Semester Project – Database 2023-2024

National Technical University of Athens
School of Electrical and Computer Engineering
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Databases – Semester Project

I. Assignment Description

A popular cooking competition has requested you to design and implement a system for storing and managing the information required for its operation regarding recipes, ingredients, and equipment necessary for the competition.

Through the corresponding application, the competition aims to handle cooking and pastry recipes. Each recipe belongs to either cooking or pastry. Additionally, it is categorized under a specific national cuisine (e.g., French, Italian) and has a difficulty level (e.g., very easy = 1, easy = 2, medium = 3, difficult = 4, very difficult = 5).

Each recipe has a name, a short description, and belongs to one or more meal types (e.g., breakfast, brunch, lunch, afternoon snack, dinner). The competition also wants each recipe to be classified with additional, unlimited meal-type tags (e.g., brunch, quick-lunch, cold dish) and potentially include up to three useful tips (e.g., "Can be stored in the fridge for up to 3 days").

The execution of a recipe requires specific equipment/tools (e.g., bowl, sieve, blender, whisk) regardless of quantity (e.g., 3 blenders). Each piece of equipment/tool comes with usage instructions (e.g., "The whisk is used when we want to add volume to a mixture").

The total execution time of a recipe is divided into preparation time and cooking time. Each recipe consists of one or more steps that must be performed sequentially. Each step describes what the cook must do (e.g., "In a bowl, place the eggs and whisk them"). Once all steps are completed, the final dish yields specific portions (e.g., 2 servings).

Each recipe requires specific ingredients in varying quantities (e.g., 100g feta cheese, 2 eggs, 1 tbsp oil, some pepper, a little flour). The ingredients used in recipes (food items) are categorized into Food Groups. For these groups, you may use either the National

Food and Drink Code or classifications from the Institute of Preventive, Environmental, and Occupational Medicine. Each food group has a name and description.

Each recipe has only one main ingredient. Based on this main ingredient, the recipe is classified accordingly (e.g., if the main ingredient belongs to the "Various Plant-Based Foods" category, the recipe is classified as vegetarian; if the main ingredient falls under "Fish and Seafood," it is categorized as seafood).

Each recipe may have nutritional information, including grams of fat, protein, and carbohydrates per serving, as well as the calorie count per serving. Calories per serving should be dynamically calculated based on the individual calories and ratios of ingredients since foods have specific calorie values per 100g or ml (e.g., strawberries = 24 calories per 100g).

The competition organizes recipes into thematic categories (e.g., Village Recipes, Risotto Recipes, Easter Desserts). Each recipe may belong to one or more such categories. Each category has a name (e.g., "Easter Desserts") and a description (e.g., "Ideal for the Easter table").

Each recipe is associated with one or more chefs who can execute it. Each chef has a first name, last name, contact number, date of birth, age, years of professional experience, and specialization in one or more national cuisines. Additionally, they have a professional ranking: Junior Chef, Chef de Partie, Sous Chef, Assistant Head Chef, or Head Chef (Executive Chef).

The competition consists of 10 annual episodes. In each episode, the system randomly selects:

- 10 national cuisines
- 10 chefs representing each cuisine
- 3 judges
- 1 recipe per national cuisine, assigned to a chef

(No chef, judge, cuisine, or recipe can participate in more than three consecutive episodes. Each participating chef is assigned a recipe they must execute.)

Each chef executes their assigned recipe and is graded by the three judges on a scale of 1 to 5. The chef with the highest total score is declared the winner. In the case of a tie, the chef with the highest professional ranking wins. If there is still a tie, the winner is chosen randomly.

All entities stored in the application must have corresponding images (e.g., images for food groups, categories, recipes, ingredients, chefs, episodes, equipment, etc.). Each

image must have a textual description of what it depicts (e.g., "Banana Protein Smoothie").

Application Users

Each user must be authenticated (via username/password) upon accessing the application.

- **Administrator**: Registers and modifies all required data. Can create and restore database backups.
- **Chef**: Can edit all details of recipes assigned to them and add new recipes. They can also edit their personal details but cannot modify other system data (e.g., recipes not assigned to them).

Since the competition may not have fully specified the data/information requirements and reports, you must document all system specifications in detail, along with your assumptions.

You must insert data into the database for all entities. The database must have sufficient data to ensure all queries execute successfully and return appropriate information. If a query returns no data, it will not be graded. Indicatively, the database should include:

- **50+ recipes**
- **100+ ingredients**
- **50+ chefs**
- **50+ episodes**

You may use resources such as the **Airtable Recipe Database**.

II. Requirements & Deliverables

1. (10%) ER Diagram

Design an **Entity-Relationship (ER) Diagram** based on the above description.

2. (20%) Relational Schema & Database Development

Design the relational schema and develop the database.

- **2.1. (5%) Define all necessary constraints** ensuring database correctness (integrity constraints, keys, referential integrity, domain constraints, and user-defined constraints).
- **2.2. (5%) Define appropriate indexes** for database tables and justify their selection based on query performance.

3. (60%) Query Implementation

Implement SQL queries for the following tasks (each weighted equally):

1. Average rating per chef and national cuisine.
2. Chefs by national cuisine and year, and their participation in episodes.
3. Young chefs (<30 years) with the most recipes.
4. Chefs who have never acted as judges.
5. Judges appearing in the same number of episodes within a year (3+ appearances).
6. Top-3 recipe tag pairs appearing together in episodes.
7. Chefs with at least 5 fewer episode participations than the most frequent chef.
8. Episode with the most equipment used.
9. Average carbohydrate grams per year in the competition.
10. National cuisines with the same participation in two consecutive years (3+ per year).
11. Top-5 judges giving the highest ratings to a chef.
12. Most technically difficult episode per year.
13. Episode with the lowest professional rating (judges & chefs).
14. Most frequently appearing thematic category.
15. Food groups that have never appeared in the competition.

Deadlines & Evaluation

- **Team Registration Deadline:** April 1, 2024 (max 3 members per team)
- **Submission Deadline:** May 26, 2024 (no extensions)
- **Application Demonstration:** May 27–31, 2024
- **Programming Languages:** MySQL (MariaDB), PostgreSQL, PHP, Java, Python, Node.js (No ORM allowed)
- **Final Submission:** Includes SQL scripts, ER diagram, documentation, installation steps, and Git repository.
- **Strict plagiarism policy:** Any copied work will receive zero marks.