San Pablo Catholic University (UCSP)
Undergraduate Program in
Computer Science
SILABO

Universidad Católica San Pablo
2020-I

CS272. Databases II (Mandatory)

1. General information

1.1 School	:	Ciencia de la Computación
1.2 Course	:	CS272. Databases II
1.3 Semester	:	5^{to} Semestre.
1.4 Prerrequisites	:	CS271. Databases I. (4^{th} Sem)
1.5 Type of course	:	Mandatory
1.6 Learning modality	:	Virtual
1.7 Horas	:	1 HT; 2 HP; 2 HL;
1.8 Credits	:	3

2. Professors

3. Course foundation

Information Management (IM) plays a leading role in almost every area where computers are used. This area includes the capture, digitization, representation, organization, transformation and presentation of information; Algorithms to improve the efficiency and effectiveness of access and update of stored information, data modeling and abstraction, and physical file storage techniques.
It also covers information security, privacy, integrity and protection in a shared environment. Students need to be able to develop conceptual and physical data models, determine which IM methods and techniques are appropriate for a given problem, and be able to select and implement an appropriate IM solution that reflects all applicable constraints, including scalability and Usability.

4. Summary

1. Physical Database Design 2. Transaction Processing 3. Information Storage and Retrieval 4. Distributed Databases

5. Generales Goals

- To make the student understand the different applications that the databases have, in the different areas of knowledge.
- Show appropriate ways of storing information based on their various approaches and their subsequent retrieval of information.

6. Contribution to Outcomes

This discipline contributes to the achievement of the following outcomes:

1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. (**Assessment**)

4) Recognize professional responsabilities and make informed judgments in computing practice based on legal and ethical principles. (**Assessment**)

6) Apply computer science theory and software development fundamentals to produce computing-based solutions. (**Assessment**)

7) Develop computational technology for the well-being of all, contributing with human formation, scientific, technological and professional skills to solve social problems of our community. (**Assessment**)

7. Content

UNIT 1: Physical Database Design (10)

Competences:

Content	**Generales Goals**
• Storage and file structure • Indexed files • Hashed files • Signature files • B-trees • Files with dense index • Files with variable length records • Database efficiency and tuning	• Explain the concepts of records, record types, and files, as well as the different techniques for placing file records on disk [Usage] • Give examples of the application of primary, secondary, and clustering indexes [Usage] • Distinguish between a non-dense index and a dense index [Usage] • Implement dynamic multilevel indexes using B-trees [Usage] • Explain the theory and application of internal and external hashing techniques [Usage] • Use hashing to facilitate dynamic file expansion [Usage] • Describe the relationships among hashing, compression, and efficient database searches [Usage] • Evaluate costs and benefits of various hashing schemes [Usage] • Explain how physical database design affects database transaction efficiency [Usage]

Readings: Burleson (2004), Celko (2005)

UNIT 2: Transaction Processing (12)

Competences:

Content	**Generales Goals**
• Transactions • Failure and recovery • Concurrency control • Interaction of transaction management with storage, especially buffering	• Create a transaction by embedding SQL into an application program [Usage] • Explain the concept of implicit commits [Usage] • Describe the issues specific to efficient transaction execution [Usage] • Explain when and why rollback is needed and how logging assures proper rollback [Usage] • Explain the effect of different isolation levels on the concurrency control mechanisms [Usage] • Choose the proper isolation level for implementing a specified transaction protocol [Usage] • Identify appropriate transaction boundaries in application programs [Usage]

Readings: Philip A. Bernstein (1997), Ramez Elmasri (2004)

UNIT 3: Information Storage and Retrieval (10)

Competences:

Content	Generales Goals
• Documents, electronic publishing, markup, and markup languages • Tries, inverted files, PAT trees, signature files, indexing • Morphological analysis, stemming, phrases, stop lists • Term frequency distributions, uncertainty, fuzziness, weighting • Vector space, probabilistic, logical, and advanced models • Information needs, relevance, evaluation, effectiveness • Thesauri, ontologies, classification and categorization, metadata • Bibliographic information, bibliometrics, citations • Routing and (community) filtering • Multimedia search, information seeking behavior, user modeling, feedback • Information summarization and visualization • Faceted search (e.g., using citations, keywords, classification schemes) • Digital libraries • Digitization, storage, interchange, digital objects, composites, and packages • Metadata and cataloging • Naming, repositories, archives • Archiving and preservation, integrity • Spaces (conceptual, geographical, 2/3D, VR) • Architectures (agents, buses, wrappers/mediators), interoperability • Services (searching, linking, browsing, and so forth) • Intellectual property rights management, privacy, and protection (watermarking)	• Explain basic information storage and retrieval concepts [Usage] • Describe what issues are specific to efficient information retrieval [Usage] • Give applications of alternative search strategies and explain why the particular search strategy is appropriate for the application [Usage] • Design and implement a small to medium size information storage and retrieval system, or digital library [Usage] • Describe some of the technical solutions to the problems related to archiving and preserving information in a digital library [Usage]

Readings: Peter Brusilovsky (1998), Ramez Elmasri (2004)

UNIT 4: Distributed Databases (36)	
Competences:	
Content	**Generales Goals**
• Distributed DBMS – Distributed data storage – Distributed query processing – Distributed transaction model – Homogeneous and heterogeneous solutions – Client-server distributed databases • Parallel DBMS – Parallel DBMS architectures: shared memory, shared disk, shared nothing; – Speedup and scale-up, e.g., use of the MapReduce processing model – Data replication and weak consistency models	• Explain the techniques used for data fragmentation, replication, and allocation during the distributed database design process [Usage] • Evaluate simple strategies for executing a distributed query to select the strategy that minimizes the amount of data transfer [Usage] • Explain how the two-phase commit protocol is used to deal with committing a transaction that accesses databases stored on multiple nodes [Usage] • Describe distributed concurrency control based on the distinguished copy techniques and the voting method [Usage] • Describe the three levels of software in the client-server model [Usage]
Readings: M. Tamer Ozsu (1999)	

8. Methodology

El profesor del curso presentará clases teóricas de los temas señalados en el programa propiciando la intervención de los alumnos.

El profesor del curso presentará demostraciones para fundamentar clases teóricas.

El profesor y los alumnos realizarán prácticas

Los alumnos deberán asistir a clase habiendo leído lo que el profesor va a presentar. De esta manera se facilitará la comprensión y los estudiantes estarán en mejores condiciones de hacer consultas en clase.

9. Assessment

Continuous Assessment 1 : 20 %

Partial Exam : 30 %

Continuous Assessment 2 : 20 %

Final exam : 30 %

References

Burleson, Donald K. (2004). *Physical Database Design Using Oracle*. CRC Press.
Celko, Joe (2005). *Joe Celko's SQL Programming Style*. Elsevier.
M. Tamer Ozsu, Patrick Valduriez (1999). *Principles of Distributed Database Systems, Second Edition*. Prentice Hall.
Peter Brusilovsky Alfred Kobsa, Julita Vassileva (1998). *Adaptive Hypertext and Hypermedia, First Edition*. Springer.
Philip A. Bernstein, Eric Newcomer (1997). *Principles of Transaction Processing, First Edition*. Morgan Kaufmann.
Ramez Elmasri, Shamkant B. Navathe (2004). *Fundamentals of Database Systems, Fourth Edition*. Addison Wesley.