

# Database Systems

CSCE 413/813

Final Project

Fall 2023

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The final project has the following components.

1. (15 points) **Goals.** Describe the final project's goals. In particular, you need to describe who are the expected users and what service you provide for them. For example, in a travel database system the customers are the potential travelers and the service provided is to find travel paths and reservations for flights.
2. (25 points) **Database Design and Data.** Draw an entity relationship diagram for your database. Translate your entity relationship diagram into a database scheme with at least five tables. Your design and database needs to group similar items together. For example, a House relation should contain several houses instead of representing each house as a separate table. For each table find suitable (raw) data from the internet or any publication in the library or by creating your own data. Your data need to include one of the following:
  - (a) Some spatial objects represented in the vector data model extended with time instances when those objects existed. (If you have a jpeg image of a spatial object, then you can define a polygon to approximate its shape.)
  - (b) A time series data of the form  $(x_1, y_1), \dots, (x_n, y_n)$ .
  - (c) Some measurement data over a set of points on a map.
  - (d) Some moving objects data.
  - (e) Some data with classification information.
3. (30 points total) **Define Three Functions.** Define three high-level functions that would be desirable to provide for your users. At least one of the three functions should be of the following type:
  - (a) Given the id of a spatial object  $S$ , find which other spatial objects intersect with  $S$ 's area at any given time.
  - (b) Given a time instance, find an estimate of the value for a function at that time.
  - (c) Given a point location, find an estimate of the measurement value at that location.
  - (d) Given a time instance and the id of a moving object, find the location of the moving object at that time.

- (e) Given the data with classification information, build a SVM or decision tree classifier.

4. (120 points total) **Implementation.**

Represent your data as an MLPQ data file. You can use the MATLAB scripts to transform your data from the original format to an MLPQ input file. Then implement the defined functions using MLPQ SQL queries. In particular, we provide MATLAB scripts for the following:

- Points of a polygon on a jpeg image to constraint relation: I2V2C.m
- Vector representation of a polygon to a constraint relation: Vect2Constraints.m
- Piecewise linear approximation: pline.m
- TIN interpolation: TINfunction.m

In addition to the MATLAB scripts, you may find programs that find the hyperplane of SVMs or decision trees.

5. (10 points) **Class Presentation.** Each project needs to be presented in the class. The project does not need to be completed by the time of the class presentation. However, the more complete is your project the more interesting comments and suggestions you could receive from your fellow students.
6. (**Bonus, 10 points**) You can get up to five points bonus by doing *one or two* of the five choices below. Bonus points have to be limited to a maximum of ten points.
- (a) Visualization of a geographic or spatial object, such as a map.
  - (b) Animation which shows spatio-temporal or moving objects.
  - (c) Animation which shows moving objects with changing shape.
  - (d) Animation which shows color change of several components.
  - (e) Make a YouTube video that can be shared via a Playlist and send us the link. Make sure the video is not specified as made for kids but for a general audience.