
cqlsh:emagic> SELECT SUM (stock) AS total_stock FROM products ALLOW FILTERING;

 total_stock
-------------
        1765

(1 rows)
```

Fig.B9.

9.When want to see a single product stock. (Fig.B10.)

```
cqlsh:emagic> SELECT brand, SUM(stock) AS total_stock FROM products WHERE BRAND = 'Apple' ALLOW FILTERING;

 brand | total_stock
-------+-------------
 Apple |          85

(1 rows)

Warnings :
Aggregation query used without partition key
```

Fig.B10.

Implementation /Discussion

Cassandra can handle big datasets and high write and read throughput, which allows it to scale linear when additional nodes are added to the cluster. Cassandra is able to operate regardless of instances of failures of nodes or network splits due to data replication and distributed architecture.

Distributes data across numerous nodes and lets clients to connect to any node in the cluster to achieve high availability through its decentralised architecture and data replication. Depending on the needs of their applications, developers can select a suitable degree of constancy for each reading and writing operation using Cassandra's adjustable consistency levels. Contrary to conventional relational databases, Cassandra's schema is more adaptable. Tables do not have to contain the same number of columns in every row; columns can be added dynamically.

Cassandra is a global NoSQL database management system that prioritises fault tolerance, high availability, and scalability. Real-time analytics, content management systems, and Internet of Things applications are just a few of the use cases that can benefit from its decentralised architecture, data replication, and adjustable consistency.

Assignment C: JSON. (Appendix 1)

Assignment D: Mongo DB.

Implementation /Discussion

MongoDB Collection Report: "songs" in "Laur_DJ" Database (Fig.D1)

- Description:

The "Songs" collection in the "Laur_DJ" MongoDB database serves as a repository for storing information about various music tracks.

- Collection Contents:

The collection contains 22 documents, each representing a single music track. Each document includes the following fields:

- _id: Unique identifier for the document, represented as an ObjectId.

title: Title of the music track.
artist: Artist or band performing the track.
album: Album on which the track appears.
year: Year of release for the track.
genre: Array of genres associated with the track.
duration_seconds: Duration of the track in seconds.
popularity: Popularity score for the track.

- Data Structure:

JSON-like structure with key-value pairs representing track attributes.
"genre" field stored as an array, allowing multiple genres per track.
Numeric values (e.g., "year", "duration_seconds", "popularity") stored as integers or floating-point numbers.

- Usage:

Querying for specific tracks, artists, albums, or genres.
Basis for applications like music streaming platforms, recommendation systems, or analytics dashboards.

- Indexing:

Indexes may be created on fields such as "title", "artist", "album", or "genre" for query optimization.

- Integration:

Data can be integrated with other systems or applications via MongoDB's query interface or APIs for seamless access to music track information.

- Conclusion:

The "songs" collection in the "Laur_DJ" database contains a total of 22 music tracks, providing structured storage for managing music-related data in MongoDB. It facilitates retrieval, analysis, and integration of music track information for various purposes.

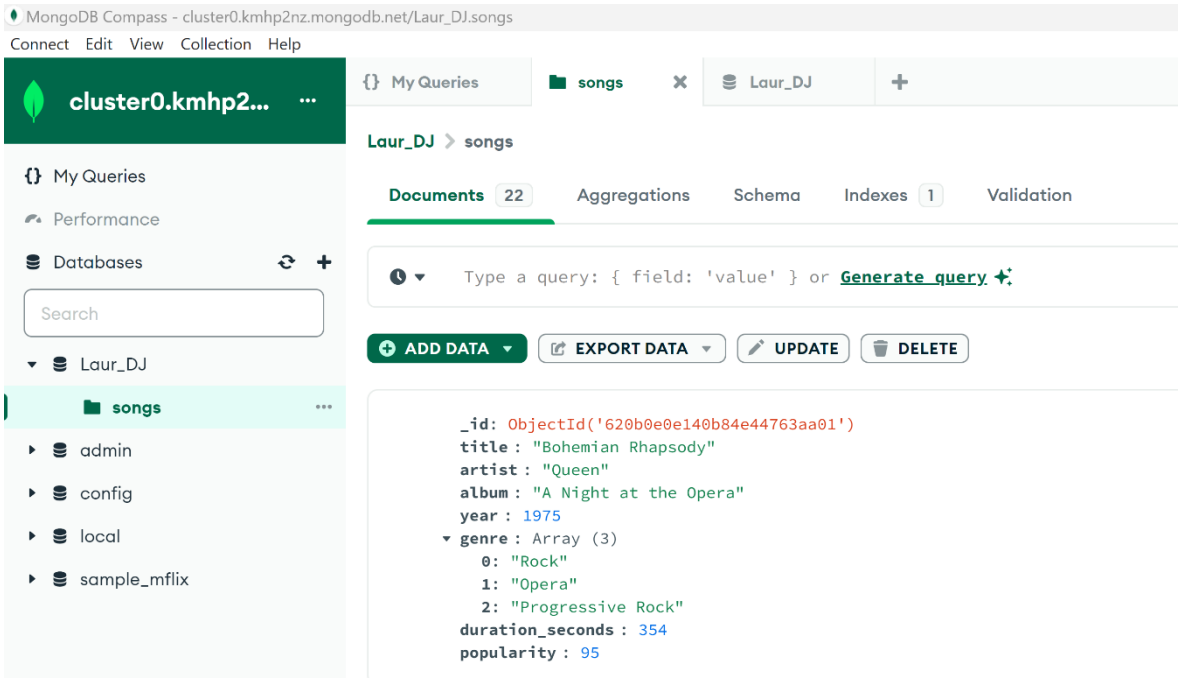

Fig.D1.

Queries:

Find all songs with "Devil" in the title. (Fig.D2.)

