

# **Students Exams Management System**

**Done By**

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## Abstract

This project is a web-based Examination Management System designed to manage the complete exam process, from exam creation by instructors to exam submission and evaluation by students. The system follows a role-based structure that ensures clear separation of responsibilities and secure handling of academic data.

The system supports three main user roles: **Admin**, **Instructor**, and **Student**. Students can log in to view their assigned courses, take online exams, submit answers, and review their grades. Instructors are able to create exams, and add questions to the system. Administrators have full control over the platform, including managing student and instructor accounts.

The front-end is developed using **React**, providing a responsive and interactive user interface. The back-end is implemented using **Node.js**, which handles business logic, authentication, and communication with the database through secure APIs. **Microsoft SQL Server** is used to store and manage system data efficiently.

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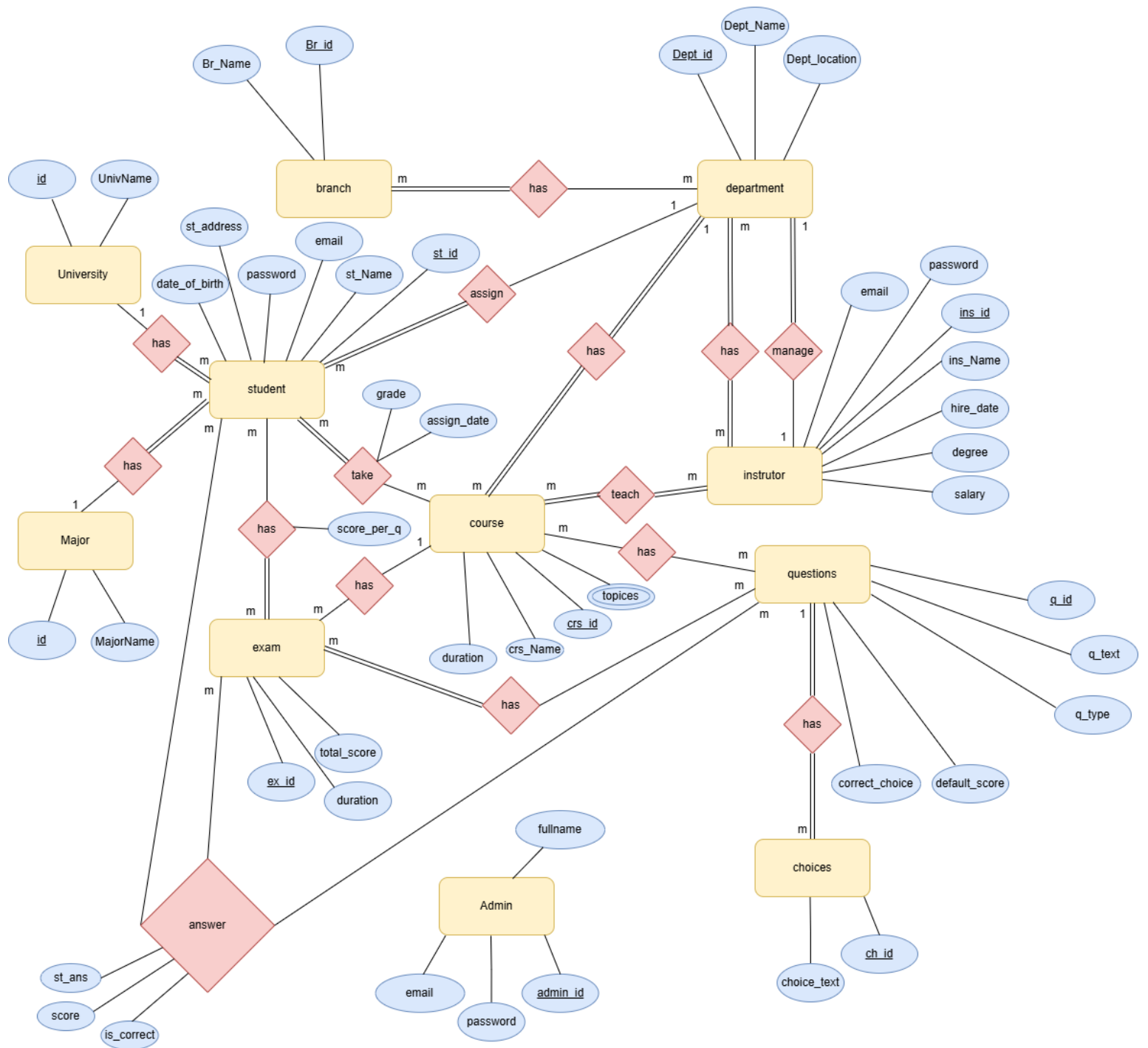
# Database

