Databases - Introduction

Amos Azaria

Administration

- Lecturers: Amos Azaria and Merav Chkroun
- TAs: Avigail Stekel Chaya Liberman, and Keren Nivasch, Gil Levi
- Classes (4 groups):
  - Tuesdays: 9:00-12:00 and 14:00-15:00 (Amos)
  - Sundays: 9:00-12:00 and Mondays: 11:00-14:00 (Merav)
- Office hour: Tuesdays at 13:00 (11.2.11)

Home Assignments

- Grading policy:
  - 4 Home assignments: Each assignment can add up to 2 bonus points to the final grade.
  - Final Grade: Test + bonus points
- Submission in pairs.
- First home assignment should be published on Monday (you will have 2 weeks to submit it).
- Submission time is always at 23:55.
- No late submission.
- Only a subset of the questions in each assignment will be graded.

Don't copy! Don't share your work! Don't work in groups!

5. **עונשי מינימום**

א. הורשע הסטודנט בהכנסת חומר עזר אסור או החזקתו- עונשו של המורשע לא יפחת מציון 0 בקורס בו בוצעה העבירה והרחקה מהלימודים למשך סמסטר אחד לכל הפחות.

ב. הורשע הסטודנט בהכנסת שינוי כלשהו בבחינה – עונשו של המורשע יכלול הרחקה מהלימודים למשך סמסטר אחד לכל הפחות.

ג. הורשע הסטודנט הונאה בעבודות סמינריוניות או כל מטלה לימודית אחרת – עונשו של המורשע יכלול לפחות ציון 0 בקורס בו בוצעה העבירה והרחקה מהלימודים למשך סמסטר אחד לכל הפחות.

ד. הורשע הסטודנט בפלילים בעבירה שיש עמה קלון הקשורה למעמדו כסטודנט באוניברסיטה - יורחק הסטודנט מלימודים למשך סמסטר אחד לפחות.

Github

- You may not post your assignments to a public repository until after the deadline.
- You may want to consider the usage of Bitbucket instead of Github.

Course Structure

- Relational Databases Management Systems
  - SQL
  - Building databases
  - ERD Entity-Relational-Diagrams (next semseter)
- Java
  - Connecting to MySQL
  - Streams
- Object representation languages:
  - XML (and XSD)
  - JSON
- NoSQL
  - Key-Value Store, Wide-Column Store, Document Store, Graph Store, Search Engines, RDF
- Big Data
  - Spark
- Naïve Bayes and Regression
  - Linear regression
  - Logistic regression

Handling huge amounts of data

What can we do when we need to know what might happen where we don't have data

Relational Databases

Relational Databases

- Relational databases are built from tables (relations), with attributes (columns) and entries (rows).
- Relational data-bases are based upon relational algebra and SQL.
- Most common databases in use:
  - Open Source: MySQL, SQLite, PostgreSQL
  - Proprietary: SQL Server and Oracle.

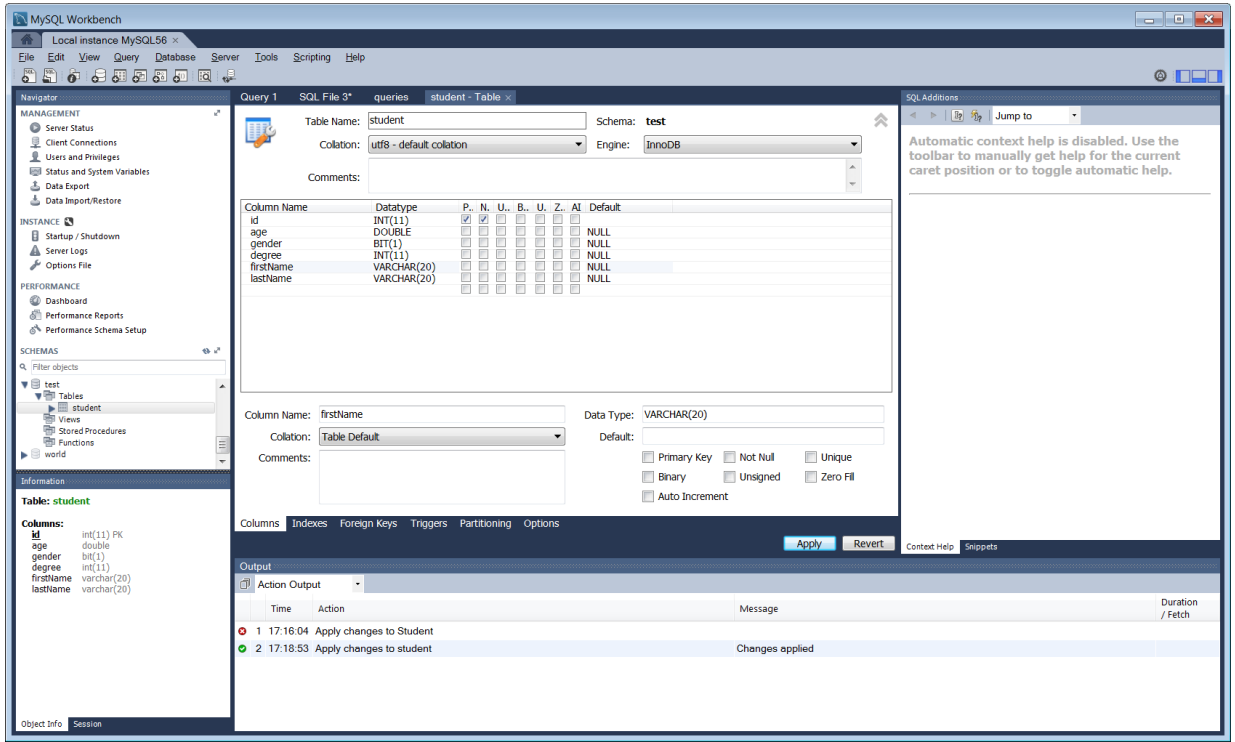
Database management system usage (http://db-engines.com/en/ranking)

