

Lab work 1

Database Design. Introduction to SQL.

Full Name: Daniil Kalts.

Group: IT2-2404SE.

Goal: Perform a subject area analysis for a University Database.

Task:

1. Describe at least 7 tables to store in the Database.
 2. Describe attributes for each table in the Database.
 3. Make sure that the Database has 5 constrained attributes.
 4. Describe relations between entities in the Database.
 5. Describe 2 access rights groups in the Database.
 6. Provide 10-15 queries for the Database.
-

1. What tables does the Database store?

1. The Database includes the following tables:

1. **faculties**
2. **departments**
3. **programs**
4. **subjects**
5. **program_subject**
6. **roles**
7. **persons**
8. **phone_numbers**
9. **dean_faculty**
10. **groups**
11. **student_group**
12. **buildings**
13. **classrooms**
14. **schedules**
15. **assignments**

16. **student_assignment**

17. **clubs**

18. **student_club**

2. What attributes does the Database store?

2. The Database includes the attributes tables:

1. **faculties:**

- faculty_id (PK)
- name
- description

2. **departments:**

- department_id (PK)
- faculty_id (FK to faculties.faculty_id)
- name
- description

3. **programs:**

- program_id (PK)
- department_id (FK to departments.department_id)
- name
- description

4. **subjects:**

- subject_id (PK)
- name
- description
- credits

5. **program_subject:**

- program_id (FK to programs.program_id)
- subject_id (FK to subjects.subject_id)
- PRIMARY KEY (program_id, subject_id)

6. **roles:**

- role_id (PK)
- name
- description

7. **persons:**

- person_id (PK)
- role_id (FK to roles.role_id)
- first_name
- last_name
- patronymic

- o gender
- o birth_date
- o nationality
- o citizenship
- o email
- o iin
- o address
- o education

8. phone_numbers:

- o phone_id (PK)
- o person_id (FK to persons.person_id)
- o phone_number (must follow Kazakhstan format: +7 followed by 10 digits)

9. dean_faculty:

- o dean_id (FK to persons.person_id)
- o faculty_id (FK to faculties.faculty_id)
- o PRIMARY KEY (dean_id, faculty_id)

10. groups:

- o group_id (PK)
- o head_student_id (FK to persons.person_id)
- o curator_id (FK to persons.person_id)
- o course_year
- o name

11. student_group:

- o student_id (FK to persons.person_id)
- o group_id (FK to groups.group_id)
- o PRIMARY KEY (student_id, group_id)

12. buildings:

- o building_id (PK)
- o name
- o description
- o address
- o floor_count

13. classrooms:

- o classroom_id (PK)
- o building_id (FK to buildings.building_id)
- o name
- o description
- o floor_number
- o capacity

14. schedules:

- o schedule_id (PK)
- o group_id (FK to groups.group_id)
- o subject_id (FK to subjects.subject_id)
- o teacher_id (FK to persons.person_id)

- classroom_id (FK to classrooms.classroom_id)
- weekday
- start_time
- end_time

15. assignments:

- assignment_id (PK)
- schedule_id (FK to schedules.schedule_id)
- name
- description
- deadline

16. student_assignment:

- student_id (FK to persons.person_id)
- assignment_id (FK to assignments.assignment_id)
- score
- PRIMARY KEY (student_id, assignment_id)

17. clubs:

- club_id (PK)
- name
- description
- founded_date

18. student_club:

- student_id (FK to persons.person_id)
- club_id (FK to clubs.club_id)
- PRIMARY KEY (student_id, club_id)

3. What constrained attributes does the Database have?

3. Constrained attributes of each table:

1. faculties:

- **name:** 5-100 characters.
- **description:** 20-500 characters.

2. departments:

- **name:** 5-100 characters.
- **description:** 20-500 characters.

3. programs:

- **name:** 5-100 characters.
- **description:** 20-500 characters.

4. subjects:

- **name:** 5-50 characters.
- **description:** 20-250 characters.

- **credits:** Must be between 1 and 10.

5. **roles:**

- **name:** Must be one of the following: student, teacher, dean, head_student, head_department, rector.
- **description:** 10-250 characters.

6. **persons:**

- **first_name:** 2-100 characters.
- **last_name:** 2-100 characters.
- **patronymic:** 2-100 characters.
- **gender:** Must be either MALE, FEMALE, or OTHER.
- **birth_date:** Valid date; age must be between 17 and 70 (depending on role).
- **email:** Must be in valid email format.
- **iin:** Exactly 12 digits.
- **address:** 10-100 characters.
- **education:** 20-200 characters.

7. **phone_numbers:**

- **phone_number:** Must follow Kazakhstan format: +7 followed by 10 digits.

8. **groups:**

- **name:** 6-20 characters.
- **course_year:** Must be between 1 and 4.

9. **buildings:**

- **name:** 5-100 characters.
- **description:** 20-500 characters.
- **address:** 10-100 characters.
- **floor_count:** Must be between 1 and 50.

10. **classrooms:**

- **name:** 5-100 characters.
- **description:** 20-200 characters.
- **floor_number:** Must be between 1 and the total number of floors in the building.
- **capacity:** Must be between 5 and 100.

