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- **Sem.** : 4
- **Subject Code** : 05DS0401
- **Subject** : NoSQL Databases
- **Course Objectives** :

1. To give insights on NoSQL.
2. To get familiarize with the concepts & types of NoSQL
3. To understand & implement key/value storage database using Redis
4. To be able to understand & implement document base database with MongoDB
5. To be able to understand the working of graph based database using Neo4J

- **Prerequisites** :Fundamentals of RDBMS, SQL

Unit No	Topics Covered	No of lectures required
1	**Introduction to NoSQL:** What is NoSQL? , File system and distributed file system, NoSQL introduction, Why NoSQL? Primary history of NoSQL, Characteristics and history, primary benefits for using NoSQL databases, Dis advantages on NoSQL, Compare NoSQL with relational data base	10
2	**NoSQL Concepts & Types:** NoSQL databases concepts & types Types of NoSQL databases with its practical use case, Distributed database, Query Mechanism tools for NoSQL , CAP theory	10

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3	**NoSQL Key/Value Databases Using Redis :** Introduction , Architecture, Feature of Redis, Redis Data Structures, Redis commands – String commands, List commands, Set commands, Sorted Set commands, Hash commands	**08**
4	**Document Base Database Using MONGODB:** What is MongoDB? MongoDB Features/characteristics, MongoDB concepts – Databases, collections, and documents, Understanding the concepts of MongoDB Embedded document and reference document Downloading Installing and running MongoDB, The Data Model and Working with Data, Database handling commands of MongoDB, CRUD OPERATIONS, Range queries FIND, SKIP, LIMIT,SORT, Aggregation pipeline with :projection, match, group, sort, limit and use of $unwind	**12**
5	**Graph Based Databases using Neo4j :** Introduction, Advantages of Neo4j, Data Types, Operators Building Blocks, Creating Nodes, Creating Relationships, CQL write clauses, CQL read clauses, CQL general clauses, return clause, SKIP, LIMIT ORDER BY, WITH	**10**

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Course Outcomes: (Students will be able to)

1. Students will able to gain the insights on NoSQL

2. Students will able to get familiarize with the concepts & types of NoSQL

3. Student will able to understand & implement key/value storage database using Redis

4. Student will able to understand & implement document base database with MongoDB

5. Student will able to understand the working of graph based database using Neo4J

Course Outcomes – Program Outcomes Mapping Table:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	L	L		L			L
CO2		L	L		L			M
CO3		M	L	L	M			
CO4		H	H	M	H	L	H	
CO5	H		M	M	H	L	M	H

Text Book:

1. Professional NoSQL, Shashank Tiwari, WROX, First Edition
2. "Big Data and Analytics", Seema Acharya, Subhashini Chellappan Wiley India Pvt. Ltd.,2015, First Edition
3. MongoDB in Action - Kyle Banker Manning Sheltar Island.

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Reference Book:

1. MongoDB Complete Guide, Manu Sharma, BPB Publications, 2021

Web References:

1. https://redislabs.com/
2. http://www.mongodb.com
3. https://www.tutorialspoint.com/neo4j
4. https://www.tutorialspoint.com/redis

App References:

1. MongoDB, SuperDreamEducation
2. The definitive guide to MongoDB - NoSQL Database for cloud and desktop

Syllabus Coverage from text /reference book & web/app reference:

Unit #	Chapter Numbers
1	Book 1 : chapter 1 and 5
2	Book 2 : chapter 4.1, Book 3 : chapter 4,5,6,7 (only Redis Commands)
3	Book 2 : Chapter 6
4	Book 2 : Chapter 7
5	Book 3 : chapter 1 (graph databases), https://www.tutorialspoint.com/neo4j

