

CIS345 NoSQL Databases – Summer 2024

Instructor: Weimin He, PhD

Contact: Email: whe@uwsp.edu

Schedule: July 08, 2024 – August 16, 2024

Delivery: 100% Online

Course Description

Introduction to four types of NoSQL databases, including key-value, document, graph, and column-family databases. Architecture, data model, key features, and use cases of each of four NoSQL databases. Data definition and manipulation commands in MongoDB databases; Querying data in MongoDB databases. Data definition and manipulation commands in Neo4j databases; A comprehensive introduction to Cypher Query Language in Neo4j databases; Querying data in Neo4j databases.

Course Objectives

- Know architecture, data model, key features, and suitable use cases of key-value databases.
- Know architecture, data model, key features, and suitable use cases of document databases.
- Use essential commands with different operators to create and query data in MongoDB databases, such as **insert**, **insertOne**, **update**, **updateMany**, and **find** commands.
- Know architecture, data model, key features, and suitable use cases of graph databases.
- Use essential clauses in Cypher Query Language to create and query data in Neo4j graph databases, such as **MATCH**, **WHERE**, **WITH**, **RETURN**, **UNWIND**, **ORDER BY**, and **LIMIT** clauses.
- Know architecture, data model, key features, and suitable use cases of column-family databases.

Prerequisites

- CIS 210

Textbooks (Recommended, but NOT required)

- Pramod J. Sadalage and Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley. 1st ed. ISBN-10: 0321826620 | ISBN-13: 978-0321826626
- David Hows, Pepter Membrey, Eelco Plugge, and Tim Hawkins. The Definitive Guide to MongoDB: A Complete Guide to Dealing with Big Data using MongoDB. APRESS. 3rd ed. ISBN: 978-1-4842-1183-054999

Grading

- 4 Assignments: 12%
- 5 Labs: 40%
- 12 Lesson Quizzes: 48%

Final grades will be assigned according to the following scale:

A: score \geq 90, A⁻: 87 \leq score $<$ 90,
B⁺: 83 \leq score $<$ 87, B: 80 \leq score $<$ 83, B⁻: 77 \leq score $<$ 80,
C⁺: 73 \leq score $<$ 77, C: 70 \leq score $<$ 73, C⁻: 67 \leq score $<$ 70,
D⁺: 63 \leq score $<$ 67, D: 60 \leq score $<$ 63, F: score $<$ 60

I may use lower cutoff points, depending on the overall performance of the class.

Outline of Course Content

- Lesson 1 Introduction to NoSQL Databases
 - Why NoSQL
 - Aggregate Data Models
 - More Details on Data Models
- Lesson 2 Key-Value Databases
 - What is a Key-Value Database
 - Features of Key-Value Databases
 - Suitable Use Cases
 - When Not to Use
- Lesson 3 Document Databases
 - What is a Document Database
 - Features of Document Databases
 - Suitable Use Cases
 - When Not to Use
- Lesson 4 Introduction to MongoDB
 - What is MongoDB
 - Key Features of MongoDB
 - Data Format in MongoDB
 - Keys and Indexes in MongoDB
 - Replicating and Sharding in MongoDB
 - Installing MongoDB
- Lesson 5 Data Model in MongoDB
 - Data Modelling Introduction
 - Model Relationships Between Documents
 - Model Tree Structures
- Lesson 6 Manipulating Data in MongoDB
 - Navigating Databases
 - Inserting Data into a Collection
 - Updating Data
 - Processing Data in Bulk
 - Deleting Data
 - Referencing Data
- Lesson 7 Querying Data in MongoDB
 - Simple Queries Using find() Function
 - Queries Using sort, limit, skip Functions
 - Filtering with Conditional Operators
 - Queries Using Other Operators
- Lesson 8 Graph Databases
 - What is a Graph Database
 - Features of Graph Databases
 - Suitable Use Cases
 - When Not to Use
- Lesson 9 Cypher Query Language I
 - Core Concepts
 - Basic Queries

- Conditional Expressions(CASE)
- Clauses
 - CREATE
 - SET
 - DELETE
 - REMOVE
- Lesson 10 Cypher Query Language II
 - Clauses
 - MATCH
 - OPTIONAL MATCH
 - RETURN
 - WITH
 - UNWIND
 - WHERE
 - ORDER BY
 - LIMIT
- Lesson 11 Cypher Query Language III
 - Subqueries
 - CALL Subqueries
 - EXISTS Subqueries
 - COUNT Subqueries
 - COLLECT Subqueries
- Lesson 12 Column-Family Databases
 - What is a Column-Family Database
 - Features of Column-Family Databases
 - Suitable Use Cases
 - When Not to Use