## System Requirements

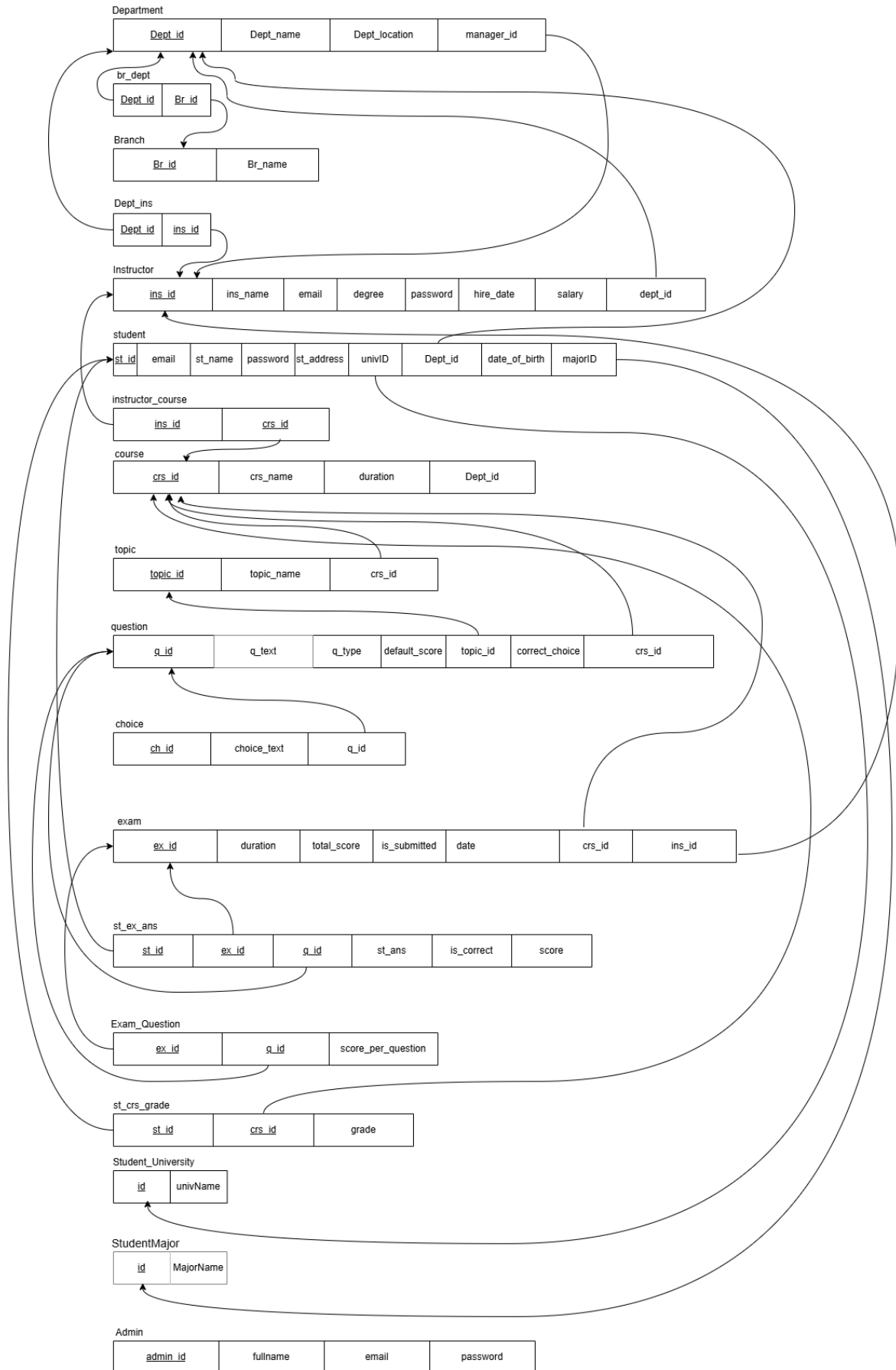
1. The system shall store and manage **branch data**, including branch ID and branch name.
2. The system shall store and manage **department data**, including department ID, name, and location.
3. The system shall enforce that **each branch must be associated with one or more departments**, while a department may be associated with zero or more branches.
4. The system shall store and manage **instructor data**, including ID, name, email, password, hire date, degree, and salary.
5. The system shall enforce that **each instructor must belong to at least one department**, and each department must have one or more instructors.
6. The system shall support assigning **one instructor as a manager for each department**, while an instructor may manage zero or one department.
7. The system shall store and manage **student data**, including ID, name, email, password, and address.
8. The system shall enforce that **each student must be assigned to exactly one department**, while a department may have zero or more students.
9. The system shall store and manage **course data**, including course ID, name, duration, and multi-valued topics.
10. The system shall enforce that **each course belongs to exactly one department**, while each department must offer one or more courses.
11. The system shall support a **many-to-many relationship between students and courses**, where each student must be enrolled in one or more courses, and each course may have zero or more students.
12. The system shall store additional data for student–course enrollment, including **grade and assignment date**.
13. The system shall support a **many-to-many relationship between instructors and courses**, ensuring that each course must be taught by one or more instructors and each instructor may teach multiple courses.

14. The system shall store and manage **question data**, including question ID, question text, question type, default score, correct choice, and difficulty level.
15. The system shall allow each question to be associated with **one or more courses**, while a course may have zero or more questions.
16. The system shall store and manage **exam data**, including exam ID, total score, and duration.
17. The system shall enforce that **each exam must include multiple questions**, while a question may appear in zero or more exams.
18. The system shall support a **many-to-many relationship between students and exams**, where each student may take one or more exams and each exam must be taken by multiple students.
19. The system shall store **score per question** for each student in an exam.
20. The system shall store and manage **choice data**, including choice ID and choice text.
21. The system shall enforce that **each choice belongs to exactly one question**, and each question must have one or more choices.
22. The system shall store and manage **university data**, including university ID and name.
23. The system shall enforce that **each student must belong to exactly one university**, while a university may have many students.
24. The system shall store and manage **major data**, including major ID and name.
25. The system shall enforce that **each student must belong to exactly one major**, while a major may have many students.
26. The system shall store and manage **student answers** for exams through an answer relationship that combines student, exam, and question.
27. The system shall store answer attributes including **student answer, score, and correctness status**.
28. The system shall store and manage **admin data**, including admin ID, full name, email, and password.
29. The system shall allow administrators to **manage system data** and oversee system operations.

## ER Diagram



# Mapping





## Tables

The system contains 18 tables, we will move through them step by step

### Admin

```
CREATE TABLE Admin
(
    admin_id    INT IDENTITY(1,1) PRIMARY KEY,
    email       NVARCHAR(100) NOT NULL UNIQUE,
    password    NVARCHAR(255) NOT NULL,
    full_name   NVARCHAR(100) NULL
);
```

### br\_dept

```
CREATE TABLE br_dept
(
    Dept_id INT NOT NULL,
    Br_id   INT NOT NULL,
    PRIMARY KEY (Dept_id, Br_id),
    FOREIGN KEY (Dept_id) REFERENCES Department(Dept_id),
    FOREIGN KEY (Br_id)   REFERENCES Branch(Br_id)
);
```

### Branch

```
CREATE TABLE Branch
(
    Br_id    INT IDENTITY(1,1) PRIMARY KEY,
    Br_name  NVARCHAR(50) NOT NULL
);
```

### Choice

```
CREATE TABLE Choice
(
    ch_id      INT IDENTITY(1,1) PRIMARY KEY,
    choice_text NVARCHAR(MAX) NOT NULL,
    q_id       INT NOT NULL,
```

```
        FOREIGN KEY (q_id) REFERENCES Question(q_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE
    );
```

## Course

```
CREATE TABLE Course
(
    crs_id      INT PRIMARY KEY,
    crs_name    NVARCHAR(50) NULL,
    duration    INT NULL,
    Dept_id     INT NOT NULL,
    FOREIGN KEY (Dept_id) REFERENCES Department(Dept_id)
);
```

## Dep\_Ins

```
CREATE TABLE Dep_Ins
(
    Dept_id INT NOT NULL,
    ins_id  INT NOT NULL,
    PRIMARY KEY (Dept_id, ins_id),
    FOREIGN KEY (Dept_id) REFERENCES Department(Dept_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE,
    FOREIGN KEY (ins_id) REFERENCES Instructor(ins_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE
);
```

## Department

```
CREATE TABLE Department
(
    Dept_id      INT PRIMARY KEY,
    Dept_name    NVARCHAR(50) NOT NULL,
    Dept_location NVARCHAR(50) NOT NULL,
    manager_id   INT NULL,
    FOREIGN KEY (manager_id) REFERENCES Instructor(ins_id));
```