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Practical Definitions

Unit No	List of Practical

3	**Demonstrate the use of following Redis commands**
	• Get & set operations
	  ○ LPUSH
	  ○ RPUSH
	  ○ LPOP
	  ○ RPOP
	  ○ RANGE
	  ○ SADD
	  ○ SMEMBERS
	  ○ SUNION
	  ○ SINTERSECT
	  ○ SCARD
	  ○ SDIFF
	• LIST
	• Redis Sorted Sets
	  ○ ZADD
	  ○ ZCARD
	  ○ ZCOUNT
	  ○ ZRANGE

4	Perform with mongodb **Practice assignment: 1** • Create a database named "mydb" • Show all databases. • Show currently selected database. • Create a collection named "emp". • Show all collections of selected database. • Insert following documents in emp collection:

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Empno	Ename	Sal	Desig	Dept
1	Sachin	60000	Manager	Purchase
2	Kohli	50000	Manager	Sales
3	Dhoni	30000	Clerk	Admin
4	Dravid	40000	Manager	Purchase
5	Bumrah	50000	Manager	Sales
6	Jadeja	20000	Clerk	Admin
7	Ashwin	45000	Manager	Sales

Find()

- List all documents.
- List all documents with formatted output.
- List the document of employee whose name is "sachin"
- List the documents of employee whose salary is less than 30000
- List employees whose designation is manager and
- department is sales.
- List employees whose salary is less than 50000 and designation is manager or department is admin.
- Arrange the records by name in descending order.
- List first 3 documents of emp collection.
- Skip first 3 documents of emp collection.
- List 3rd and 4th documents of emp collection.
- Count no. of employees.
- List distinct designation.

Aggregate()

- Calculate annual salary of employees
- Display no. of employees designation wise.
- Display total salary of employees department wise.
- Display employee whose salary is highest.
- List highest salary of the employee department wise.
- Calculate total salary of employees department wise and list whose total is greater than 70000.

Update()

- Increment salary by 2000 whose name is Sachin.
- Increment salary by 2000 of all the employees.
- Update designation of Sachin with CEO.

	• Update designation of Sachin with „MD“ and insert as new document. • Add a new field “remark” to document with name “dhoni” and set remark “head” • Remove the added new field. Save() • Replace the whole document whose _id is 1. Regular Expression : • To find documents from the emp collection where the ename begins with “S”. (with and without regex) • To find documents from the emp collection where the ename ends with “n”. (with and without regex) • Modify above query with case insensitivity. • To find documents from the emp collection where ename has an “a” in any position. Dealing with null values : • Update the document with null value in designation field where name is “Kohli”. • To search for null values in designation field. • To remove designation field having null values in emp collection where name is “Kohli”.

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Practice assignment : 2

EMPNO	EMPNAME	GENDER	QUA	JOB	EXP	SAL	COMM.	DEPTNO	SKILLS
7369	SMITH	M	MBA	CLERK	2	8000		20	DANCING, SPORTS
7499	ALLENA	F	MCA	OPERATOR	2	16000	300	30	READING, TRAVELLING, SPORTS, MU
7521	WARD	M	MBA	SALESMAN	3	12500	500	30	MUSIC, TRAKKING
7566	JONES	M	MCA	MANAGER	5	29750		20	READING, SPORTS
7654	MERRY	F	MCOM	SALESMAN	3	12500	1400	30	TRAKKING, ADVENTURE
7698	BLAKE	M	MCOM	MANAGER	2	28500		30	SPORTS, ADVENTURE, OUTING
7782	CLARK	M	MCA	MANAGER	5	24500		10	READING, SURFFING, OUTING
7788	SCOTT	M	MBA	ANALYST	4	30000		20	READING, CHATTING, MUSIC
7839	KING	M	MCA	PRESIDENT	8	50000		10	TRAINING, RESEARCH, READING
7844	TURNER	M	MCA	OPERATOR	2	15000		30	READING, MUSIC
7876	ANEE	F	MBA	CLERK	1	11000		20	SPORTS
7900	JENNY	F	MBA	CLERK	0	9500		30	MUSIC, DANCING
7902	FORD	M	MCA	ANALYST	5	30000		20	TRAVELLING

- Create documents in dept collection of emp database.

