

Database Design

CmpE 226

Practice Problems

Practice Problem (10)

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1. Design a database with at least 10-12 of tables or ((**constraint tables. The constraint tables should use the full power of linear constraints. (For example, the equality constraint $x = 1$ does not use the full power of linear constraints. So don't use only equality constraints in your database.**)) The tables should contain a reasonable number of tuples or (**constraint tuples**), not too few and not too many.
 2. Prepare traditional class diagram for the following problems showing at least 10 relationships among the following object classes, including associations, aggregations, and generalizations. Show multiplicities in your diagrams. Your model should have 3-5 attributes and 3-5 operations per class. Use association and role names when needed. As you prepare the diagrams, you may add additional object classes.
 3. **If you use MLPQ**, find at least 4 iconic queries or sequence of iconic queries. Explain what they mean and write them down in the style of the examples in the MLPQ system manual. (**Iconic queries are shown in Figure 1 MLPQ Graphical Interface in the MLPQ Specifications, such as Intersection, Union, Difference, Max, Min, etc.**)
 4. Find at least 4 SQL queries of each of the following kind: **Basic, Aggregation, Sets, and Nested.** (That is, a total of 16 queries.)
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A solution to track spread of Genetically modified Organism

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Abstract.....	3
Description of domain.....	3
Description of the program and sample queries.....	4
Detailed Requirements.....	4
Relation or entities' names and attributes.....	5
Landscape: location, elevation, forest density.....	5
Climate: location, time, rainfall, temperature, wind, humidity.....	5
Animal: location, time, average number present per area of land.....	5
Land cultivated: physical boundaries of plots of land under GMO cultivation, time.....	5
Herbicide Usage: plot of land, total herbicide used, season.....	6
GMO Crop Yield: plot of land, total crop yield, season.....	6
GMO Contamination: percentage GMO plant, location of test site.....	6
Herbicide-resistant wild weeds: plot of GMO cultivated land, frequency of occurrence.....	6
Superweed: frequency of occurrence, location.....	6

Abstract

Biotechnology has lots of new and upcoming research being conducted on agricultural products and lot of work has already been done in genetic engineering of agricultural products. The goal of this program is to collect and analyze available information about cultivation of a particular genetically modified organism, its spread, and conditions affecting the spread. Information about area under cultivation, landscape, climate, animals affecting spread of seed and pollen, use of herbicides, crop yield, GMO contamination, occurrence of superweeds, will be stored in our database.

We propose to design a database to record and analyze the undesirable spread of a specific genetically modified organism in the United States. We choose a crop that has been engineered to tolerate a specific herbicide. Our database would contain available or easily obtainable information related to the undesirable spread of this GMO crop.

Description of domain

Biotechnology is a relatively new and quickly growing area of research and development. Large biotech companies invest resources into developing agricultural products with certain desirable properties. Modern technology allows scientists to take a desirable gene from one organism and insert it into another organism, producing an organism that does not exist in nature. The so-called "first generation" of genetically-modified (GMO) agricultural crops has been engineered to either tolerate specific herbicides or resist pests. Such properties make it easier for farmers to grow these crops.

The first GMO crop was marketed in the United States in 1996. Since then, cultivation of GMO agricultural crops in the US has been rapidly expanding. Today the US produces two thirds of the world's production of GMO crops. Most of the corn, soybeans, and cotton cultivated in the US are from the genetically modified variety.

Because the technology is relatively new and untested, many GMO crops have been marketed prematurely and are still considered unsafe and banned by many countries outside the US. Some of the unforeseen consequences of consumption and use of GMO products are allergic reactions in humans and animals, other health concerns, disappearance of some insects in areas where GMO plants are cultivated, which could potentially have severe ecological consequences.

Many scientists consider the introduction of GMO plants into the environment to be irreversible. Seeds or pollen of these plants can easily spread outside the area of cultivation with the help of wind, animals, and other environmental factors. Below are listed some of the consequences of the uncontrollable spread of genetically modified organisms:

- 1) **Endangering organic agriculture.** Many farmers market their produce as being "natural" or "GMO free." The organic status of these farms could be endangered by

the spread of GMO organisms. Seed developers are also concerned about contamination of their seeds with genes from GMO strains.

- 2) **Risk to US Export.** Other countries may refuse to buy any US crop for the fear that all of it may be contaminated (as in the case of Japan refusing to buy US rice).
- 3) **Occurrence of Superweeds.** Most GMO plants are engineered to resist a specific herbicide, so that other weeds may be killed, while leaving the GMO plant unharmed. In order to kill the GMO plant, if desired, a different herbicide is used. Some wild weeds are naturally resistant to the herbicide used to control GMO plants. It is possible that the GMO plant cross-pollinates with these wild weeds, producing hybrids, known as superweeds, resistant to both herbicides. It becomes more difficult to kill these hybrids, requiring more and different varieties of herbicides

Description of the program and sample queries.

We propose to design a database to record and analyze the undesirable spread of a specific genetically modified organism in the United States. We choose a crop that has been engineered to tolerate a specific herbicide. Our database would contain available or easily obtainable information related to the undesirable spread of this GMO crop.

The goals of this program are to collect and analyze available information about cultivation of a particular genetically modified organism, its spread, and conditions affecting the spread. Information about area under cultivation, landscape, climate, animals affecting spread of seed and pollen, use of herbicides, crop yield, GMO contamination, occurrence of superweeds, will be stored in our database. After designing the database we should be able to use queries to answer the following questions:

- 1) How do physical boundaries affect the spread of GMO organism?
- 2) How does the use of herbicide change as a result of continued GMO cultivation?
- 3) How does climate affect yield and spread of GMO?
- 4) What are the areas that are least likely to be contaminated?
- 5) What is the relationship between the use of herbicide and the occurrence of superweeds?
- 6) What is the level of GMO contamination and how quickly is it changing?
- 7) What is the relationship between seasonal behavior of particular animals and the spread of GMO crops?