

# “ITI Examination System”

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## Introduction:

The Examination System is a comprehensive automated solution developed to streamline the process of creating, managing, and evaluating online exams. It enables ITI staff to efficiently handle exams, student information, and course-related data. This documentation outlines the system’s core functionalities, database design, implemented stored procedures, and reporting features.

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# 1. Database Design

## 1.1 Conceptual Design – ERD

### Student

Each student is uniquely identified by STU\_ID.

Students have personal details such as name, Gender, phone, email, Password, GPA, hired or not, job title and company name.

Students can get one or more of the following (freelancing job, certificate).

Students can enroll in multiple courses.

Each student is assigned to only one department.

### Instructor

Each instructor is uniquely identified by INST\_ID.

Instructors have personal details such as name, Gender, email, internal or external and hired date.

Instructors can teach multiple courses.

Instructors can work in multiple departments.

One instructor can manage one department.

One Instructor can supervise many instructors.

### Course

Each course is uniquely identified by COURSE\_ID.

Each course has its name, duration and credit hours.

Each course is taught by one instructor only.

Each course is enrolled by many students.

Each course has many of the following (exams, questions).

Each course can be registered in one or more than one department.

### Department

Each department is uniquely identified by DEPT\_NO.

Each department has its name.

Each department is managed by one instructor only.

Each department contains a group of courses, students and instructors.

## Exam

Each exam is uniquely identified by EXAM\_ID.

Each exam has number of questions, dates, time, total score and duration.

Each exam is linked to only one course.

Each exam contains a group of courses, students and instructors.

Each exam is linked to only one course.

Each exam contains multiple questions solved by students, the answers are stored, and the score is saved.

## Question

Each question is uniquely identified by QUES\_ID.

Each question has text, correct answer, the type (T/F, MCQ) and the score.

Each question can appear in more than one exam and is answered by students.

Each question is linked to only one course.

## Freelance

Each freelance work is uniquely identified by FREELANCE\_ID.

Each freelance work has its platform, duration and date.

Many freelance works can be done by one student.