```
db.songs.find({ "title": { $regex: /Devil/i } });
{
  _id: ObjectId('620b0e0e140b84e44763aa21'),
  title: 'Sympathy for the Devil',
  artist: 'The Rolling Stones',
  album: 'Beggars Banquet',
  year: 1968,
  genre: [
    'Rock',
    'Blues Rock'
```

Fig.D2.

Find all songs by "Johnny Cash"(Fig.D3)

```
> db.songs.find({ "artist": "Johnny Cash" });
< {
    _id: ObjectId('620b0e0e140b84e44763aa16'),
    title: 'Hurt',
    artist: 'Johnny Cash',
    album: 'American IV: The Man Comes Around',
    year: 2002,
    genre: [
      'Country',
      'Folk'
    ],
    duration_seconds: 220,
    popularity: 96
```

Fig.D3.

Find all songs released after the year 1975. (Fig.D4.)

```
> db.songs.find({ "year": { $gt: 1975 } });
< {
    _id: ObjectId('620b0e0e140b84e44763aa02'),
    title: 'Smells Like Teen Spirit',
    artist: 'Nirvana',
    album: 'Nevermind',
    year: 1991,
    genre: [
      'Grunge',
      'Alternative Rock'
    ],
    duration_seconds: 301,
    popularity: 90
  }
```

Fig.D4.

All songs with a duration more than 400 seconds. (Fig.D5.)

```
db.songs.find({ "duration_seconds": { $gt: 400 } });
{
  _id: ObjectId('620b0e0e140b84e44763aa06'),
  title: 'Stairway to Heaven',
  artist: 'Led Zeppelin',
  album: 'Led Zeppelin IV',
  year: 1971,
  genre: [
    'Rock',
    'Hard Rock',
    'Progressive Rock'
  ],
  duration_seconds: 482,
  popularity: 97
```

Fig.D5.

All songs with the genre "Folk Rock". (Fig.D6.)

```
> db.songs.find({ "genre": "Folk Rock" });
< {
    _id: ObjectId('620b0e0e140b84e44763aa18'),
    title: 'Like a Rolling Stone',
    artist: 'Bob Dylan',
    album: 'Highway 61 Revisited',
    year: 1965,
    genre: [
      'Folk Rock',
      'Blues Rock'
    ],
    duration_seconds: 389,
    popularity: 93
```

Fig.D6.

All songs and sort them by popularity in descending order. (Fig.D7.)