## Exam

```
CREATE TABLE Exam
(
    ex_id          INT IDENTITY(1,1) PRIMARY KEY,
    duration       INT NOT NULL,
    total_score    INT NOT NULL,
    date           DATETIME DEFAULT GETDATE(),
    crs_id         INT NOT NULL,
    ins_id         INT NOT NULL,
    is_submitted   BIT DEFAULT 0,
    FOREIGN KEY (crs_id) REFERENCES Course(crs_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE,
    FOREIGN KEY (ins_id) REFERENCES Instructor(ins_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE
);
```

## Exam\_Question

```
CREATE TABLE Exam_Question
(
    ex_ID  INT NOT NULL,
    q_ID   INT NOT NULL,
    degree INT NOT NULL,
    PRIMARY KEY (ex_ID, q_ID),
    FOREIGN KEY (ex_ID) REFERENCES Exam(ex_id),
    FOREIGN KEY (q_ID) REFERENCES Question(q_id)
);
```

## Instructor

```
CREATE TABLE Instructor
(
    ins_id          INT IDENTITY(1,1) PRIMARY KEY,
    ins_name        VARCHAR(50) NOT NULL,
    degree          VARCHAR(20) NULL,
    hire_date       DATE DEFAULT GETDATE(),
    salary          FLOAT NOT NULL,
    Dept_id         INT NULL,
```

```

        ins_email      NVARCHAR(100) NULL,
        ins_password NVARCHAR(100) NULL,
        FOREIGN KEY (Dept_id) REFERENCES Department(Dept_id)
    );

Instructor_course
CREATE TABLE Instructor_Course
(
    instructor_ID INT NOT NULL,
    course_ID     INT NOT NULL,
    PRIMARY KEY (instructor_ID, course_ID),
    FOREIGN KEY (instructor_ID) REFERENCES Instructor(ins_id),
    FOREIGN KEY (course_ID)     REFERENCES Course(crs_id)
);

```

## Question

```

CREATE TABLE Question
(
    q_id          INT IDENTITY(1,1) PRIMARY KEY,
    q_text        NVARCHAR(MAX) NOT NULL,
    q_type        NVARCHAR(20) NOT NULL,
    default_score FLOAT NOT NULL,
    correct_choice NVARCHAR(MAX) NOT NULL,
    crs_id        INT NULL,
    top_id        INT NOT NULL,
    FOREIGN KEY (crs_id) REFERENCES Course(crs_id)
        ON UPDATE CASCADE
        ON DELETE CASCADE,
    FOREIGN KEY (top_id) REFERENCES Topic(topic_id)
);

```

## st\_crs\_grade

```

CREATE TABLE st_crs_grade
(
    st_id  INT NOT NULL,
    crs_id INT NOT NULL,
    grade  INT NULL,
    PRIMARY KEY (st_id, crs_id),
    FOREIGN KEY (st_id) REFERENCES Student(st_id),

```

```
FOREIGN KEY (crs_id) REFERENCES Course(crs_id)
);
```

## Student

```
CREATE TABLE Student
(
    st_id          INT IDENTITY(1,1) PRIMARY KEY,
    st_name        NVARCHAR(50) NOT NULL,
    st_address     NVARCHAR(100) NULL,
    Dept_id        INT NOT NULL,
    DateOfBirth    DATE NULL,
    Univ_id        INT NULL,
    Major_id       INT NULL,
    st_email       NVARCHAR(100) NULL,
    st_password    NVARCHAR(100) NULL,
    FOREIGN KEY (Dept_id) REFERENCES Department(Dept_id) ON
UPDATE CASCADE ON DELETE CASCADE,
    FOREIGN KEY (Major_id) REFERENCES StudentMajor(MajorID),
    FOREIGN KEY (Univ_id) REFERENCES
Student_University(Univ_id)
);
```

## Student\_Exam\_Answer

```
CREATE TABLE Student_Exam_Answer
(
    student_ID     INT NOT NULL,
    exam_ID        INT NOT NULL,
    question_ID    INT NOT NULL,
    student_Answer NVARCHAR(250) NOT NULL,
    isCorrect      BIT NULL,
    score          INT NULL,
    PRIMARY KEY (student_ID, exam_ID, question_ID),
    FOREIGN KEY (student_ID) REFERENCES Student(st_id),
    FOREIGN KEY (exam_ID) REFERENCES Exam(ex_id),
    FOREIGN KEY (question_ID) REFERENCES Question(q_id)
);
```

## Student\_University

```
CREATE TABLE Student_University
(
    Univ_id    INT IDENTITY(1,1) PRIMARY KEY,
    univ_name  NVARCHAR(50) NOT NULL
);
```

## StudentMajor

```
CREATE TABLE StudentMajor
(
    MajorID    INT IDENTITY(1,1) PRIMARY KEY,
    MajorName  NVARCHAR(50) NOT NULL
);
```

## Topic

```
CREATE TABLE Topic
(
    topic_id   INT PRIMARY KEY,
    topic_name NVARCHAR(50) NULL,
    crs_id     INT NOT NULL,
    FOREIGN KEY (crs_id) REFERENCES Course(crs_id)
);
```

## Stored Procedures

### Exam generation

```
CREATE OR ALTER PROC sp_generate_exam
@ex_id INT,
@mcq_cnt INT,
@tf_cnt INT,
@mode NVARCHAR(20)
AS
BEGIN
    DECLARE @easy_pct FLOAT, @med_pct FLOAT, @hard_pct FLOAT;

    IF @mode = 'hard'
    BEGIN
        SET @easy_pct = 0.1;
        SET @med_pct = 0.3;
        SET @hard_pct = 0.6;
    END
    ELSE IF @mode = 'easy'
    BEGIN
        SET @easy_pct = 0.6;
        SET @med_pct = 0.3;
        SET @hard_pct = 0.1;
    END
    ELSE
    BEGIN
        SET @easy_pct = 0.2;
        SET @med_pct = 0.6;
        SET @hard_pct = 0.2;
    END

    DECLARE @crs_id INT;
    SELECT @crs_id = crs_id FROM exam WHERE ex_id = @ex_id;

    INSERT INTO exam_question (ex_id, q_id, degree)
    SELECT TOP (CAST(CEILING(@mcq_cnt * @easy_pct) AS INT))
        @ex_id, q_id, default_score
    FROM question
    WHERE crs_id = @crs_id AND q_type = 'mcq' AND default_score
    BETWEEN 1 AND 2
```

```

ORDER BY NEWID();

INSERT INTO exam_question (ex_id, q_id, degree)
SELECT TOP (CAST(CEILING(@mcq_cnt * @med_pct) AS INT))
    @ex_id, q_id, default_score
FROM question
WHERE crs_id = @crs_id AND q_type = 'mcq' AND default_score
BETWEEN 3 AND 5
ORDER BY NEWID();

INSERT INTO exam_question (ex_id, q_id, degree)
SELECT TOP (CAST(CEILING(@mcq_cnt * @hard_pct) AS INT))
    @ex_id, q_id, default_score
FROM question
WHERE crs_id = @crs_id AND q_type = 'mcq' AND default_score
> 5
ORDER BY NEWID();

INSERT INTO exam_question (ex_id, q_id, degree)
SELECT TOP (CAST(CEILING(@tf_cnt * @easy_pct) AS INT))
    @ex_id, q_id, default_score
FROM question
WHERE crs_id = @crs_id AND q_type = 'tf' AND default_score
BETWEEN 1 AND 2
ORDER BY NEWID();

INSERT INTO exam_question (ex_id, q_id, degree)
SELECT TOP (CAST(CEILING(@tf_cnt * @med_pct) AS INT))
    @ex_id, q_id, default_score
FROM question
WHERE crs_id = @crs_id AND q_type = 'tf' AND default_score
BETWEEN 3 AND 5
ORDER BY NEWID();

INSERT INTO exam_question (ex_id, q_id, degree)
SELECT TOP (CAST(CEILING(@tf_cnt * @hard_pct) AS INT))
    @ex_id, q_id, default_score
FROM question
WHERE crs_id = @crs_id AND q_type = 'tf' AND default_score>5
ORDER BY NEWID();

END;

