

Lab work 1

Database Design. Introduction to SQL.

Full Name: Daniil Kalts.

Group: IT2-2404.

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

Task:

Provide a description of the future Database according to the following plan:

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** – What's the info about the faculties?
2. **departments** – What departments are there within the faculties?
3. **deans** – Who are the head administrators managing the faculties and departments?
4. **educational_programs** – Which programs are offered in each department?
5. **courses** – What courses can students take in the programs?
6. **semesters** – When do the semesters for these courses start and end?
7. **teacher_subject_semesters** – Which teachers are assigned to which subjects in specific semesters, and what roles do they have?
8. **subjects** – What subjects are included in the courses?
9. **teachers** – Who are the teachers for the subjects?
10. **students** – Who are the students taking these subjects?
11. **groups** – What student groups are formed for the subjects?
12. **student_groups** – Which students are in which groups?
13. **buildings** – Where are the buildings located?
14. **classrooms** – What are the classrooms for the scheduled subjects?
15. **schedule** – When and where do the classes happen?
16. **assignments** – What assignments are given to the groups?
17. **exams** – What exams do students have to take?
18. **lab_works** – What lab work are students assigned?
19. **quizzes** – What quizzes do students have to complete?
20. **attendance** – How is attendance tracked for students in subjects?
21. **clubs** – What clubs can students join?
22. **students_clubs** – Which students are in which clubs?

2. What attributes does each table have?

2. Each table contains the following attributes:

1. faculties:

- **id:** What's the faculty ID?
- **name:** What's the faculty name?
- **description:** What's the faculty description?

2. departments:

- **id:** What's the department ID?
- **faculty_id:** Which faculty does this department belong to?
- **name:** What's the department name?
- **description:** What's the department description?

3. deans:

- **id:** What's the dean's ID?
- **name:** What's the name of the dean?
- **surname:** What's the dean's surname?
- **patronymic:** What's the dean's patronymic?
- **gender:** What's the gender of the dean?
- **birth_date:** When was the dean born?
- **nationality:** What's the dean's nationality?
- **citizenship:** What's the dean's citizenship?
- **department_id:** Which department does the dean belong to?
- **phone_number:** What's the dean's phone number?
- **email:** What's the dean's email address?
- **experience:** How many years of experience does the dean have?
- **education:** What's the dean's educational background?
- **position:** What's the title or position of the dean?
- **address:** What's the address of the dean?
- **created_at:** When was this dean's record created?
- **updated_at:** When was this dean's record last updated?

4. educational_programs:

- **id:** What's the program ID?
- **faculty_id:** Which faculty does this program belong to?
- **department_id:** Which department does this program belong to?
- **name:** What's the program name?
- **description:** What's the program description?
- **type:** What's the type of program?
- **credits:** How many credits does this program have?
- **study_duration:** How long is the program?

5. courses:

- **id:** What's the course ID?
- **educational_program_id:** Which educational program does this course belong to?
- **name:** What's the course name?
- **description:** What's the course description?
- **year_of_study:** What's the year of study for this course?
- **price:** What's the course price?

6. semesters:

- **id:** What's the semester ID?
- **course_id:** Which course does this semester belong to?
- **start_date:** When does the semester start?
- **end_date:** When does the semester end?
- **semester_half:** What's the semester half?

7. subjects:

- **id:** What's the subject ID?

- **educational_program_id:** Which educational program does this subject belong to?
- **semester_id:** Which semester does this subject belong to?
- **name:** What's the subject name?
- **description:** What's the subject description?
- **credits:** How many credits does this subject have?
- **lecture_hours:** How many lecture hours does this subject have?
- **lab_hours:** How many lab hours does this subject have?

8. teachers:

- **id:** What's the teacher ID?
- **educational_program_id:** Which program does this teacher belong to?
- **semester_id:** Which semester does this teacher belong to?
- **name:** What's the teacher's name?
- **surname:** What's the teacher's surname?
- **patronymic:** What's the teacher's patronymic?
- **gender:** What's the teacher's gender?
- **birth_date:** When was the teacher born?
- **nationality:** What's the teacher's nationality?
- **citizenship:** What's the teacher's citizenship?
- **phone_number:** What's the teacher's phone number?
- **email:** What's the teacher's email address?
- **experience:** How many years of experience does the teacher have?
- **education:** What's the teacher's educational background?
- **position:** What's the teacher's position?
- **iin:** What's the teacher's national ID number?
- **address:** What's the teacher's address?
- **created_at:** When was this teacher record created?
- **updated_at:** When was this teacher record last updated?

9. teacher_subject_semesters:

- **id:** What's the record ID?
- **teacher_id:** Which teacher is assigned to the subject and semester?
- **subject_id:** Which subject is this for?
- **semester_id:** Which semester is this assignment for?
- **role:** What's the teacher's role (lecture or lab)?