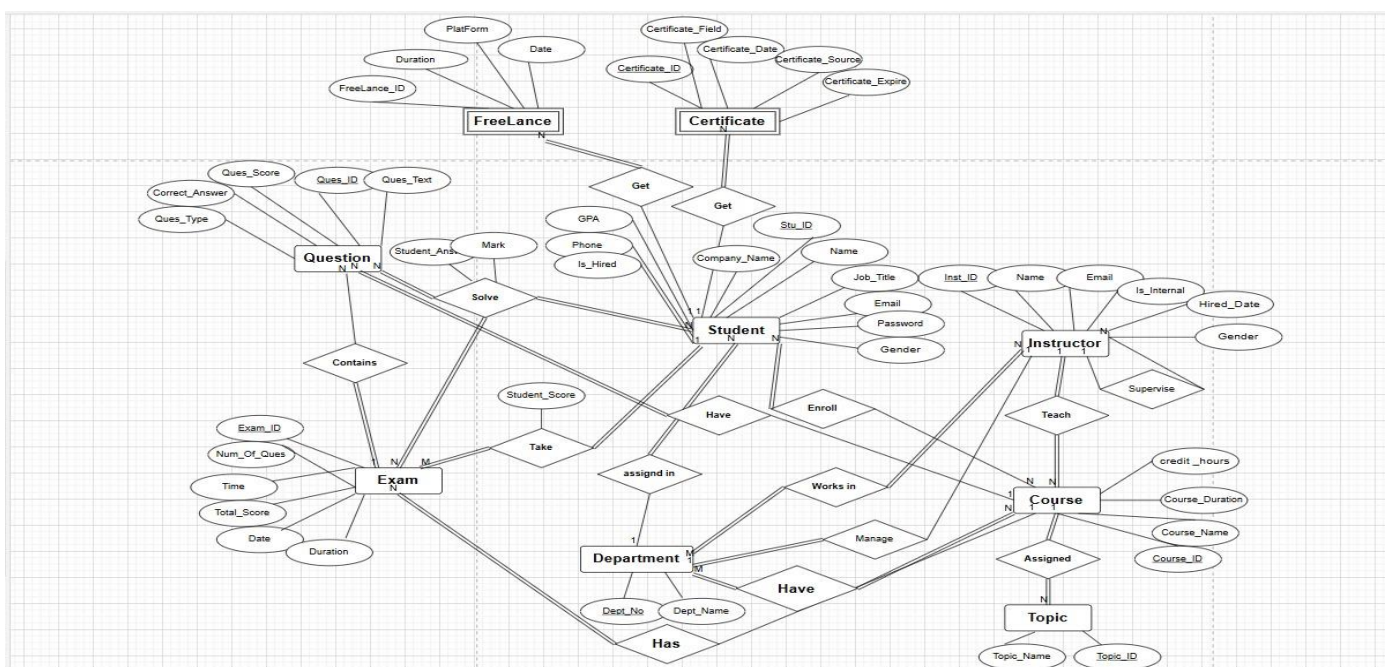
## Certificate

Each certificate is uniquely identified by CERTIFICATE\_ID.

Each certificate has its source, date, expiring date and related to a specific field.

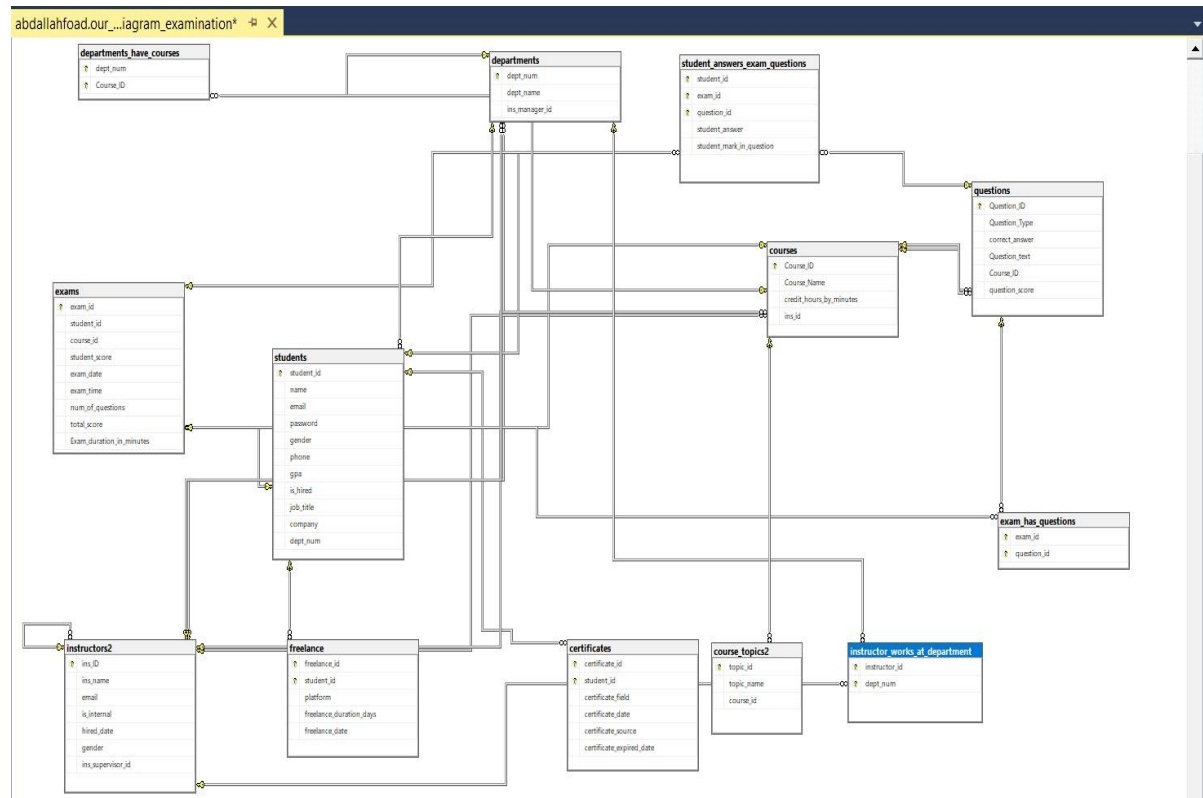
Many certificates can be obtained by one student.

