
Lab 1

Database Simulation via C/C++/Python

CSE 4308

DATABASE MANAGEMENT SYSTEMS LAB

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1 Objective

The objective of this lab is to understand how basic database operations such as Create, Read, Update, and Delete (CRUD) are implemented internally. This will be achieved by simulating database functionality using a simple text file and Python.

2 Dataset Description

A text file named `students.txt` will be used as the data store. Each record in the file represents one student, with fields separated by a pipe (|) character.

```
1 -- Format: ID|Name|Age|Major|GPA
2 1|Alice Johnson|20|Computer Science|3.8
3 2|Bob Smith|22|Mathematics|3.5
4 3|Carol Davis|21|Physics|3.9
5 4|David Brown|23|Computer Science|3.6
```

Listing 1: Sample Database: `students.txt`

3 Full Python Solution

3.1 Overview

The following Python program implements all CRUD operations and a simple text-based menu interface.

```
1 # -----
2 # Basic CRUD System using Text File (students.txt)
3 # -----
4
5 FILENAME = 'students.txt'
6
7 # ----- CREATE -----
8 def insert_student(student_id, name, age, major, gpa):
9     """Insert a new student record into the file."""
10    with open(FILENAME, 'a') as file:
11        file.write(f"{student_id}|{name}|{age}|{major}|{gpa}\n")
12    print("Record inserted successfully.\n")
13
14
15 # ----- READ -----
16 def read_students():
17     """Read and display all records from the file."""
18    try:
19        with open(FILENAME, 'r') as file:
20            print("Student Records:")
21            for line in file:
22                if not line.startswith('--'):
23                    print(line.strip())
24            print()
25    except FileNotFoundError:
26        print("Database file not found.\n")
27
28
```

```

29 # ----- UPDATE -----
30 def update_student(student_id, field, new_value):
31     """Update a specific student's field."""
32     lines = []
33     found = False
34     with open(FILENAME, 'r') as file:
35         for line in file:
36             if line.startswith('--'):
37                 lines.append(line)
38                 continue
39             data = line.strip().split('|')
40             if data[0] == str(student_id):
41                 found = True
42                 mapping = {'name':1, 'age':2, 'major':3, 'gpa':4}
43                 if field in mapping:
44                     data[mapping[field]] = str(new_value)
45                     print(f"Updated {field} for ID {student_id}.")
46                     line = '|'.join(data) + '\n'
47                 lines.append(line)
48     if not found:
49         print("Record not found.")
50     else:
51         with open(FILENAME, 'w') as file:
52             file.writelines(lines)
53         print("Record updated successfully.\n")
54
55 # ----- DELETE -----
56 def delete_student(student_id):
57     """Delete a student record by ID."""
58     with open(FILENAME, 'r') as file:
59         lines = file.readlines()
60
61     new_lines = [l for l in lines if not (l.split('|')[0] == str(student_id))]
62
63     if len(new_lines) == len(lines):
64         print("Record not found.")
65     else:
66         with open(FILENAME, 'w') as file:
67             file.writelines(new_lines)
68         print("Record deleted successfully.\n")
69
70 # ----- MENU -----
71 def menu():
72     while True:
73         print("===== Student Database Menu =====")
74         print("1. Insert Student")
75         print("2. View All Students")
76         print("3. Update Student")
77         print("4. Delete Student")
78         print("5. Exit")
79         choice = input("Enter your choice: ")
80
81         if choice == '1':
82             student_id = input("Enter ID: ")
83             name = input("Enter Name: ")
84             age = input("Enter Age: ")

```

```

87         major = input("Enter Major: ")
88         gpa = input("Enter GPA: ")
89         insert_student(student_id, name, age, major, gpa)
90     elif choice == '2':
91         read_students()
92     elif choice == '3':
93         student_id = input("Enter ID to update: ")
94         field = input("Field to update (name/age/major/gpa): ").lower()
95         new_value = input("Enter new value: ")
96         update_student(student_id, field, new_value)
97     elif choice == '4':
98         student_id = input("Enter ID to delete: ")
99         delete_student(student_id)
100    elif choice == '5':
101        print("Exiting program.")
102        break
103    else:
104        print("Invalid choice.\n")
105
106    # Run the menu when script is executed
107    if __name__ == "__main__":
108        menu()

```

Listing 2: Full CRUD Implementation in Python

4 Sample Run

4.1 Example Output

```

1  ===== Student Database Menu =====
2  1. Insert Student
3  2. View All Students
4  3. Update Student
5  4. Delete Student
6  5. Exit
7  Enter your choice: 1
8  Enter ID: 5
9  Enter Name: Eve Wilson
10 Enter Age: 20
11 Enter Major: Data Science
12 Enter GPA: 3.9
13 Record inserted successfully.
14
15 Enter your choice: 2
16 Student Records:
17 1|Alice Johnson|20|Computer Science|3.8
18 2|Bob Smith|22|Mathematics|3.5
19 3|Carol Davis|21|Physics|3.9
20 4|David Brown|23|Computer Science|3.6
21 5|Eve Wilson|20|Data Science|3.9

```

Listing 3: Program Output Example