```
db.songs.find().sort({ "popularity": -1 });
{
  _id: ObjectId('620b0e0e140b84e44763aa03'),
  title: 'Thriller',
  artist: 'Michael Jackson',
  album: 'Thriller',
  year: 1982,
  genre: [
    'Pop',
    'Funk',
    'Post-disco'
  ],
  duration_seconds: 357,
  popularity: 98
```

Fig.D7.

Total number of songs in the collection. (Fig.D8.)

```
db.songs.find({ "featured": true });

db.songs.count();
DeprecationWarning: Collection.count()
22
```

Fig.D8.

Update the popularity of a specific song (replace ObjectId("1") with the actual _id). (Fig.D9.)

```
db.songs.updateOne({ "_id": ObjectId("620b0e0e140b84e44763aa12") }, { $set: { "popularity": 98 } });
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
```

Fig.D9.

The most popular song. (Fig.D10.)

```
db.songs.find().sort({ "popularity": -1 }).limit(1);
{
  _id: ObjectId('620b0e0e140b84e44763aa03'),
  title: 'Thriller',
  artist: 'Michael Jackson',
  album: 'Thriller',
  year: 1982,
  genre: [
    'Pop',
    'Funk',
    'Post-disco'
  ],
  duration_seconds: 357,
  popularity: 98
```

Fig.D10.

All artists in the collection. (Fig.D11.)

```
> db.songs.distinct("artist");
< [
    'AC/DC',              'Billy Joel',
    'Bob Dylan',          'Bon Jovi',
    'Eagles',             "Guns N' Roses",
    'Jimi Hendrix',       'John Lennon',
    'Johnny Cash',        'Led Zeppelin',
    'Michael Jackson',    'Nirvana',
    'Oasis',              'Pink Floyd',
    'Queen',              'The Beatles',
    'The Rolling Stones'
  ]
Atlas atlas-7hwpr7-shard-0 [primary] Laur_DJ>
```

Fig.D11

Assignment E. Graph Database.

Project Configuration (A)/Implementation (B):

A.

- Definition of objectives and requirements: Start by clearly defining the objectives and requirements of the project, including the functionalities and features of the project management system.

- Project planning: We have done detailed project planning, including establishing development stages, resource allocation and setting deadlines for each phase of the project.

- Infrastructure creation: I configured and implemented the infrastructure required for the project, including the configuration of the Neo4j graph database and development environment.

- Budget creation and management: I established an initial budget for the project and managed the allocation and expenditure of funds according to the requirements and needs of the project.

- Assembling the project team: We selected and assigned the right team members for each project based on experience, skills and availability.

- System development and testing: We then developed the project management system according to the established requirements, performing rigorous tests to ensure its functionality and reliability.

- Progress monitoring and reporting: Throughout the implementation, we constantly monitored the progress of the project and reported updates to the management team and other stakeholders, ensuring that we were on schedule with the established deadlines.

- Risk and change management: I identified and managed potential project risks, taking proactive measures to minimize their impact. We also managed project changes effectively, ensuring they were properly documented and communicated.

- Completion and Delivery: Finally, we completed the development of the project management system and delivered it according to the set requirements and expectations. We also provided post-implementation support to ensure a smooth and efficient transition to production use of the system.

- These are the main stages of implementing our project management project. By strategically and meticulously approaching each stage, we were able to achieve our goals and deliver a successful system.

B.

Project Management

- Project Purpose:
    - The purpose of this project is to develop a project management system to facilitate planning, monitoring and tracking the progress of projects within our organization. The system will help streamline work processes and improve collaboration between teams.

- Budget: For our project, we have allocated a total budget of 500,000 monetary units, distributed as follows:

    - Project A: 100,000 currency units
    - Project B: 150,000 currency units
    - Project C: 120,000 currency units
    - Project D: 200,000 currency units

- Start and end dates:

    - Project A: January 1, 2024 - December 31, 2024
    - Project B: 1 February 2024 - 30 November 2024
    - Project C: March 1, 2024 - October 31, 2024
    - Project D: April 1, 2024 - September 30, 2024

- Project teams:

    - Project A: The project team is led by Alice and consists of members Bobita, Charlie and George.
    - Project B: The project team is led by Aurelia and consists of members Alice, Bobita and George.
    - Project C: The project team is led by Larry and consists of members Alice, Charlie and Aurelia.
    - Project D: The project team is led by Larry and consists of members Bobita, Charlie and George.

- Requirements Nodes at least 25 this (Fig.E1)
    - Project have 111 nodes.

Fig.E1.

a. Phase of the Project. (Fig.E2.)