```



**Overview:**

sp\_generate\_exam is a stored procedure that automatically generates an exam by selecting random MCQ and True/False questions based on difficulty mode.

**Parameters:**

- @ex\_id: Exam ID
- @mcq\_cnt: Number of MCQ questions
- @tf\_cnt: Number of True/False questions
- @mode: Difficulty mode (easy, normal, hard)

**Difficulty Distribution:**

Easy Mode -> 60% Easy, 30% Medium, 10% Hard

Normal Mode -> 20% Easy, 60% Medium, 20% Hard

Hard Mode -> 10% Easy, 30% Medium, 60% Hard

**Difficulty Classification:**

Easy -> default\_score between 1 and 2

Medium -> default\_score between 3 and 5

Hard -> default\_score > 5

**Tables Used:**

- exam (to get course ID)
- question (source of questions)
- exam\_question (generated exam questions)

**Randomization:**

Uses ORDER BY NEWID() to randomize question selection.

**Example Usage:**

```
EXEC sp_generate_exam 5, 20, 10, 'hard';
```

**Notes:**

- No duplicate check if executed multiple times.
- Ensure sufficient questions exist per difficulty level.

## Exam Answers

```
CREATE PROCEDURE [dbo].[sp_ExamAnswers]
(
    @Student_ID      INT,
    @Exam_ID          INT,
    @Question_ID      INT,
    @Student_Answer   NVARCHAR(250)
)
AS
BEGIN
    INSERT INTO Student_Exam_Answer
    VALUES
    (
        @Student_ID,
        @Exam_ID,
        @Question_ID,
        @Student_Answer,
        NULL,
        NULL
    );
END
```

**Overview:**

The sp\_ExamAnswers stored procedure is used to store a student's answer for a specific question in a specific exam. It inserts the student's response into the Student\_Exam\_Answer table.

### Input Parameters:

Parameter Name	Description
@Student_ID	Unique identifier of the student
@Exam_ID	Unique identifier of the exam
@Question_ID	Unique identifier of the question
@Student_Answer	The answer selected or entered by the student

### Logic Description :

1. Receives the student, exam, and question identifiers.
2. Stores the student's answer without validation or correction.
3. Leaves correction-related columns empty for later processing.

### Exam Correction

```
CREATE PROCEDURE [dbo].[sp_ExamCorrection]
(
    @student_ID INT,
    @exam_ID     INT
)
AS
BEGIN
    UPDATE SEA
    SET
        isCorrect = CASE
                        WHEN SEA.student_Answer =
Q.correct_choice THEN 1
                        ELSE 0
                    END,
        score = CASE
                  WHEN SEA.student_Answer = Q.correct_choice
THEN EQ.degree
                  ELSE 0
                END
END
```

```

FROM Student_Exam_Answer SEA
INNER JOIN Question Q ON SEA.question_ID = Q.q_id
INNER JOIN Exam_Question EQ ON EQ.q_ID = Q.q_id
WHERE SEA.student_ID = @student_ID
      AND SEA.exam_ID = @exam_ID;

-- Calculate total score and maximum score
DECLARE @totalScore INT;
DECLARE @maxScore    INT;

-- Assign total score obtained by the student
SELECT @totalScore = SUM(score)
FROM Student_Exam_Answer
WHERE student_ID = @student_ID
      AND exam_ID = @exam_ID;

-- Assign maximum possible score for the exam
SELECT @maxScore = SUM(EQ.degree)
FROM Exam_Question EQ
INNER JOIN Question Q ON EQ.q_ID = Q.q_id
WHERE EQ.ex_ID = @exam_ID;

SELECT
    @student_ID AS Student_ID,
    @exam_ID AS Exam_ID,
    @totalScore AS Total_Score,
    @maxScore AS Full_Mark,
    CAST((@totalScore * 100.0 / @maxScore) AS DECIMAL(5, 2))
AS Percentage;
END

```

### Overview :

The sp\_ExamCorrection stored procedure is responsible for:

- Correcting the student's exam automatically.
- Updating correctness and score per question.
- Calculating the total score and percentage result.

### Input Parameters :

Parameter Name	Data Type	Description
@student_ID	int	Unique identifier of the student
@exam_ID	int	Unique identifier of the exam

### Correction Logic (Question Level)

This part compares the student's answers with the correct answers stored in the Question table.

#### ***Actions Performed:***

- Updates the isCorrect column:
  - 1 if the student answer matches the correct choice.
  - 0 otherwise.
- Updates the score column:
  - Assigns default\_score if the answer is correct.
  - Assigns 0 if the answer is incorrect.

This is achieved using:

- CASE expressions for conditional logic.
- INNER JOIN between Student\_Exam\_Answer and Question tables.

## Reports

### Report 1

Report that returns the students information according to Department No parameter.