10. students:

- **id:** What's the student ID?
- **semester_id:** Which course does this student belong to?
- **name:** What's the student's name?
- **surname:** What's the student's surname?
- **patronymic:** What's the student's patronymic?
- **gender:** What's the student's gender?
- **birth_date:** When was the student born?
- **nationality:** What's the student's nationality?
- **citizenship:** What's the student's citizenship?
- **phone_number:** What's the student's phone number?
- **email:** What's the student's email?
- **iin:** What's the student's national ID number?
- **address:** What's the student's address?
- **created_at:** When was this student record created?
- **updated_at:** When was this student record last updated?

11. groups:

- **id:** What's the group ID?
- **semester_id:** Which course does this group belong to?
- **name:** What's the group name?
- **student_count:** How many students are in this group?

- **created_at:** When was this group record created?
 - **updated_at:** When was this group record last updated?
12. **student_groups:**
- **student_id:** Which student belongs to this group?
 - **group_id:** Which group is the student assigned to?
13. **buildings:**
- **id:** What's the building ID?
 - **name:** What's the building's name?
 - **description:** What's the building's description?
 - **address:** What's the building's address?
 - **floors:** How many floors does the building have?
14. **classrooms:**
- **id:** What's the classroom ID?
 - **building_id:** Which building does this classroom belong to?
 - **name:** What's the classroom's name?
 - **description:** What's the classroom's description?
 - **floor:** What floor is the classroom located on? (Must not exceed the building's total floors)
 - **capacity:** How many people can fit in the classroom?
15. **schedule:**
- **id:** What's the schedule ID?
 - **student_group_id:** Which student group is scheduled for this time?
 - **teacher_id:** Which teacher is responsible for this schedule?
 - **subject_id:** What subject is being taught during this schedule?
 - **classroom_id:** Which classroom is assigned to this schedule?
 - **start_datetime:** When does this scheduled session start?
 - **end_datetime:** When does this scheduled session end?
 - **created_at:** When was this schedule record created?
 - **updated_at:** When was this schedule record last updated?
16. **assignments:**
- **id:** What's the assignment ID?
 - **student_group_id:** Which student group is this assignment for?
 - **teacher_id:** Which teacher assigned this task?
 - **subject_id:** What subject is the assignment related to?
 - **name:** What's the assignment name?
 - **description:** What's the assignment description?
 - **deadline_date:** What's the assignment deadline date?
 - **created_at:** When was this assignment record created?
 - **updated_at:** When was this assignment record last updated?
17. **exams:**
- **id:** What's the exam ID?
 - **student_id:** Which student took this exam?
 - **subject_id:** Which subject is this exam related to?
 - **exam_type:** What type of exam is this (midterm, final)?
 - **mark:** What mark did the student receive for this exam?
 - **date:** When was the exam held?
 - **created_at:** When was this exam record created?
 - **updated_at:** When was this exam record last updated?
18. **lab_works:**
- **id:** What's the lab work ID?
 - **student_id:** Which student completed this lab work?
 - **subject_id:** Which subject does this lab work relate to?
 - **assignment_id:** Which assignment does this lab work relate to?
 - **lab_work_number:** What's the number of this lab work (1st, 2nd, etc.)?

- **mark:** What's the mark for this lab work?
 - **created_at:** When was this lab work record created?
 - **updated_at:** When was this lab work record last updated?
19. **quizzes:**
- **id:** What's the quiz ID?
 - **student_id:** Which student took this quiz?
 - **subject_id:** Which subject does this quiz relate to?
 - **lab_work_id:** Which subject does this quiz relate to?
 - **quiz_number:** What's the quiz number (1st, 2nd, etc.)?
 - **mark:** What's the mark for this quiz?
 - **created_at:** When was this quiz record created?
 - **updated_at:** When was this quiz record last updated?
20. **attendance:**
- **id:** What's the attendance record ID?
 - **student_id:** Which student is this attendance record for?
 - **subject_id:** Which subject is this attendance record for?
 - **total_lessons:** How many total lessons were held?
 - **attended_lessons:** How many lessons did the student attend?
 - **created_at:** When was this attendance record created?
 - **updated_at:** When was this attendance record last updated?
21. **clubs:**
- **id:** What's the club ID?
 - **name:** What's the club's name?
 - **description:** What's the club's description?
 - **president_student_id:** Who's the president or head of the club (student ID)?
 - **founded_date:** When was the club founded?
 - **created_at:** When was this club record created?
 - **updated_at:** When was this club record last updated?
22. **students_clubs:**
- **id:** What's the membership record ID?
 - **student_id:** Which student is a member of this club?
 - **club_id:** Which club does this membership record refer to?
 - **join_date:** When did the student join the club?
 - **role:** What role does the student have in the club (e.g., member, vice president)?
 - **created_at:** When was this membership record created?
 - **updated_at:** When was this membership record last updated?

