Lab work 1

Database Design. Introduction to SQL.

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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.

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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
    - gender
    - birth_date
    - nationality
    - citizenship
    - email
    - iin
    - address
    - education
8. **phone_numbers:**
    - phone_id (PK)
    - person_id (FK to persons.person_id)
    - phone_number (must follow Kazakhstan format: +7 followed by 10 digits)
9. **dean_faculty:**
    - dean_id (FK to persons.person_id)
    - faculty_id (FK to faculties.faculty_id)
    - PRIMARY KEY (dean_id, faculty_id)
10. **groups:**
    - group_id (PK)
    - head_student_id (FK to persons.person_id)
    - curator_id (FK to persons.person_id)
    - course_year
    - name
11. **student_group:**
    - student_id (FK to persons.person_id)
    - group_id (FK to groups.group_id)
    - PRIMARY KEY (student_id, group_id)
12. **buildings:**
    - building_id (PK)
    - name
    - description
    - address
    - floor_count
13. **classrooms:**
    - classroom_id (PK)
    - building_id (FK to buildings.building_id)
    - name
    - description
    - floor_number
    - capacity
14. **schedules:**
    - schedule_id (PK)
    - group_id (FK to groups.group_id)
    - subject_id (FK to subjects.subject_id)
    - 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

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1. **faculties:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - rw (read-write, can override subjects related to their faculty)
    - Rector - rw (read-write)
2. **departments:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - rw (read-write, can override department related to their department)
    - Deans - rw (read-write, can override department related to their faculty)
    - Rector - rw (read-write)
3. **programs:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - rw (read-write, can override program related to their department)
    - Deans - rw (read-write, can override program related to their faculty)
    - Rector - rw (read-write)
4. **subjects:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - rw (read-write, can override subject related to their department)
    - Deans - rw (read-write, can override subject related to their faculty)
    - Rector - rw (read-write)
5. **roles:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - ro (read-only)
    - Rector - rw (read-write, can assign roles)
6. **persons:**
    - Students - rw (read-write for their own data)
    - Teachers - rw (read-write for their own data)
    - Head Department - rw (read-write for their own data)
    - Deans - rw (read-write for their own data)
    - Rector - rw (read-write for their own data)
7. **phone_numbers:**
    - Students - rw (read-write for their own data)
    - Teachers - rw (read-write for their own data)
    - Head Department - rw (read-write for their own data)
    - Deans - rw (read-write for their own data)
    - Rector - rw (read-write for their own data)
8. **dean_faculty:**

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

9. **groups:**
   - Students - ro (read-only)
   - Teachers - ro (read-only)
   - Head Department - rw (read-write, can override groups related to their departments)
   - Deans - rw (read-write, can override groups related to their faculties)
   - Rector - rw (read-write)
10. **buildings:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - ro (read-only)
    - Rector - rw (read-write)
11. **classrooms:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - ro (read-only)
    - Rector - rw (read-write)
12. **schedules:**
    - Students - ro (read-only)
    - Teachers - rw (read-write, can override schedules related to their subjects)
    - Head Department - rw (read-write, can override schedules related to their departments)
    - Deans - rw (read-write, can override schedules related to their faculties)
    - Rector - rw (read-write)
13. **assignments:**
    - Students - ro (read-only)
    - Teachers - rw (read-write, can give assignments related to their subjects)
    - Head Department - rw (read-write, can override assignments related to their departments)
    - Deans - rw (read-write, can override assignments related to their faculties)
    - Rector - rw (read-write)
14. **student_assignment:**
    - Students - rw (read-write for their own data)
    - Teachers - rw (read-write, can override assignments related to their departments)
    - Head Department - rw (read-write, can override assignments related to their departments)
    - Deans - rw (read-write, can override assignments related to their faculties)
    - Rector - rw (read-write)
15. **clubs:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - ro (read-only)
    - Rector - rw (read-write)
16. **student_club:**
    - Students - rw (read-write for their own data)
    - Teachers - ro (read-only)
    - Head Department - ro (read-only)
    - Deans - ro (read-only)
    - 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!