## ERD



## 1.2 Logical Design – Mapping

### Mapping



## 1.3 Physical Design – SQL

After the logical design, we started to create our database using SQL.

The data itself is generated by using Faker library in python and tools like Mockaroo.

## 2. Stored Procedures

### 1. **sp\_GetStudentsByDepartment**

Fetches a list of students who belong to a specific department, along with their personal and academic details, **if the department exists**

### 2. **sp\_GetStudentGrades**

Retrieves all exam results for a specific student, including their score, the total score, and the percentage grade, **if the student exists**.

### 3. **sp\_GetExamQuestions**

Displays all the questions included in a given exam, showing each question's text, type, correct answer, and score.

### 4. **sp\_GetInstructorCoursesWithStudentCount**

Lists all the courses taught by a specific instructor and shows how many unique students have taken exams in each course, **if the instructor exists**.

### 5. **sp\_GenerateExam**

Automatically creates an exam for a student by inserting the exam record and randomly selecting a fixed number of True/False and MCQ questions, **as long as the total is exactly 10 questions**.

### 6. **sp\_SubmitAnswers**

Submits a student's answers to a specific exam by linking them to the correct questions based on exam ID.

### 7. **sp\_CorrectExam**

Automatically grades the exam by comparing the student's answers to the correct ones and updates the total score.

### 8. **sp\_GetStudentExamAnswers**

Displays the exam questions along with the correct answers, the student's submitted answers, and their marks per question.

### 9. **sp\_GetCourseTopics**

Returns the list of topics covered in a specific course if the course exists.

### 10. **Insert, Update, Delete**

**Students, Exams, Freelance, Instructors, Questions, Certificates, Courses, Departments** all have procedures to **insert, update, and delete** records.

Each **insert** adds a new entry with the relevant fields.

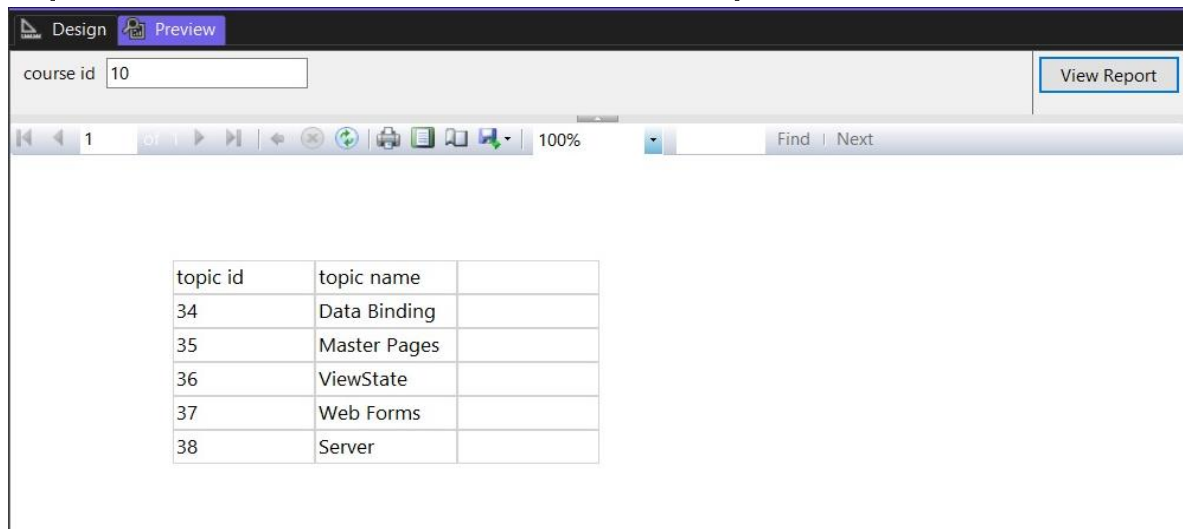
Each **update** modifies specific attributes like name, score, status, or platform.