3. What constrained attributes does the Database has?

3. Constrained attributes of each table:

1. **faculties:**
 - **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
2. **departments:**
 - **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
3. **deans:**
 - **name:** The character limit is between 2 and 100 characters.
 - **surname:** The character limit is between 2 and 100 characters.
 - **patronymic:** The character limit is between 2 and 100 characters.
 - **gender:** Must be one of the following: MALE, FEMALE, OTHER.

- **birth_date:** Must be a valid date, and the dean's age must be between 30 and 70 years.
 - **phone_number:** Must be a valid phone number format (e.g., +[country code] [number], 10-15 digits).
 - **email:** Must be a valid email format (e.g., number@iitu.edu.kz).
 - **experience:** Must be a number between 5 and 40 years.
 - **education:** The character limit is between 10 and 250 characters.
 - **position:** The position can be Dean, Professor, or Head of Department.
 - **iin:** Must be exactly 12 digits (assuming a national ID number).
 - **address:** The character limit is between 10 and 100 characters.
4. **educational_programs:**
- **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
 - **type:** The type can only be BACHELOR, MASTER, or DOCTORAL STUDY.
 - **study_duration:** The program can last from 1 to 4 years.
5. **courses:**
- **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
 - **year_of_study:** The year of study can be 1, 2, 3, or 4.
 - **price:** The price can vary between \$100 and \$10,000.
6. **semesters:**
- **semester_half:** The semester half can be 1 or 2.
7. **subjects:**
- **name:** The character limit is between 5 and 50 characters.
 - **description:** The character limit is between 20 and 250 characters.
8. **teachers:**
- **name:** The character limit is between 2 and 100 characters.
 - **surname:** The character limit is between 2 and 100 characters.
 - **patronymic:** The character limit is between 2 and 100 characters.
 - **gender:** Must be one of the following: MALE, FEMALE, OTHER.
 - **birth_date:** Must be a valid date, and the teacher's age must be between 25 and 70 years.
 - **phone_number:** Must be a valid phone number format (e.g., +[country code] [number], 10-15 digits).
 - **email:** Must be a valid email format (e.g., number@iitu.edu.kz).
 - **experience:** Must be a number between 1 and 45 years.
 - **education:** The character limit is between 10 and 250 characters.
 - **position:** The position can be Lecturer, Professor, or Academic.
 - **iin:** Must be exactly 12 digits (assuming a national ID number).
 - **address:** The character limit is between 10 and 100 characters.
9. **teacher_subject_semesters:**
- **role:** Must be one of the following: lecturer, lab instructor
10. **students:**
- **name:** The character limit is between 2 and 100 characters.
 - **surname:** The character limit is between 2 and 100 characters.
 - **patronymic:** The character limit is between 2 and 100 characters.
 - **gender:** Must be one of the following: MALE, FEMALE, OTHER.
 - **birth_date:** Must be a valid date, and the student's age must be between 17 and 50 years.
 - **phone_number:** Must be a valid phone number format (e.g., +[country code] [number], 10-15 digits).
 - **email:** Must be a valid email format (e.g., number@iitu.edu.kz).
 - **iin:** Must be exactly 12 digits (assuming a national ID number).
 - **address:** The character limit is between 10 and 100 characters.

11. **groups:**
 - **name:** The character limit is between 10 and 20 characters.
 - **student_count:** The student limit is between 2 and 60.
12. **student_groups:**
 - Nothing to constrain.
13. **buildings:**
 - **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
 - **address:** The character limit is between 10 and 100 characters.
 - **floors:** The number of floors must be between 1 and 50.
14. **classrooms:**
 - **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 200 characters.
 - **floor:** The classroom floor must be between 1 and the number of floors in the building.
 - **capacity:** The number of people must be between 5 and 100.
15. **schedule:**
 - Nothing to constrain.
16. **assignments:**
 - **name:** The character limit is between 5 and 40 characters.
 - **description:** The character limit is between 15 and 100 characters.
17. **exams:**
 - **exam_type:** Must be one of the following: midterm, final.
 - **mark:** Must be between 0 and 100.
18. **lab_works:**
 - **lab_work_number:** The lab work number must be between 1 and 10 (e.g., 1st, 2nd, etc.).
 - **mark:** The mark for this lab work must be between 0 and 100.
19. **quizzes:**
 - **quiz_number:** The quiz number must be between 1 and 10 (e.g., 1st, 2nd, etc.).
 - **mark:** The mark for this quiz must be between 0 and 100.
20. **attendance:**
 - **total_lessons:** The number of total lessons must be between 1 and 50.
 - **attended_lessons:** The number of attended lessons must be between 0 and the total lessons.
21. **clubs:**
 - **name:** The character limit is between 5 and 100 characters.
 - **description:** The character limit is between 20 and 500 characters.
 - **founded_date:** Must be a valid date in the past.
22. **students_clubs:**
 - **join_date:** Must be a valid date in the past.
 - **role:** Must be one of the following: member, vice president.