```
neo4j$ MATCH (n:Phase) RETURN n LIMIT 25;
```

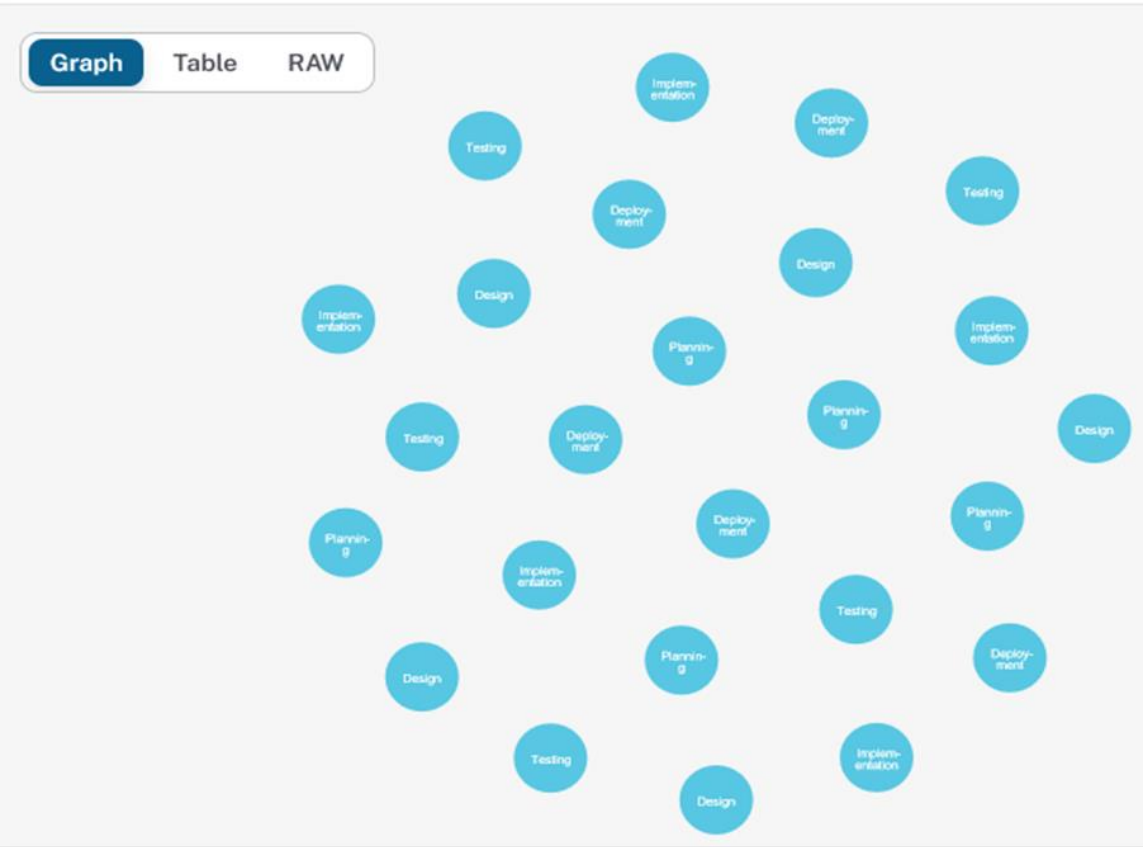

Fig.E2.

b. Stage of the planning. (Fig.E3)