Each **delete** removes a record using its unique ID or number.

## 3. Reports and Dashboards

### 1.1 SSRS Reports

Report that takes course ID and returns its topics

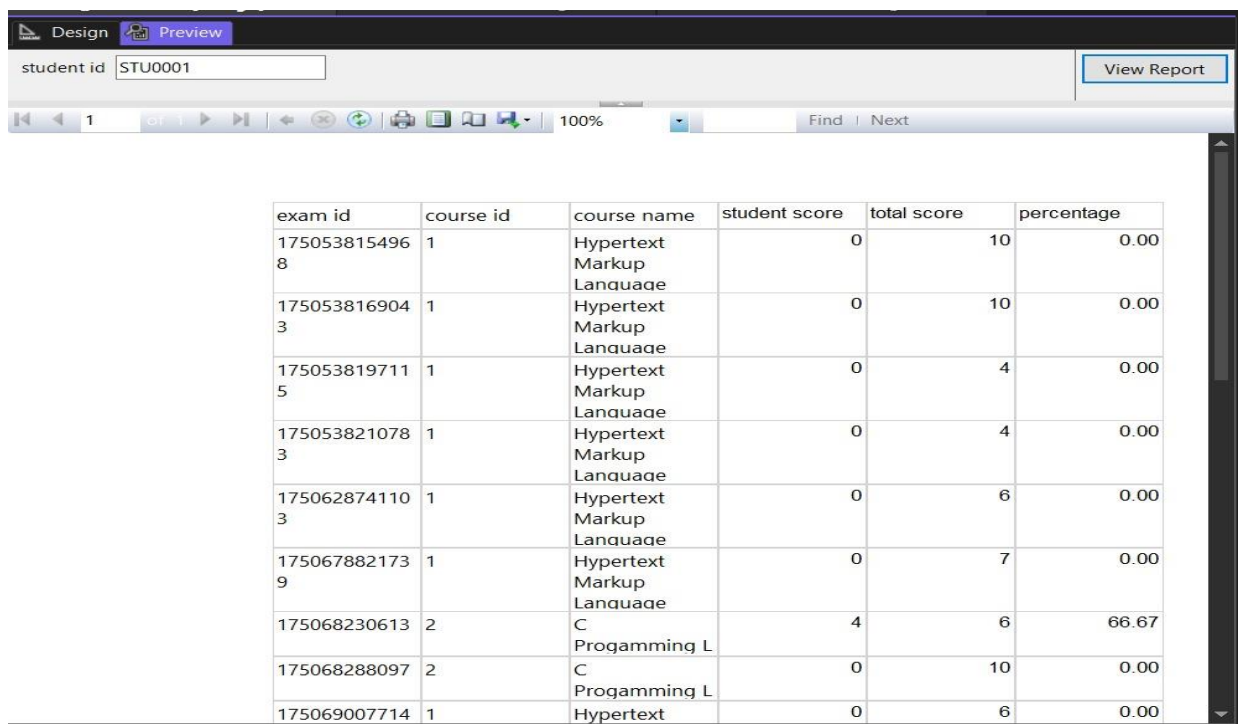


course id 10

View Report

topic id	topic name	
34	Data Binding	
35	Master Pages	
36	ViewState	
37	Web Forms	
38	Server	

