MASENO UNIVERSITY

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

YEAR 4 SEMESTER 2 JANUARY – APRIL 2024

CCS 418: ADVANCED DATABASE SYSTEMS

COURSE OUTLINE

Instructor:	Michael ondeja Adongo
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Office hours:	Thursday: 10am – 1pm. Friday: 12 – 4 PM
Important notice:	
Learning outcomes:	At the end of the course, the student should be able to: 1. Design, develop and Query Object Oriented Databases 2. Understand different Database architectures 3. Demonstrate how database are optimized to enhance performance 4. Understand how data is stored and managed in the emerging Databases Management systems
Grading	• Two assignments constituting 10% of total marks • Two CATs constituting 20% of total marks • Final examination constituting 70% of total marks
Make-up policy	All exams and assignments will have strict due dates.

WEEK	TOPIC	SUB-TOPIC
1	Object oriented databases.	• Object-relational databases. • The *Object-Oriented Data Model* • *Object-Oriented Languages* • *Persistent Programming* Languages • *Persistent C++* Systems • Nested Relations • Need for *Complex Data Types* • *Complex* Types and Object Orientation • Querying with *Complex Types*

		• Creation of *Complex* Values and Objects • Comparison of *Object-Oriented* and *Object-Relational* Databases
2	Advanced SQL	• SQL Data Types and Schemas • Integrity Constraints • Authorization • Embedded SQL • Dynamic SQL • Functions and Procedural Constructs • Recursive Queries • Advanced SQL Features
3	Database architectures	• Centralized and Client-Server Systems • Server System Architectures • Parallel Systems • Distributed Systems • Network Types
4	Distributed Databases	• Heterogeneous and Homogeneous Databases • Distributed Data Storage • Distributed Transactions • Commit Protocols • Concurrency Control in Distributed Databases • Availability • Distributed Query Processing • Heterogeneous Distributed Databases • Directory Systems
5	Query processing and Optimization	Query processing • Overview • Measures of *Query* Cost • *Selection* Operation • *Sorting* • *Join* Operation • *Other* Operations • Evaluation of *Expressions* Query Optimization • Introduction • Transformation of Relational Expressions • Catalog Information for Cost Estimation • Statistical Information for Cost Estimation • Cost-based optimization • Dynamic Programming for Choosing Evaluation Plans • Materialized views
CAT 1		
6	Transactions and Concurrency Control	Transactions • Transaction Concept • Transaction State • Concurrent Executions • Serializability • Recoverability • Implementation of Isolation

		• Transaction Definition in SQL • Testing for Serializability. Concurrency Control • Lock-Based Protocols • Timestamp-Based Protocols • Validation-Based Protocols • Multiple Granularity • Multiversion Schemes • Deadlock Handling • Insert and Delete Operations • Concurrency in Index Structures
7	System and Data recovery	• Failure Classification • Storage Structure • Recovery and Atomicity • Log-Based Recovery • Shadow Paging • Recovery With Concurrent Transactions • Buffer Management • Failure with Loss of Nonvolatile Storage • Advanced Recovery Techniques • ARIES Recovery Algorithm • Remote Backup Systems
8	Parallel Databases	• Introduction • I/O Parallelism • Interquery Parallelism • Intraquery Parallelism • Intraoperation Parallelism • Interoperation Parallelism • Design of Parallel Systems
9	Data warehousing and data mining.	• Decision Support Systems • Data Analysis and OLAP • Data Warehousing • Data Mining
10	Deductive databases.	• Introduction • Prolog/Datalog Notation • Rule Interpretation • Inference Mechanisms
11	Active databases and Mobile databases	Temporal databases. • Temporal database concepts(Valid time, Transaction time, Timestamp, Calendar, Time order) • Database representation and reasoning with time(Snapshot databases, Rollback databases, Historical databases, Temporal databases) • Incorporating time in Relational databases(Recording changes to databases – Archiving, Time-slicing) – Tuple timestamping – Attribute timestamping Multimedia databases. • The Nature of Multimedia Data and Applications

		• Data Management Issues • Multimedia Database Applications GIS (Geographic Information Systems). • Introduction • Data management requirements of GIS • Specific GIS data Operations Mobile Databases • Mobile Computing Architecture • Characteristics of Mobile Environments • Data Management Issues • Application: Intermittently Synchronized Databases
CAT 2		
12	Emerging database technologies.	Digital libraries • Concept and Definition • Characteristics of Digital Libraries • Development of Digital Libraries • Digital Libraries and their Uses • Major Issues/Challenges Genome Databases • Genome data management • Characteristics of Biological Data • The Human Genome Project and Existing Biological Databases
13	EXAMINATIONS	
14	EXAMINATIONS	
15	EXAMINATIONS	
Mode of presentation	Lectures, lecture notes, class discussions and group discussions, Lab demonstrations and assignments	
Instructional material and equipments	Audio visual equipments, white board and white board markers, Computers with Turbo Pascal 7.0	
References	• Elmasri, Navathe, Fundamentals of Database Systems, 6th Edition • Hector Garcia-Molina and Jeffrey D. Ullman(2008). Database Systems: The Complete Book (2nd Edition). Prentice Hall • Silberschatz, Korth and Sudarshan, Database System Concepts, 5th Edition • Noerr, P (2000).The Digital Library tool Kit; Ed. 2 Palo Alto : Sun System • Arora, Jagdish (2001). Building Digital Libraries: An Overview. DESIDOCBull of Information Technology	