```
neo4j $ MATCH (n:Stage) RETURN n LIMIT 25;
```

Graph | Table | RAW

n
(:Stage)
(:Stage {name: "Planning"})
(:Stage {name: "Design"})
(:Stage {name: "Implementation"})
(:Stage {name: "Testing"})
(:Stage {name: "Deployment"})
(:Stage {name: "Planning"})
(:Stage {name: "Design"})
(:Stage {name: "Implementation"})

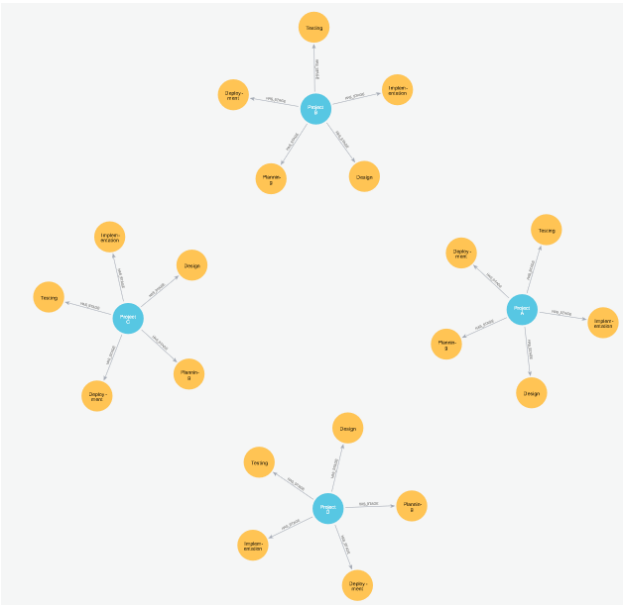

Fig.E3.

c. Projects Goals. (Fig.E4)

```
1 MATCH (p:Project)
2 RETURN p.name AS Project, p.project_goal AS ProjectGoal;
```

Table RAW

Project	ProjectGoal
"Project A"	"Creating a project management platform to facilitate team collaboration and progress monitoring."
"Project B"	"Developing a data analysis system to optimize marketing processes and identify revenue growth opportunities."
"Project C"	"Implementing an administrative process automation solution to streamline internal activities and reduce time spent on repetitive tasks."
"Project D"	"Building a mobile application to provide customers with easy access to company services and enhance user experience."

Fig.E4.

d. Resources of projects. (Fig.E5.)

```
1
2 MATCH (p:Project)
3 RETURN p.name AS Project, p.resources AS Resources;
```

Table RAW

Project	Resources
"Project A"	"EU finance"
"Project B"	"Government grant"
"Project C"	"Private funding"
"Project D"	"Corporate sponsorship"

Fig.E5.

e. Date when the projects start and end. (Fig.E6.)

```
MATCH (p:Project)
WHERE p.start_date ≥ date('2024-01-01') AND p.start_date ≤ date('2024-12-31')
RETURN p.name AS Project
```

Table RAW

Project
"Project A"
"Project B"
"Project C"
"Project D"

Fig.E6.

f. What kind of project type is each one? (Fig.E7)

```
neo4j $ MATCH (p:Project) RETURN p.name AS ProjectName, p.project_type AS ProjectType
```

Table RAW

ProjectName	ProjectType
"Project A"	"Software Development"
"Project B"	"Research"
"Project C"	"Marketing Campaign"
"Project D"	"Product Launch"

Fig.E7.

g. Project Managers for the Projects. (Fig.E8.)

```
MATCH (p:Project)
OPTIONAL MATCH (m:TeamMember)-[:ASSIGNED_TO]→(p)
WHERE p.project_manager IS NOT NULL
RETURN DISTINCT p.name AS ProjectName, p.project_manager AS ProjectManager
```

Table RAW

ProjectName	ProjectManager
"Project A"	"Aurelia"
"Project B"	"Aurelia"
"Project C"	"Larry"
"Project D"	"Larry"

Fig.E8.

h. Team Members, ages, companies belong to and salary. (Fig.E9.)