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

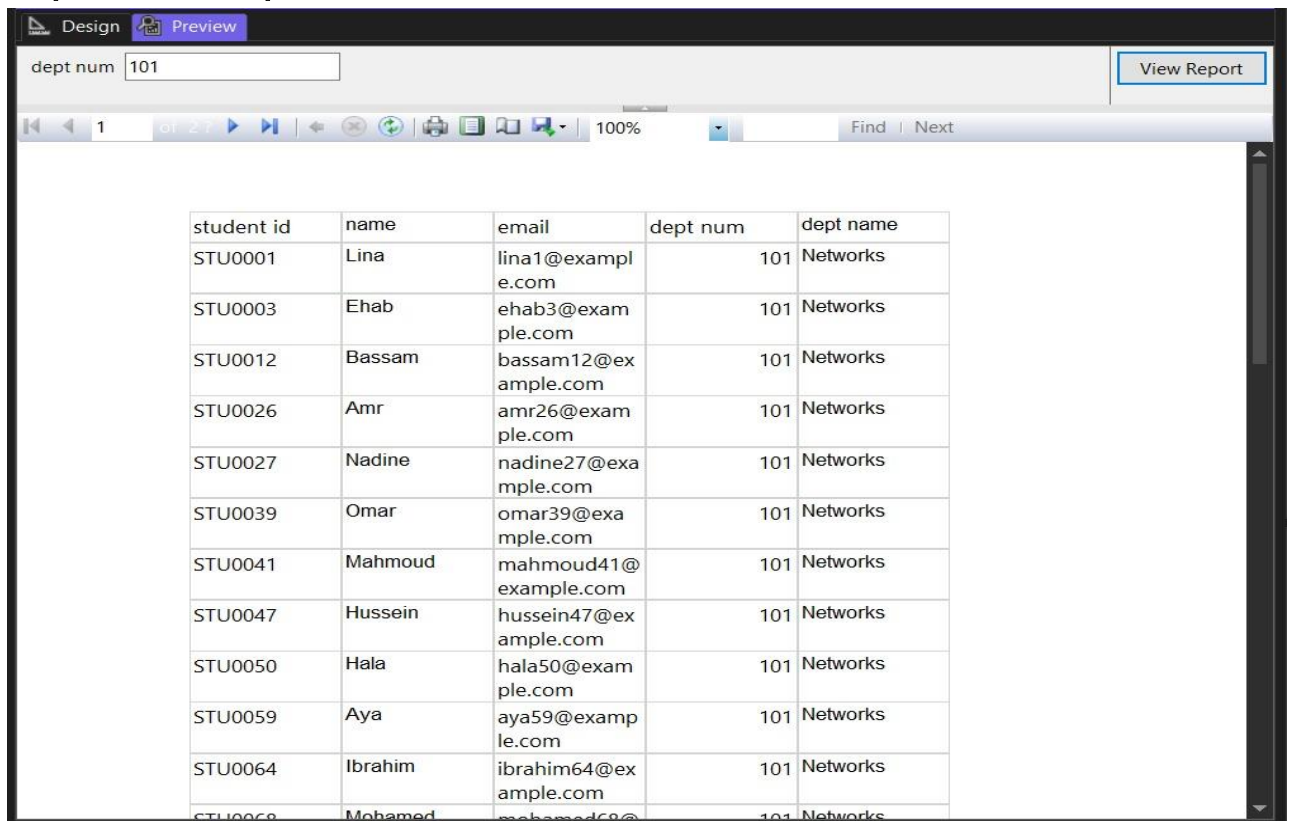


student id STU0001

View Report

exam id	course id	course name	student score	total score	percentage
1750538154968	1	Hypertext Markup Language	0	10	0.00
1750538169043	1	Hypertext Markup Language	0	10	0.00
1750538197115	1	Hypertext Markup Language	0	4	0.00
1750538210783	1	Hypertext Markup Language	0	4	0.00
1750628741103	1	Hypertext Markup Language	0	6	0.00
1750678821739	1	Hypertext Markup Language	0	7	0.00
175068230613	2	C Programming L	4	6	66.67
175068288097	2	C Programming L	0	10	0.00
175069007714	1	Hypertext	0	6	0.00