4. What relations between tables does the Database have?

4. Relations between tables:

1. **faculties:**
 - faculties - departments (one-to-many)
2. **departments:**
 - departments - deans (one-to-one)
 - departments - educational_programs (many-to-many)
3. **deans:**

- No relations
- 4. **educational_programs:**
 - educational_programs - courses (one-to-many)
 - educational_programs - subjects (many-to-one)
 - educational_programs - teachers (many-to-many)
- 5. **courses:**
 - courses - semesters (one-to-many)
- 6. **semesters:**
 - semesters - subjects (one-to-many)
 - semesters - teachers (many-to-many)
 - semesters - students (many-to-one)
 - semesters - groups (many-to-one)
- 7. **subjects:**
 - subjects - teachers (one-to-many)
 - subjects - schedule (one-to-many)
 - subjects - assignments (one-to-many)
 - subjects - exams (one-to-many)
 - subjects - quizzes (one-to-many)
 - subjects - lab_works (one-to-many)
 - subjects - attendance (one-to-many)
- 8. **teachers:**
 - teachers - teacher_subject_semesters (one-to-many)
 - teachers - schedule (many-to-many)
 - teachers - assignments (many-to-many)
- 9. **teacher_subject_semesters:**
 - No relations
- 10. **students:**
 - students - student_groups (one-to-many)
 - students - exams (one-to-many)
 - students - quizzes (one-to-many)
 - students - lab_works (one-to-many)
 - students - attendance (one-to-many)
 - students - clubs (one-to-one)
 - students - students_clubs (one-to-many)
- 11. **groups:**
 - groups - student_groups (one-to-many)
- 12. **student_groups:**
 - student_groups - schedule (one-to-many)
 - student_groups - assignments (one-to-many)
- 13. **buildings:**
 - buildings - classrooms (many-to-one)
- 14. **classrooms:**
 - classrooms - schedule (one-to-many)
- 15. **schedule:**
 - No relations.
- 16. **assignments:**
 - assignments - lab_works (one-to-one)
- 17. **exams:**
 - No relations.
- 18. **lab_works:**
 - lab_works - quizzes (one-to-one).
- 19. **quizzes:**
 - No relations.
- 20. **attendance:**

- No relations.
- 21. **clubs:**
 - clubs - students_clubs (one-to-many)
- 22. **students_clubs:**
 - No relations.

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:** Deans
-

1. **faculties:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
2. **departments:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
3. **deans:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
4. **educational_programs:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
5. **courses:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
6. **semesters:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
7. **subjects:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
8. **teachers:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
9. **teacher_subject_semesters:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
10. **students:**
 - Students - rw (read-write)

- Teachers - ro (read-only)
- Deans - rw (read-write)
- 11. **groups:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 12. **student_groups:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 13. **buildings:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 14. **classrooms:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 15. **schedule:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
- 16. **assignments:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
- 17. **exams:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 18. **lab_works:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
- 19. **quizzes:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
- 20. **attendance:**
 - Students - ro (read-only)
 - Teachers - rw (read-write)
 - Deans - rw (read-write)
- 21. **clubs:**
 - Students - ro (read-only)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)
- 22. **students_clubs:**
 - Students - rw (read-write)
 - Teachers - ro (read-only)
 - Deans - rw (read-write)

6. What are potential queries for the Database?

6. The Database may have the following queries:

- 1. List all students from the first-year course.**
- 2. List all students from foreign countries.**
- 3. List all students who failed the Mathematics exam.**
- 4. List the top 5 students from the first-year Cyber Security course based on GPA.**
- 5. List all students with an average GPA above 90% in their current course.**
- 6. List all students who attended less than 80% of their lessons.**
- 7. List all teachers with more than 5 years of experience.**
- 8. List all classrooms on the 3rd floor of a building.**
- 9. List all subjects scheduled for group IT2-2404SE on Monday.**
- 10. List all courses and semesters that include Mathematics for Software Engineering.**
- 11. List all courses that include C++ programming.**
- 12. List the top 5 groups from the second-year course based on the average GPA of students.**
- 13. List all students from IT2-2406SE who completed laboratory works but received low scores on quizzes.**
- 14. List all professors at the university.**
- 15. List all DOCTORAL educational programs.**

Thank you for your time!