```
1 MATCH (m:TeamMember)
2 RETURN m.name AS MemberName, m.age AS Age, m.company AS Company, m.salary AS Salary
```

Table RAW

	MemberName	Age	Company	Salary
1	"Alice"	30	"TechCorp"	80000
2	"Bobita"	28	"SoftWorks"	75000
3	"Charlie"	35	"CodeNest"	85000
4	"George"	40	"DevX"	90000
5	"Aurelia"	33	"DataSolutions"	82000
6	"Larry"	32	"TechSavvy"	82000

Fig.E9.

g. Team members relations with the projects. (Fig.E10.)

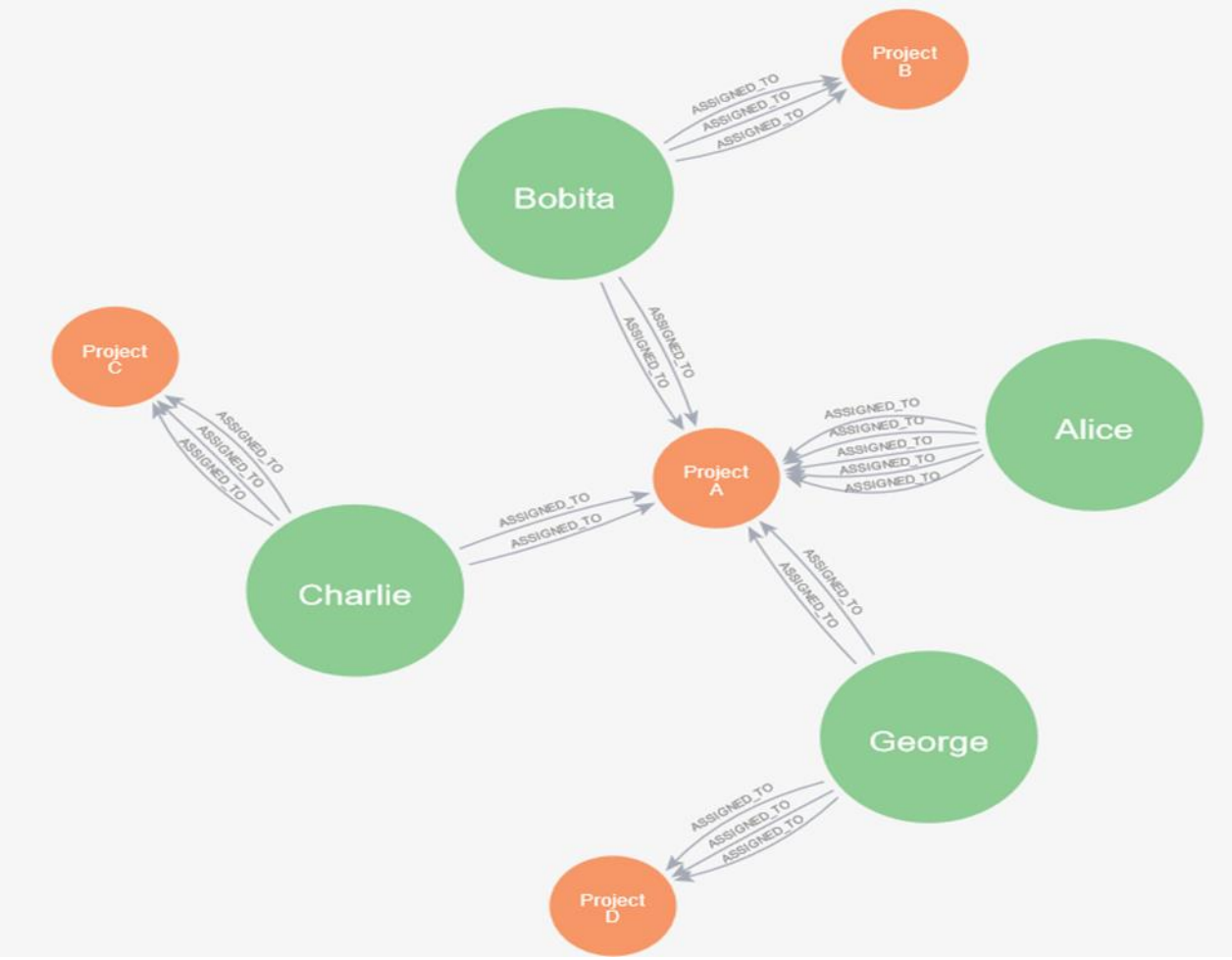

Fig.E10.

i. **Budget allocated for every project. (Fig.E11)**