11. **schedules:**

- **weekday:** Must be one of the days Monday to Sunday.
- **start_time:** Must be in valid 24-hour time format (HH:MM:SS).
- **end_time:** Must be in valid 24-hour time format (HH:MM:SS) and must occur after **start_time** on the same day.

12. **assignments:**

- **name:** 5-40 characters.
- **description:** 15-100 characters.
- **deadline:** Must be a valid date.

13. **student_assignment:**

- **score:** Must be between 0 and 10.

14. **clubs:**

- **name:** 5-100 characters.
- **description:** 20-500 characters.
- **founded_date:** Must be a valid date in the past.

4. What relations between tables does the Database have?

4. Relations between tables:

1. faculties:

- **faculties - departments** (one-to-many)
- **faculties - dean_faculty** (one-to-one)

2. departments:

- **departments - programs** (one-to-many)

3. persons:

- **persons - phone_numbers** (one-to-many)
- **persons - groups** (many-to-one)
- **persons - clubs** (many-to-many)
- **persons - assignments** (many-to-many)
- **persons - dean_faculty** (one-to-one)

4. programs:

- **programs - program_subject** (one-to-many)
- **programs - subjects** (many-to-many through program_subject)

5. schedules:

- **schedules - assignments** (many-to-one)
- **schedules - classrooms** (many-to-one)
- **schedules - persons (teachers)** (many-to-one)
- **schedules - groups** (many-to-one)

6. classrooms:

- **classrooms - buildings** (many-to-one)

5. What access rights groups does the Database have?

5. Access rights groups of the Database:

-
- **User Group 1:** Students
 - **User Group 2:** Teachers
 - **User Group 3:** Head Department
 - **User Group 4:** Deans
 - **User Group 5:** Rector
-

1. faculties:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - rw (read-write, can override subjects related to their faculty)
- o Rector - rw (read-write)

2. departments:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - rw (read-write, can override department related to their department)
- o Deans - rw (read-write, can override department related to their faculty)
- o Rector - rw (read-write)

3. programs:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - rw (read-write, can override program related to their department)
- o Deans - rw (read-write, can override program related to their faculty)
- o Rector - rw (read-write)

4. subjects:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - rw (read-write, can override subject related to their department)
- o Deans - rw (read-write, can override subject related to their faculty)
- o Rector - rw (read-write)

5. roles:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - ro (read-only)
- o Rector - rw (read-write, can assign roles)

6. persons:

- o Students - rw (read-write for their own data)
- o Teachers - rw (read-write for their own data)
- o Head Department - rw (read-write for their own data)
- o Deans - rw (read-write for their own data)
- o Rector - rw (read-write for their own data)

7. phone_numbers:

- o Students - rw (read-write for their own data)
- o Teachers - rw (read-write for their own data)
- o Head Department - rw (read-write for their own data)
- o Deans - rw (read-write for their own data)
- o Rector - rw (read-write for their own data)

8. dean_faculty:

- o Students - ro (read-only)
- o Teachers - ro (read-only)

- o Head Department - ro (read-only)
- o Deans - ro (read-only)
- o Rector - rw (read-write)

9. groups:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - rw (read-write, can override groups related to their departments)
- o Deans - rw (read-write, can override groups related to their faculties)
- o Rector - rw (read-write)

10. buildings:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - ro (read-only)
- o Rector - rw (read-write)

11. classrooms:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - ro (read-only)
- o Rector - rw (read-write)

12. schedules:

- o Students - ro (read-only)
- o Teachers - rw (read-write, can override schedules related to their subjects)
- o Head Department - rw (read-write, can override schedules related to their departments)
- o Deans - rw (read-write, can override schedules related to their faculties)
- o Rector - rw (read-write)

13. assignments:

- o Students - ro (read-only)
- o Teachers - rw (read-write, can give assignments related to their subjects)
- o Head Department - rw (read-write, can override assignments related to their departments)
- o Deans - rw (read-write, can override assignments related to their faculties)
- o Rector - rw (read-write)

14. student_assignment:

- o Students - rw (read-write for their own data)
- o Teachers - rw (read-write, can override assignments related to their departments)
- o Head Department - rw (read-write, can override assignments related to their departments)
- o Deans - rw (read-write, can override assignments related to their faculties)
- o Rector - rw (read-write)

15. clubs:

- o Students - ro (read-only)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - ro (read-only)

- o Rector - rw (read-write)

16. student_club:

- o Students - rw (read-write for their own data)
- o Teachers - ro (read-only)
- o Head Department - ro (read-only)
- o Deans - ro (read-only)
- o Rector - rw (read-write)

6. What are potential queries for the Database?

6. The Database may have the following queries:

1. List all faculties along with their departments.
2. List all students enrolled in the Cyber Security program.
3. List all subjects with more than 3 credits.
4. List all students with a GPA below 50%.
5. List all assignments due next week.
6. List all teachers assigned to the Database Design subject.
7. List all groups with their corresponding head students.
8. List all classrooms that have a capacity greater than 30.
9. List the names of all clubs along with their founding dates.
10. List all students who are in the same group as a specific student.
11. List all buildings with more than 5 floors.
12. List all students who are enrolled in more than one group.
13. List all subjects that are not scheduled for any groups this semester.
14. List all assignments related to a specific subject.
15. List the average score of students for each assignment.

Thank you for your time!