#### **GetStudentsByDeptID**

```
CREATE PROCEDURE GetStudentsByDeptID @dept_ID INT
AS
BEGIN
    SELECT S.st_id[ID], S.st_name[Student Name], S.st_address
[Government], D.Dept_name[Department],
    U.univ_name[University], M.MajorName[Major],
YEAR(GETDATE()) - YEAR(DateOfBirth) [Age]
    FROM student S
    inner join student_university U
        ON S.Univ_id = U.Univ_id
    inner join StudentMajor M
        ON S.Major_id = M.MajorID
    inner join Department D
        ON D.Dept_id = S.Dept_id
    WHERE D.Dept_id = @dept_ID
END
```

**Purpose:** Retrieve all students who belong to a specific department.

**Execution behavior:**

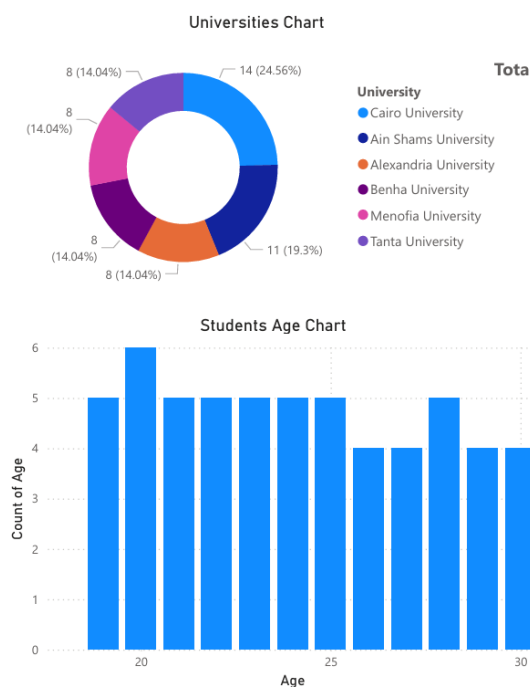
- The procedure takes a department ID.
- It looks in the student table for all students linked to that department.
- It joins with other tables (student\_university, StudentMajor, Department) to get extra details like university name, major name, and department name.
- It also calculates the student's age by subtracting the year of birth from the current year.

**Input:**

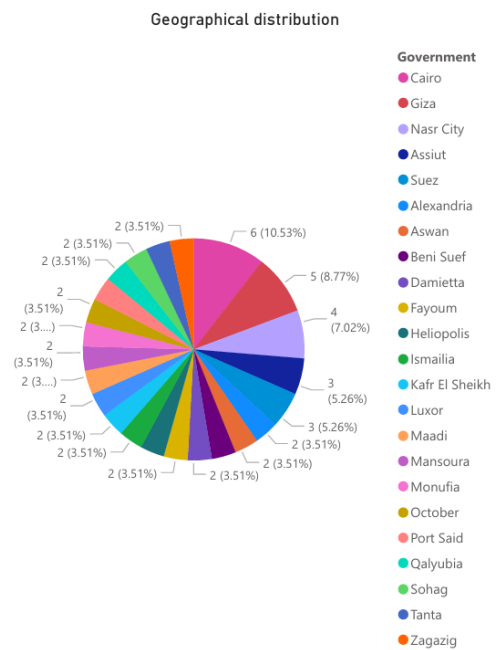
- @dept\_ID → the department ID you want to filter by.

**Output:** A result set with these columns:

- Student ID
- Student Name
- Address (Government)
- Department Name
- University Name
- Major Name
- Age (calculated from DateOfBirth).



**57**  
Total number of Students



*Report 1 : Get Student By Department ID*

## Report 2

Report that takes the student ID and returns the grades of the student in all courses. %

### SP\_Student\_Grades

```
CREATE PROCEDURE [dbo].[SP_Student_Grades]
(
    @St_id INT
)
AS
BEGIN
    SET NOCOUNT ON;

    SELECT
        c.crs_id,
        c.crs_name,
        sc.grade,
        CASE
            WHEN sc.grade >= 60 THEN 'Pass'
            ELSE 'Fail'
        END AS status
    FROM st_crs_grade sc
    INNER JOIN Course c
        ON sc.crs_id = c.crs_id
    WHERE sc.st_id = @St_id;
END
```

**Purpose:** Retrieve all grades for a specific student across all courses.

**Execution behavior:**

- When you run this procedure, the database looks into the st\_crs\_grade table (where student grades are stored).
- It matches the student ID you provide (@St\_id).
- It joins with the Course table to get the course names.
- It also joins with the student table to get the student's name.
- Finally, it returns a list of all courses that student has taken, with the grade in each.



**Input:**

- @St\_id → the student's ID (INT).

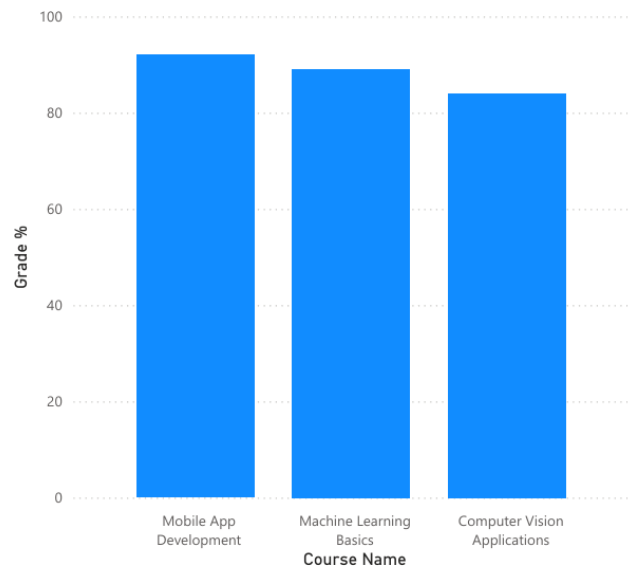
**Output:** A result set with four columns:

- Student ID
- Student Name
- Course Name
- Grade (percentage or score).

**Youssef Anwar**

Student Name

Student Courses Grades



*Reposrt 2 : Student Grade in all courses*

## Report 3

Report that takes the instructor ID and returns the name of the courses that he teaches and the number of student per course.

### SP\_InstructorCoursesReport

```
CREATE PROCEDURE [dbo].[SP_InstructorCoursesReport]
@InstructorID INT
AS
    SELECT
        I.ins_name [Instructor], c.crs_name AS CourseName,
        COUNT(scg.st_id) AS StudentCount
    FROM instructor_Course ic INNER JOIN Course c
        ON ic.course_ID = c.crs_id
    LEFT JOIN st_crs_grade scg
        ON c.crs_id = scg.crs_id
        inner join Instructor I
            on ic.instructor_ID = I.ins_id
    WHERE ic.instructor_ID = @InstructorID
    GROUP BY c.crs_name, I.ins_name;
```

**Purpose:** Generate a report of all courses taught by a specific instructor, along with the number of students enrolled in each course.

#### Execution behavior:

- The procedure starts from the instructor\_Course table to find which courses are linked to the instructor ID you provide.
- It joins with the Course table to get the course names.
- It joins with the Instructor table to get the instructor's name.
- It uses a **LEFT JOIN** with st\_crs\_grade to count how many students are enrolled in each course (even if some courses have zero students, they will still appear).
- Finally, it groups the results by course name and instructor name so you get one row per course.

**Input:**

- @InstructorID → the instructor's ID (INT).

