Lab work 1

Database Design. Introduction to SQL.

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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.

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1. What tables does the Database store?

1. The Database includes the following tables:

1. **faculties:**
   - faculty_id (PK)
   - name
   - description
2. **departments:**
   - department_id (PK)
   - faculty_id (FK to faculties.faculty_id)
   - name
   - description
3. **subjects:**
   - subject_id (PK)
   - department_id (FK to departments.department_id)
   - name
   - description

    - credits
4. **person:**
    - person_id (PK)
    - name
    - surname
    - patronymic
    - gender
    - birth_date
    - nationality
    - citizenship
    - phone_number
    - email
    - iin
    - address
5. **teachers:**
    - teacher_id (PK, FK to person.person_id)
    - education
6. **deans:**
    - dean_id (PK, FK to person.person_id)
    - faculty_id (FK to faculties.faculty_id)
    - education
7. **department_dean:**
    - department_id (FK to departments.department_id)
    - dean_id (FK to deans.dean_id)
8. **subject_teacher:**
    - subject_id (FK to subjects.subject_id)
    - teacher_id (FK to teachers.teacher_id)
9. **students:**
    - student_id (PK, FK to person.person_id)
    - group_id (FK to groups.group_id)
10. **groups:**
    - group_id (PK)
    - course_year
    - name
11. **group_student:**
    - group_id (FK to groups.group_id)
    - student_id (FK to students.student_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)
    - teacher_subject_id (FK to subject_teacher.subject_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. **assignment_student:**
    - assignment_id (FK to assignments.assignment_id)
    - student_id (FK to students.student_id)
    - mark
17. **exams:**
    - exam_id (PK)
    - exam_type
    - min_score
    - max_score
    - date
18. **exam_schedule:**
    - exam_id (FK to exams.exam_id)
    - schedule_id (FK to schedules.schedule_id)
19. **exam_student:**
    - exam_id (FK to exams.exam_id)
    - student_id (FK to students.student_id)
    - mark
20. **attendance:**
    - attendance_id (PK)
    - schedule_id (FK to schedules.schedule_id)
    - student_id (FK to students.student_id)
    - attended
21. **clubs:**
    - club_id (PK)

- name
- description
- founded_date

22. **club_student:**
    - club_id (FK to clubs.club_id)
    - student_id (FK to students.student_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. **subjects:**
    - **name:** 5-50 characters.
    - **description:** 20-250 characters.
    - **credits:** Must be between 1 and 10.
4. **person:**
    - **name:** 2-100 characters.
    - **surname:** 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).
    - **phone_number:** Must follow Kazakhstan format: +7 followed by 10 digits (e.g., +7 707 123 4567).
    - **email:** Valid email format.
    - **iin:** Exactly 12 digits.
    - **address:** 10-100 characters.
5. **teachers:**
    - **education:** 20-200 characters.
6. **deans:**
    - **education:** 20-200 characters.
7. **groups:**
    - **name:** 6-20 characters.
    - **course_year:** Must be between 1 and 4.
8. **buildings:**
    - **name:** 5-100 characters.
    - **description:** 20-500 characters.

- **address:** 10-100 characters.
- **floor_count:** Must be between 1 and 50.

9. **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.
10. **schedules:**
    - **weekday:** Must be one of the days Monday to Sunday.
    - **start_time:** Must be in valid time format (HH:MM:SS).
    - **end_time:** Must be in valid time format (HH:MM:SS) and later than start_time.
11. **assignments:**
    - **name:** 5-40 characters.
    - **description:** 15-100 characters.
    - **deadline:** Must be a valid date.
12. **exams:**
    - **exam_type:** Must be either 'midterm' or 'final'.
    - **min_score:** Minimum score must be 50.
    - **max_score:** Maximum score must be 100.
    - **date:** Must be a valid date.
13. **exam_student:**
    - **mark:** Must be between 0 and 100.
14. **attendance:**
    - **attended:** Boolean value (true/false).
15. **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 - departments **(one-to-many)**
2. departments - subjects **(one-to-many)**
3. departments - deans **(one-to-one)**
4. subjects - teachers **(many-to-many)**
5. students - groups **(one-to-many)**
6. students - clubs **(many-to-many)**
7. students - attendance **(one-to-many)**
8. assignments - students **(many-to-many)**

9. schedules - classrooms **(one-to-many)**
10. schedules - groups **(one-to-many)**
11. schedules - teachers **(one-to-many)**
12. schedules - assignments **(one-to-one)**
13. exams - schedules **(one-to-one)**
14. exams - students **(one-to-many)**
15. classrooms - buildings **(one-to-many)**

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

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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. **subjects:**
    - Students - ro (read-only)
    - Teachers - rw (read-write)
    - Deans - rw (read-write)
4. **person:**
    - Students - rw (read-write for their own data)
    - Teachers - rw (read-write for their own data)
    - Deans - rw (read-write)
5. **teachers:**
    - Students - ro (read-only)
    - Teachers - rw (read-write for their own data)
    - Deans - rw (read-write for all teachers)
6. **deans:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
7. **department_dean:**

    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
8. **subject_teacher:**
    - Students - ro (read-only)
    - Teachers - rw (read-write for assigned subjects)
    - Deans - rw (read-write)
9. **students:**
    - Students - rw (read-write for their own data)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
10. **groups:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
11. **group_student:**
    - Students - ro (read-only)
    - Teachers - rw (read-only)
    - Deans - rw (read-write)
12. **buildings:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
13. **classrooms:**
    - Students - ro (read-only)
    - Teachers - ro (read-only)
    - Deans - rw (read-write)
14. **schedules:**
    - Students - ro (read-only)
    - Teachers - rw (read-write)
    - Deans - rw (read-write)
15. **assignments:**
    - Students - ro (read-only)
    - Teachers - rw (read-write)
    - Deans - rw (read-write)
16. **assignment_student:**
    - Students - rw (read-only)
    - Teachers - rw (read-write)
    - Deans - rw (read-write)
17. **exams:**
    - Students - ro (read-only)
    - Teachers - rw (read-write)
    - Deans - rw (read-write)
18. **exam_schedule:**

- Students - ro (read-only)
- Teachers - rw (read-write)
- Deans - rw (read-write)

19. **exam_student:**
    - Students - rw (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. **club_student:**
    - Students - rw (read-write for their own data)
    - 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 classrooms on the 3rd floor of a Baizak building.**
8. **List all subjects scheduled for group IT2-2404SE on Monday.**
9. **List all departments that include C++ programming.**
10. **List the top 5 groups from the second-year course based on the average GPA of students.**
11. **List all teachers who are assigned to more than 2 subjects.**
12. **List all students who have participated in more than 2 clubs.**
13. **List all exams scheduled for next week.**
14. **List all students who haven't submitted their assignments on time.**

Thank you for your time!