

**1. Course Code**

2205

**2. Course Title**

G8e:Introduction to the Data Systems and Visualization

**3. Teacher**

WANNOUS, Muhammad

**4. Term**

Fall 3

**5. Course Requirements (Courses / Knowledge prerequisite for this course)**

Course:

[1] Foundations of Computer Systems (2206)

[2] Data Structures and Object Oriented Programming (2291)

Skills

[1] Use of the command-line and IDE

[2] Software installation and setup

[3] Programming (the programming language used is Java)

**6. Course Overview and Objectives**

This course covers database design and uses in applications. It also introduces tools that can help visualize/analyze data. The course starts with SQL statements and continues to describe the relational model. The later part of the course covers topics related to connecting to the database, the NoSQL model, and data visualization. SQLite (<http://sqlite.org/>) is the database engine accompanying this course. The instructor selected it for its ease of installation, popularity, and support for different platforms. Google Datastore ([cloud.google.com › datastore](http://cloud.google.com/datastore)) is the platform on which the NoSQL model will be demonstrated. Google Data Studio (<https://datastudio.google.com>) is the platform we will use for data visualization/analysis.

**7. Course Outline**

- 1 Course orientation and development environment tools and setup
- 2 Introduction to database engines and management systems
- 3 SQL, SQLite (3) engine, dot-commands, and SQLiteStudio
- 4 Database design -the relational model.
- 5 Database design demonstration
- 6 Tables, data types, and single table queries
- 7 Multi-table queries.
- 8 Managing Data, Triggers, Transactions, & Indexing
- 9 Sub-queries, aggregate operations, and case
- 10 Database design exercise
- 11 Views & PRAGMA
- 12 Connecting to a database from an application (JDBC)
- 13 NoSQL database engine
- 14 Data visualization and analysis
- 15 Final project
- 16 Final exam

## 8. Textbooks (Required Books for this course)

For this course, a set of lecture slides, handouts, and reports will be distributed in timely manner.

## 9. Reference Books (optional books for further study)

[1] Getting Started with SQL: A Hand-on Approach for Beginners, Thomas Nield, 1491938617

[2] MySQL, 5th Ed., Paul DuBois, 9780321833877

## 10. Course Goals (Attainment Targets)

- (1) Define a 'database', a 'database management system', and database structure.
- (2) Describe a relational database model and SQL syntax
- (3) Describe the non-relational model
- (4) Use the relational model in designing a database
- (5) Practice querying a database through the command-line and an application
- (6) Practice using a platform to visualize/analyze data.
- (7)
- (8)

## 11. Correspondence relationship between Educational goals and Course goals

Educational goals of the school		Course Goals
High level ICT skills	Basic academic skills	(1) (2) (3)
	Specialized knowledge and literacy	(4) (5) (6)
Human skill (Tankyu skill)	Ability to continually improve own strengths	
	Ability to discover and resolve the problem in society	Problem setting
		Hypothesis planning
		Hypothesis testing
	Fundamental Competencies for Working Persons	Practice
		Ability to step forward
Ability to think through		
Ability to work in a team		
Professional ethics		

## 12. Evaluation

Goals	Evaluation method & point allocation					
	examination	Quiz	Reports	Presentation	Deliverables	Other
(1)	○	○				
(2)	○	○				
(3)	○	○				
(4)	○				○	
(5)	○				○	
(6)	○				○	
Allocation						
(8)						
Allocation	40	30			30	

13. Evaluation Criteria		
Examination	A final exam is intended to assess students' overall understanding and application of the course goals. This is an open-book exam that allows students to locate answers in the subject materials/external resources. <b>The exam consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. and one exercise to design a database and implement the design in SQLite.</b>	
Quiz	This course will include up to three quizzes. Each quiz consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. The questions are to verify the knowledge a student has acquired regarding specific lectures. The quiz is limited in time, but a student can try it twice.	
Reports		
Presentation		
Deliverables	The course includes one exercise and one final projects. The exercise involves designing a database for a specific application. The project is relatively more significant and involves writing an application that connects to a database and performs several functions. The instructor will demonstrate the first database design while students work, individually, on the exercise and the final project. Each student should deliver a PDF file explaining the design of a database in addition to a database file where the design has been implemented. As for the final project, each student should deliver a database file in addition to the working code for the project. The instructor will verify the files on his computer.	
Other		
14. Active Learning		
Hourly percentage of active learning within the whole class time	70%	
1	Active learning such as problem solving assignment using the knowledge and skills acquired in class.	All the time
2	Active learning such as group works and discussions.	Sometimes
3	Outcome presentations and feedbacks.	Not at all