**Output:** A result set with three columns:

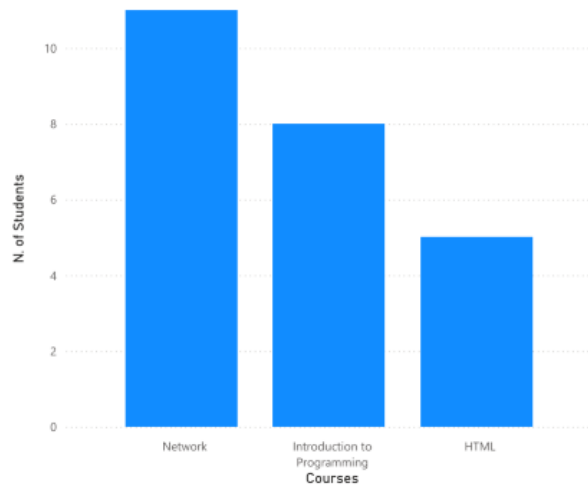
- Instructor name
- Course name
- Student count (number of students enrolled in that course).

**Sara Youssef**  
Instructor Name

**24**  
Total Number of students teaching

**3**  
Number of Courses

NO. of Students by assigned in each course



*Report 3 : Get courses names that an instructor teaches*

## Report 4

Report that takes course ID and returns its topics

### SP\_CourseTopicsReport

```
CREATE PROCEDURE [dbo].[SP_CourseTopicsReport]
    @CourseID INT
AS
    SELECT
        c.crs_name AS CourseName,
        t.topic_name AS TopicName
    FROM Course c
    INNER JOIN Topic t
        ON c.crs_id = t.crs_id
    WHERE c.crs_id = @CourseID;
```

**Purpose:** Retrieve all topics that belong to a specific course.

**Execution behavior:**

- The procedure takes a course ID (@CourseID).
- It looks in the Course table to find the course.
- It joins with the Topic table to get all topics linked to that course.
- It then returns one row for each topic inside that course.

**Input:**

- @CourseID → the ID of the course you want to see topics for.

**Output:** A result set with two columns:

- Course name
- Topic name

HTML

Course Name

Course Topics

Forms and Input Elements	Introduction to HTML	Tables and Lists
HTML Tags and Attributes	Semantic HTML and Best Practices	

Report 4 : Topics in Course

## Report 5

Report that takes exam number and returns the Questions in it and choices

### SP\_ExamQuestionsChoices

```

CREATE PROCEDURE [dbo].[SP_ExamQuestionsChoices] @ExamID INT
AS
BEGIN
    SELECT
        e.ex_ID,
        q.q_id,
        q.q_text,
        q.q_type,
        q.correct_choice,
        STRING_AGG(
            CASE WHEN c.choice_text <> q.correct_choice THEN
c.choice_text END, ', '
        ) WITHIN GROUP (ORDER BY c.ch_id) AS WrongChoices
    FROM Exam_Question e
    INNER JOIN Question q
        ON e.q_ID = q.q_id

```

```

LEFT JOIN Choice c
    ON q.q_id = c.q_id
WHERE e.ex_ID = @ExamID
GROUP BY e.ex_ID, q.q_id, q.q_text,
q.correct_choice, q.q_type;
END;

```

**Purpose:** Retrieve all questions of a specific exam, along with their correct answer and all wrong choices.

**Execution behavior:**

- The procedure takes an exam ID (@ExamID).
- It looks in the Exam\_Question table to find all questions linked to that exam.
- It joins with the Question table to get the question text, type, and correct choice.
- It joins with the Choice table to collect all possible choices.
- It uses STRING\_AGG to combine all wrong choices into one string, separated by commas, ordered by choice ID.
- Finally, it groups the results so you get one row per question with its correct and wrong choices.

**Input:**

- @ExamID → the exam's ID (INT).

**Output:** A result set with:

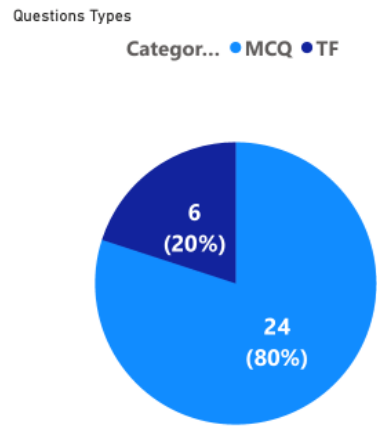
- Exam ID
- Question ID
- Question text
- Question type (MCQ, True/False, etc.)
- Correct choice
- Wrong choices (all combined in one column).

1

Exam ID

30

NO. of questions



Question	Correct Answer	Wrong Answers
HTML files are saved with which extension?	html	Link, Anchor Text, Hyperlink
Is HTML a programming language?	False	True
Is HTML case sensitive?	False	Heading 2, Heading 3, Heading 6
Is the line break element used to move text to a new line?	True	Table, Div, Section
Is the password input used to hide characters?	True	Div, List, Form
Is the unordered list element used for ordered lists?	False	Article, Section, Header
sql is case sensitive?	f	HTML4, XHTML, SGML
What does HTML stand for?	Hyper Text Markup Language	ISO, IEEE, ANSI
what is the answer to this code : int i =0; cout<< ++i;	1	txt, doc, xml
what is the command to retrieve data?	select	Home Tool Markup Language, High Text
Which attribute is used to make a field mandatory?	Required	True
Which attribute specifies the destination of form data?	Action	Optional, Nullable, Hidden
which constraint ensures unique values?	primary key	True
Which element defines a table header cell?	Header Cell	Header, Footer, Aside
Which element defines a table row?	Row	Paragraph, Span, Division
Which element is used for list items?	List Item	Header, Aside, Navigation
Which element is used for ordered lists?	Ordered List	False
Which element is used for the largest heading?	Heading 1	Method, Target, Name
Which element is used to add metadata?	Meta	Radio, Text, Number
Which element is used to create a dropdown list?	select	Data Cell, Row Header, Column Header
Which element is used to create a form?	Form	Dropdown, Option, List
Which element is used to create a hyperlink?	Anchor	Sentence, Text, Division
Which element is used to create a table?	Table	Unordered List, Definition List, Menu
Which element is used to define a paragraph?	Paragraph	False
Which element is used to define navigation links?	Navigation	Division, Paragraph, Heading
Which element is used to define the main content?	Main	Strong, Italic, Underline
Which element is used to insert an image?	Image	Style, Script, Link
Which input type is used for selecting multiple options?	Checkbox	Cell, Column, Data
Which organization maintains HTML standards?	W3C	False
Which version of HTML introduced semantic elements?	HTML5	Button, Image, Paragraph

Report 5 : Exam Questions & Choices

Report 6

Report that takes exam number and the student ID then returns the Questions in this exam with the student answers.