```
1 MATCH (p:Project)
2 RETURN p.name AS Project, p.budget AS Budget;
```

Table RAW

	Project	Budget
1	"Project A"	100000
2	"Project B"	150000
3	"Project C"	120000
4	"Project D"	200000

Fig.E11.

Reference:

Eastridge, T. (2024). Graph Data Science with Python and Neo4j. Orange Education Pvt Ltd.

Hutson, G. and Jackson, M. (2023). Graph Data Modeling in Python. Packt Publishing Ltd.

ProjectPro. (n.d.). NoSQL vs SQL- 4 Reasons Why NoSQL is better for Big Data applications. [online] Available at: https://www.projectpro.io/article/nosql-vs-sql-4-reasons-why-nosql-is-better-for-big-data-applications/86.

Qin, L., Zhang, W., Zhang, Y., Peng, Y., Kato, H., Wang, W. and Xiao, C. (2020). Software Foundations for Data Interoperability and Large Scale Graph Data Analytics. Springer Nature.

Appendix A (Assignment 3)

Examining the JSON code for errors prior to validation:

- Make that the JSON code is syntactically correct and adheres to the JSON format before validating it against a schema or carrying out any additional processing. Before validation, you can use the following methods to look for errors in JSON code:

- JSON code syntax highlighting is an option that many text editors and integrated environments for development (IDEs) offer. This function highlights different sections of the source code with different colours in order to discover syntax problems, missing or mismatched brackets, and other difficulties.

- Also known as validators, JSON linters are programmes that examine JSON code to find potential problems and syntactic flaws. Are able to offer thorough error notices along with code correction recommendations. Popular JSON linters include command-line utilities like jsonlint in Node.js and web validators like JSONLint.

- By going over the JSON code by hand, mistakes that automatic tools might miss can be found. This entails closely examining the structure, making sure that objects and arrays are nested properly, and confirming that all the values and keys have been structured.

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "type": "object",
  "properties": {
    "employees": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "id": {"type": "integer"},
          "name": {"type": "string"},
          "age": {"type": "integer"},
          "department": {"type": "string"},
          "salary": {"type": "number"},
          "address": {
            "type": "object",
            "properties": {
              "street": {"type": "string"},
              "city": {"type": "string"},
              "state": {"type": "string"},
              "zip": {"type": "string"}
            },
            "required": ["street", "city", "state", "zip"]
          },
          "hobbies": {
            "type": "array",
            "items": {"type": "string"}
          },
          "is_manager": {"type": "boolean"},
          "start_date": {"type": "string", "format": "date"}
        },
        "required": ["id", "name", "age", "department", "salary", "address", "hobbies", "is_manager", "start_date"]
      }
    }
  },
  "required": ["employees"]
}
```

```
{
  "employees": [
    {
      "id": 1,
      "name": "John Doe",
      "age": 35,
      "department": "Engineering",
      "salary": 75000.00,
      "address": {
        "street": "123 Main St",
        "city": "Anytown",
        "state": "NY",
        "zip": "12345"
      },
      "hobbies": ["reading", "gardening"],
      "is_manager": true,
      "start_date": "2022-01-15"
    },
    {
      "id": 2,
      "name": "Jane Smith",
      "age": 28,
      "department": "Marketing",
      "salary": 60000.00,
      "address": {
        "street": "456 Elm St",
        "city": "Smallville",
        "state": "CA",
        "zip": "98765"
      },
      "hobbies": ["painting", "traveling"],
      "is_manager": false,
      "start_date": "2021-09-20"
    },
    // More employee objects...
  ]
}
```