343 systems in ranking, February 2019

Rank			DBMS	Database Model	Score		
Feb 2019	Jan 2019	Feb 2018			Feb 2019	Jan 2019	Feb 2018
1.	1.	1.	Oracle	Relational, Multi-model	1264.02	-4.82	-39.26
2.	2.	2.	MySQL	Relational, Multi-model	1167.29	+13.02	-85.18
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	1040.05	-0.21	-81.98
4.	4.	4.	PostgreSQL	Relational, Multi-model	473.56	+7.45	+85.18
5.	5.	5.	MongoDB	Document	395.09	+7.91	+58.67
6.	6.	6.	IBM Db2	Relational, Multi-model	179.42	-0.43	-10.55
7.	7.	↑ 8.	Redis	Key-value, Multi-model	149.45	+0.43	+22.43
8.	8.	↑ 9.	Elasticsearch	Search engine, Multi-model	145.25	+1.81	+19.93
9.	9.	↓ 7.	Microsoft Access	Relational	144.02	+2.41	+13.95
10.	10.	↑ 11.	SQLite	Relational	126.17	-0.63	+8.89
11.	11.	↓ 10.	Cassandra	Wide column	123.37	+0.39	+0.59
12.	↑ 13.	↑ 17.	MariaDB	Relational, Multi-model	83.42	+4.60	+21.77
13.	↓ 12.	13.	Splunk	Search engine	82.81	+1.39	+15.55
14.	14.	↓ 12.	Teradata	Relational	75.97	-0.22	+2.98
15.	15.	↑ 18.	Hive	Relational	72.29	+2.38	+17.23
16.	16.	↓ 14.	Solr	Search engine	60.96	-0.52	-2.91
17.	17.	↓ 16.	HBase	Wide column	60.28	-0.12	-1.43

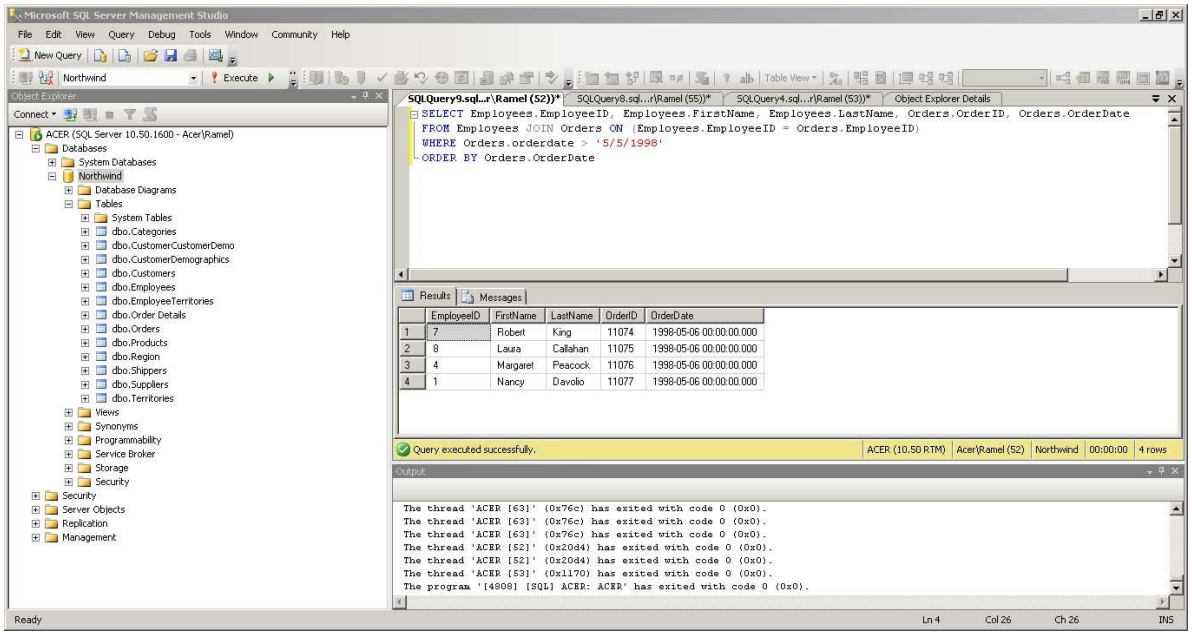
My SQL

- Open source
- Used a lot in the industry
- Workbench GUI



SQL Server

- Proprietary (Microsoft) but used a lot in the industry as well.
- SQL Management GUI
  - Will be used in the tutorials.



MySQL Installation

- Go to https://dev.mysql.com/downloads/installer/, download the installer (scroll down and click the download button) and install:
  - MySQL Server
  - MySQL Workbench: A GUI that allows us to query the DB and presents the results.
  - MySQL Connectors:
    - JDBC Driver for MySQL (Connector/J): Allows us to connect to the DB from JAVA.
    - [ADO.NET Driver for MySQL (Connector/NET)]
- You might also need to install Visual C++ Redistributable for Visual Studio 2015 from: https://www.microsoft.com/en-us/download/details.aspx?id=48145

ACID

Actions on a relational database are batched in transactions.

- **A**tomicity: each transaction is either executed in full, or not executed at all.
- **C**onsistency: database remains consistent. Transaction does not violate any integrity constraints during its execution (if a transaction leaves the database in an illegal state, it is unrolled).
- **I**solation: the DBMS can execute many transactions in parallel, as long as the result is identical to a sequential execution.
- **D**urability: a committed transaction always remains in database even in case of sudden power shortage or hardware/software failure etc.