GetExamStudentAnswers

```
CREATE PROCEDURE [dbo].[GetExamStudentAnswers]
(
    @STUDENT_ID INT,
    @EXAM_ID INT
)
AS
BEGIN
    SELECT SEA.student_ID AS [Student ID], S.st_name AS
[Student Name],
        SEA.exam_ID AS [Exam ID], SEA.question_ID AS [Question
ID], Q.q_text AS [Question ], Q.q_type AS [Question Type],
        Q.correct_choice AS [Correct Answer],
SEA.student_Answer AS [student Answer], SEA.isCorrect AS
[Result],
        SEA.score AS [Student Score]
```

```
FROM Student_Exam_Answer SEA
INNER JOIN Question Q
ON SEA.question_ID = Q.q_id
INNER JOIN Student S
ON S.st_id = SEA.student_ID
END
```

**Purpose:** Retrieve detailed information about a student's answers in a specific exam.

**Execution behavior:**

- The procedure takes two parameters: student ID and exam ID.
- It looks in the Student\_Exam\_Answer table to find all answers that student gave in that exam.
- It joins with the Question table to get the question text, type, and correct answer.
- It joins with the Student table to get the student's name.
- It then returns one row per question, showing both the student's answer and whether it was correct.

**Input:**

- @STUDENT\_ID → the student's ID (INT).
- @EXAM\_ID → the exam's ID (INT).

**Output:** A result set with:

- Student ID
- Student Name
- Exam ID
- Question ID
- Question text
- Question type (MCQ, True/False, etc.)
- Correct answer
- Student's answer
- Result (whether the answer is correct or not)
- Student's score for that question



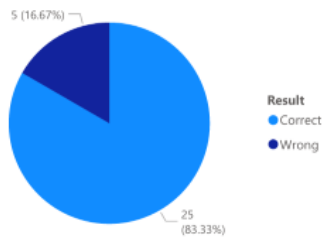
Ahmed Mohamed

Student Name

50

Student Grade

#### Student Answers Results



Question	Correct Answer	Student Answer
HTML files are saved with which extension?	.html	.css
Which organization maintains HTML standards?	W3C	.W2S
what is the answer to this code : int i =0; cout<< ++i;	1	2
Which attribute specifies the destination of form data?	Action	Action
Which element is used to create a hyperlink?	Anchor	Anchor
Which input type is used for selecting multiple options?	Checkbox	Checkbox
sql is case sensitive?	f	f
Is HTML a programming language?	False	False
Is the unordered list element used for ordered lists?	False	False
Which element is used to create a form?	Form	Form
Which element defines a table header cell?	Header Cell	Header Cell
Which element is used for the largest heading?	Heading 1	Heading 1
Which version of HTML introduced semantic elements?	HTML5	HTML5
What does HTML stand for?	Hyper Text Markup Language	Hyper Text Markup Language
Which element is used to insert an image?	Image	Image
Which element is used for list items?	List Item	List Item
Which element is used to define the main content?	Main	Main
Which element is used to add metadata?	Meta	Meta
Which element is used to define a paragraph?	Paragraph	Meta
Which element is used to define navigation links?	Navigation	Navigation
Which element is used for ordered lists?	Ordered List	Ordered List
which constraint ensures unique values?	primary key	primary key
Which attribute is used to make a field mandatory?	Required	Required
Which element defines a table row?	Row	Row
what is the command to retrieve data?	select	select
Which element is used to create a dropdown list?	select	select
Which element is used to create a table?	Table	Table
Is HTML case sensitive?	False	True
Is the line break element used to move text to a new line?	True	True

Report 6 : Student Answers in Exam

# Interface

## Technology Stack

### Frontend Libraries & Tools

- **React 19.2.0** – Component-based UI and state management
- **Vite 7.2.4** – Fast development server and build tool
- **Tailwind CSS 3.4.19** – Utility-first CSS framework
- **Axios 1.13.2** – HTTP client for API communication
- **React Router DOM 7.11.0** – Client-side routing

## User Roles

### 1. Admin

- Assign students to courses
- Display exams

### 2. Instructor

- Create exams
- Generate and regenerate questions
- Update exam settings (duration / question counts)
- Submit and finalize exams

### 3. Student

- Access assigned exams
- Take exams within a controlled time window
- Submit answers manually or automatically when time ends

## Login to Exam System

☐ Student ☐ Instructor ☐ Admin

Email Address

Password

Sign In

*Login Page*

## Questions Management

Instructors have the ability to manage questions within the system, including adding new questions, editing existing ones, and deleting questions when needed. Each question can be categorized by its type, such as multiple-choice, **true/false**, or **short-answer**, allowing for better organization and flexible exam creation.

### APIs for Questions management:

- POST /api/questions – Add a question
- PUT /api/questions/:id – Update a question
- DELETE /api/questions/:id – Delete a question
- GET /api/questions/:examId – Get all questions

The screenshot displays the ITI Question Bank interface. On the left is a sidebar with navigation links: Dashboard, Add Question, Question Bank (highlighted), Generate Exam, All Exams, and Assign Students. The main content area is titled 'Question Bank' and shows 'Total Questions: 808'. It lists three questions:

Type	ID	Points	Question Text	Correct Answer
MCQ	823	5 points	What is the complexity of typical Logging operations?	O(n)
MCQ	822	5 points	Which of these is NOT related to Logging?	Pizza
TF	821	2 points	True or False: Beginners should start with Logging.	True

Each question entry includes edit and delete icons. A '+ Add Question' button is located at the top right of the question list. The interface also shows an 'Instructor' profile icon in the top right corner.

Question Bank

ITI

Dashboard

Add Question

Question Bank

Generate Exam

All Exams

Assign Students

Add Question

Instructor

Add New Question

Course

Intro to Computer Science

Topic

Bits & Bytes

Question Type

Multiple Choice (MCQ)

Question Text

Enter the question here...

Score

5

Adding New Question to the Question Bank

Question Text

Enter the question here...

Score

5

Correct Answer

Enter the correct answer

Wrong Choices

Wrong choice 1

+ Add Wrong Choice

Save Question to Bank

Inserting Answers to Question

# Exam

## Exam Lifecycle (Core Flow)

### Step 1: Create Empty Exam

1. Instructor selects course and duration
2. Frontend sends: POST /api/exams
3. Backend creates an empty exam record

ITI

Dashboard

Add Question

Question Bank

**Generate Exam**

All Exams

Assign Students

**Generate Exam**

Select Course:

Select Course

Duration (minutes):

60

Number of MCQs Questions:

0

Number of True/False Questions:

0

Generate Exam

Instructor

Generating Exam

ITI

Dashboard

Add Question

Question Bank

**Generate Exam**

All Exams

Assign Students

**Generate Exam**

Please select a course

Select Course:

Web Development

Duration (minutes):

60

Number of MCQs Questions:

3

Number of True/False Questions:

3

Generate Exam

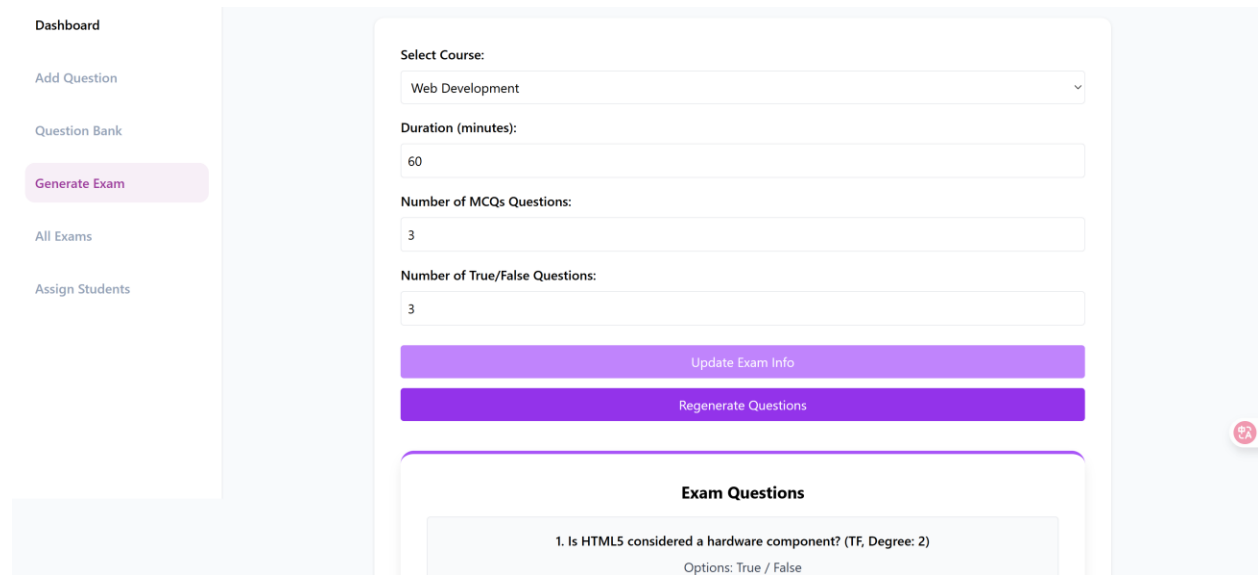
Instructor

Choosing number and type of questions

### Step 2: Generate Exam Questions

1. Instructor specifies number of MCQ and True/False questions
2. Frontend sends: POST /api/exams/generate
3. Questions are attached to the existing exam

Important: Frontend **does not regenerate automatically** to avoid duplicated questions.



The screenshot shows a web application interface for managing exams. On the left is a sidebar with navigation links: 'Dashboard', 'Add Question', 'Question Bank', 'Generate Exam' (highlighted in pink), 'All Exams', and 'Assign Students'. The main content area is a form titled 'Generate Exam'. It contains the following fields and buttons:

- 'Select Course:' dropdown menu with 'Web Development' selected.
- 'Duration (minutes):' text input with '60'.
- 'Number of MCQs Questions:' text input with '3'.
- 'Number of True/False Questions:' text input with '3'.
- 'Update Exam Info' button (light purple).
- 'Regenerate Questions' button (dark purple).
- 'Exam Questions' section showing a list of generated questions. The first question is: '1. Is HTML5 considered a hardware component? (TF, Degree: 2)' with options 'True / False'.

*Generated Exam*

### Step 3: Update Exam

1. Instructor updates:
  - Duration
  - MCQ / TF counts
2. Frontend sends: PUT /api/exams/:id

### Step 4: Regenerate Exam

1. Instructor may regenerate questions manually
2. Old questions are replaced (not appended)
3. Controlled action to avoid accidental duplication

Regenerate Questions

Exam Questions

1. Which tool is commonly associated with JavaScript? (MCQ, Degree: 5)

2. Is JavaScript considered a hardware component? (TF, Degree: 2)  
Options: True / False

3. True or False: JavaScript was invented in 1800. (TF, Degree: 2)  
Options: True / False

4. What is the complexity of typical JavaScript operations? (MCQ, Degree: 5)

5. Which tool is commonly associated with React? (MCQ, Degree: 5)

6. True or False: React was invented in 1800. (TF, Degree: 2)  
Options: True / False

Exam Questions

### Step 5: Submit Exam (Instructor)

1. Locks exam for students : POST /api/exams/submit

Exam Questions

1. Is HTML5 considered a hardware component? (TF, Degree: 2)  
Options: True / False

2. Which of these is NOT related to HTML5? (MCQ, Degree: 5)

3. True or False: Beginners should start with CSS3. (TF, Degree: 2)  
Options: True / False

4. Is JavaScript considered a hardware component? (TF, Degree: 2)  
Options: True / False

5. What is the complexity of typical JavaScript operations? (MCQ, Degree: 5)

6. What is the complexity of typical React operations? (MCQ, Degree: 5)

Submit Exam

Exam Submission



## Student Exam Flow

### Step 1: Fetch Exam & Questions

GET /api/student/exam/:id/questions

Response includes:

- startTime
- durationMinutes
- questions[]

### Step 2: Secure Timer Logic (Server-Based)

Timer **does NOT** use localStorage

If student refreshes → timer continues correctly

### Step 3: Answering Questions

- Student answers stored locally (for navigation only)
- Options shuffled per question

### Step 4: Auto Submit

- When remaining time reaches zero:

POST /api/student/exam/submit

The screenshot displays a student exam interface. At the top, there is a progress bar and a timer showing 9:54. Below this, a question card is visible, titled 'Question 1'. The question asks, 'Which component is considered the 'brain' of the computer?'. There are four options: A. RAM, B. CPU, C. HDD, and D. GPU. Option B, CPU, is selected and highlighted with a blue border. At the bottom of the question card, there are two buttons: 'Previous' and 'Next'.

Exam View



Question 2

Software is the physical part of the computer.

☐ A True

☒ B False

*Time Slider during exam solving*

Exam submitted successfully

OK

Question 8

Why is Binary Logic important?

☐ A Efficiency

☐ B It is heavy

☐ C It looks cool

☐ D It smells nice

*Submitting Exam*

Course	Grade
Intro to Computer Science	47
Database Systems	88
Web Development	88
Operating Systems	50

Grades Dashboard

## Assign Student to Course

### API Usage from Frontend Perspective:


POST /api/courses/assign


Body: { st\_id, crs\_id }


Used by: **Admin / Instructor**


Courses Assignment Dashboard


### Assign Student to Course


 Select Student


Mary Miller (ID: 1) 

 **Mary Miller**  
Student ID: 1


 Select Course

Database Systems (ID: 2) 


 **Database Systems**  
Course ID: 2


 **M** **Mary Miller**  
Student


→

 **D** **Database Systems**  
Course

+ Assign Student to Course

Total Students  
**100**

Available Courses  
**43**

Ready to Assign  
**1**

Assigning Student to Course


**ITI**

Home

**My Courses**

My Grades

**Student courses**

Mary Miller 

**My Courses**

Intro to Computer Science

Database Systems

Web Development

Operating Systems

Student Courses Dashboard