SQL and Relational Databases

* Database
  + A way to store information
  + Persist information into some kind of physical medium
    - You can turn the power off and the information is still there
    - Magnetic tape, ssd card, disk drive, cuneiform tablet
  + Relational database
    - Stores information in tables referencing other tables
    - Oracle
    - MariaDB
    - MySQL
    - Postgres
    - Microsoft SQL server
  + NoSQL databases
    - Document based
    - MongoDB

Relational Database

* Data is stored in tables
* Tables can reference other tables
* ERD (Entity Relationship Diagram)
  + Stitches together how the different entities relate to each other
* Tables store information
  + Columns are the attributes
  + Rows are the records

|  |  |  |  |
| --- | --- | --- | --- |
| FIRST\_NAME | LAST\_NAME | AGE | GRADE |
| Tim | Stevens | 12 | 5 |
| Jessica | Smith | 15 | 9 |

Normalization

* Process of eliminating redundancy in your database
* Often increases optimization of things like insertions and deletions but can make your data more difficult to retrieve
* Will decrease the overall size of your database (in gigabytes)

1nf (first normalized form)

* All records are uniquely identifiable
  + All records should have a primary key
  + A primary key is a unique value for every record in the table
  + Used to enforce that each record is distinct
* All data in a column should be atomic
  + Cannot be broken down into more useful bit of information

(Not a normalized table)

|  |  |  |
| --- | --- | --- |
| NAME | AGE | GRADE |
| Timothy Smith | 12 | 5 |
| Timothy Smith | 12 | 5 |
| Janet Harrison | 13 | 6 |

(A table in 1nf)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| STUDENT\_ID | FIRST\_NAME | LAST\_NAME | AGE | GRADE |
| 101 | Timothy | Smith | 12 | 5 |
| 102 | Timothy | Smith | 12 | 5 |
| 202 | Janet | Harrison | 13 | 6 |

2nf

* In 1nf
* You have no functional dependencies in your table
  + You should have no column that you could calculate using other columns
* Could I calculate this value?

(not in 2nd nf because shooting percentage could be calculated)

|  |  |  |  |
| --- | --- | --- | --- |
| PLAYER\_ID | ATTEMPTS | MADE | SHOOTING\_PERCENTAGE |
| 1001 | 50 | 25 | 50 |
| 1005 | 200 | 20 | 10 |
| 1006 | 50 | 40 | 80 |
| 1002 | 100 | 30 | 30 |
|  |  |  |  |

3nf

* Has to be in 2nd normalized form
* No transitive dependencies
  + You cannot find that information elsewhere in the database

SQL (Structured Query Language)

* Programming language used by relational databases
* From the 60’s \*\*\* Not sure
* Scripting language
  + Not compiled
  + Programming language
  + \*Scripting language tells the machine what to do\*
  + You can run it in separate chunks in any order
* Englishy

Multiplicities

* Relationships between your entities
* 3 types
  + 1 -1
    - Every record in one tables matches to one and only one record in another table
    - Ex tax to employee
  + 1-many
    - One record can match to many records in one table.
    - School – Student (1-many)
    - Team – player
    - Department - employee
  + Many-many
    - Many records in one table match to many records in another table
    - Junction table
    - Student – class
    - Game - player

Placing Foreign Keys

* The foreign key goes on the child record
  + The many in a one to many
* A Parent must exist before a child record can be add
  + You must have a sales department before you can have a child record reference the sales department
* The column that you place a foreign key does not have to be unique. However the foreign key must reference a column that is unique