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO

	• Display all database of mongodb • Display all collections of mongodb • Display the size of existing collection • Rename emp collection with emp1 • Copy a dept collection with department • Display all documents of emp collection • Display all documents who are managers. • Display all documents who are presidents. • Display all documents who are either manager or clerk. • Display all documents who manager of department number 10. • Display all documents who working in department number 10. • Display all documents who are not belonging to department number 20, 30, 40 and are not manager • Display all documents who are either manager of department 10 or are analyst. • Display all documents who are not president, analyst or salesman. • Display all documents who work in department number 10 and their job is clerk. • Display all who get sal>10000 and working in deptno 20 • Display all who are manager & get salary less than 20000 • Display all who are manager of department number 30. • Display all documents & limit 5 documents. • Display all documents whose sal > 5000 and skip first 5 documents. • Display all documents that are clerk & limit 5 records & skip 2 from output. • Count all documents of emp. • Count all who are working in department number 10 • Count all who are manager • Count all who are manager and working in deptno number 10 • Count all who get salaray more than 15000 • Count all document of dept • Count all whose sal > 15000 and skip 2 documents in output

- Count all who are manager and limit 3 documents
- Update sal of smith by 20000.
- Update design of black & set sales man.
- Update sal of all clerks by 1000.
- Delete the record of miller
- Display all document all whose salary in 15000,20000,16000
- Display all documents who are neither clerk or analyst
- Update comm of analyst increment by 1500
- Delete document of smith
- Delete all documents who are sales man.

aggregation operations:

- Find department wise highest salary
- Find designation wise lowest salary
- Count designation wise salary
- Find average salary of designation wise
- Find department wise average salary and arrange in descending order
- Find department wise maximum salary and arrange in ascending order

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Practice assignment : 3

- CREATE A COLLECTION CALLED PRODUCT WITH FOLLOWING FIELDS:

Proid	Proname	Qty	Price	Comp_name	Stock_detail
10001	Tv	500	25000	Chroma	instock
10002	Freeze	750	38000	Lg	sold
10003	Mobile	850	35000	Oneplus	instock
10004	Mobile	950	45000	Iphone	instock
10005	Microwave	450	9800	Lg	instock
10006	Jbl	1200	4500	Sony	sold
10007	Tv	1000	47000	Sony	instock
10008	Freeze	650	65000	Godrej	instock
10009	jbl	500	850	philips	Sold
10010	Tv	700	25000	Chroma	instock
10011	Freeze	750	38000	Lg	sold
10012	Mobile	350	35000	Oneplus	instock
10013	tv	950	45000	Iphone	sold

- CREATE A COLLECTION CALLED ORDER WITH FOLLOWING FIELDS:

Orno	Proid	Qty	Or_by
1	10001	50	Abc
2	10003	150	Zee
3	10005	25	Alpha
4	10003	30	Bita
5	10007	100	zeta

Perform following operations:

- Insert 10 documents in product & 7 documents in order.
- Display all documents of product in json format
- Display proname, qty and price of "tv"
- Display all document where product name is mobile & count it

	• Display all documents of where product is freeze & increment price by 2500 • Display all documents where stock is available & product is mobile • Display all document where product name is jbl & product id is > 10003 • Insert one field called colour & add three colours (black,white,gray) where product is freeze • Update field stock_detail to "stockdata" • Push one more colour where product is freeze • Pull out gray colour from freeze • Insert one colour "cherry" at the first position of array. • Insert blue colour at the end . • Display all document where product is freeze & company is lg • Display all documents where product is mobile & company is oneplus • Increase the price of one plus mobile by 1000 • Display highest price of product according to product name • Display lowest price of product according to product name & arrange it in descending order.
5	**Graph Based Databases using Neo4j :** Create node with label and properties, returning node, create relationship between nodes, Write Clauses, Read Clauses, General Clauses (Return, Order By, Limit, Skip, with unwind), String and Aggregation functions, Backup and Restore, Index