4	Students actively make decisions on how the class should be conducted.	Not at all
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## 15. Notes

This course contains both theoretical and practical parts. Mastering the command-line and the use of an IDE is necessary to complete the exercises.

Quizzes and projects have deadlines and they won't be postponed unless a serious issue occurs.

## 16. Course plan

(Notice) This plan is tentative and might be changed at the time of delivery

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Lesson 1: (Course orientation, Introduction to database)

(Discussion, Lecture 45 minutes, Practice 45 minutes)

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[1] Course syllabus

[2] Grading

[3] Development environment

- + Java Development Kit (JDK)

- + NetBeans IDE

- + SQLite (3)

- + SQLiteStudio

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Lesson 2: (Introduction to database engines and management systems)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Centralized and lightweight databases

- + Server-client database management systems

- + File-based database management systems

[2] Tables (introduction)

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Lesson 3: (SQL, SQLite (3) engine, dot-commands, and SQLiteStudio)

(Lecture 45 minutes, Practice 45 minutes)

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[1] SQL

[2] SQLite

- + Importing a database file

- + dot-commands

- + SQL commands

[3] SQLiteStudio

- + importing a database file

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Lesson 4: (Database design -the relational model.)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Entity Relation Diagram (ERD)

[2] Database entities

[3] Relations

- + 1-1 relation

- + 1-m relation

- + m-m relation

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Lesson 5: (Database design - demonstration)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Entity Relation Diagram (ERD)

+ From the ERD to tables

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Lesson 6: (Tables, data types, and single table queries)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Tables

+ Schema

+ Data types

[2] Single table queries

+ SELECT

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Lesson 7: (Multi-table queries)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Multi table queries

+ SELECT

+ Joins

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Lesson 8: (Managing Data, Triggers, Transactions, & Indexing)

(Discussion, 90 minutes)

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[1] Managing data

+ Insert

+ Delete

+ Update

[2] Triggers

+ Create/delete triggers

[3] Transactions

+ Complete/cancel

[4] Index

+ Create/drop an index

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Lesson 9 : (Sub-queries, aggregate operations, and case)

(Lecture 45 minutes, Practice 45 minutes)

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[1] Sub queries

[2] Aggregation operation

+ AVG, COUNT...

[3] CASE

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Lesson 10 : Database design exercise)

(Lecture 20 minutes, Practice 70 minutes)

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In this session, we will work on one exercise on designing a database for one application.

The lecturer provides the text of the exercise and the students work, individually, on designing the database.

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Lesson 11 : (Views & PRAGMA)

(Lecture 45 minutes, Practice 45 minutes)

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- [1] Views
  - [2] SQLite parameters
    - + .sqliterc
    - + PRAGMA
    - + VACUM

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Lesson 12 : (Connecting to a database from an application (JDBC))

(Coding 90 minutes)

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- [1] JDBC connections.
  - [2] Connecting to a database file in a Java application

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Lesson 13 : (NoSQL database engine)

(Lecture 45 minutes, Practice 45 minutes)

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- [1] NoSQL database
    - + Google Datastore

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Lesson 14 : (Data visualization and analysis)

(Lecture 45 minutes, Practice 45 minutes)

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- [1] Data visualization and coding
    - + Exporting data as CSV in SQLite
    - + Google Data Studio

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Lesson 15 : (Final project & Wrap up)

(Lecture 45 minutes, Practice 45 minutes)

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"In this session, we will work on the final project.

The lecturer provides the text of the final project and the students work, individually, on designing the database and the application that manages it.

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Lesson 16: (Final Exam)

(Final Exam 90 minutes)

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This is an open-book exam that allows students to locate answers in the subject materials/external resources. The exam consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. and one exercise to design a database and implement the design in SQLite.

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