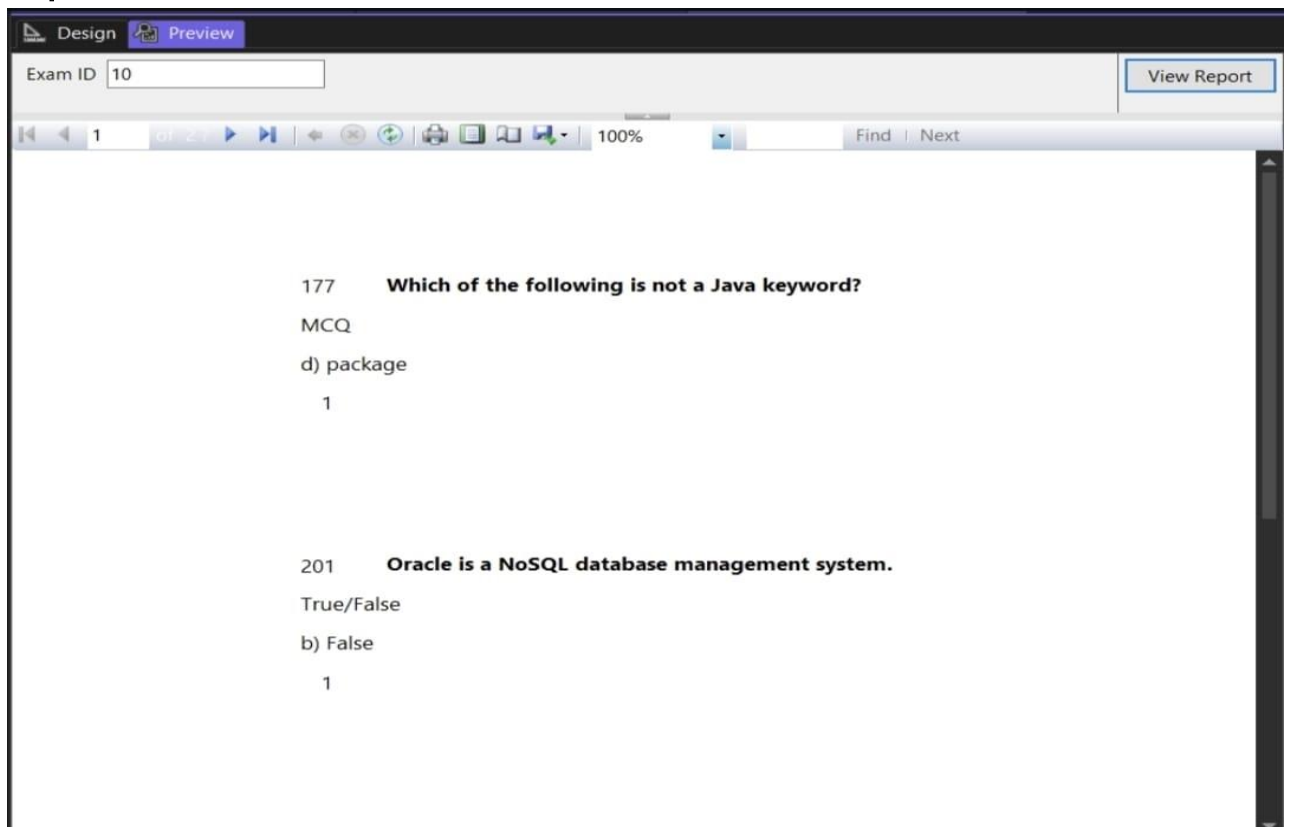
Report that returns the students' information according to Department No parameter.



The screenshot shows a report preview window with a 'Design' and 'Preview' tab. The 'dept num' parameter is set to '101'. The report displays a table with 5 columns: student id, name, email, dept num, and dept name. The table contains 13 rows of student data, all belonging to department 101 (Networks).

student id	name	email	dept num	dept name
STU0001	Lina	lina1@example.com	101	Networks
STU0003	Ehab	ehab3@example.com	101	Networks
STU0012	Bassam	bassam12@example.com	101	Networks
STU0026	Amr	amr26@example.com	101	Networks
STU0027	Nadine	nadine27@example.com	101	Networks
STU0039	Omar	omar39@example.com	101	Networks
STU0041	Mahmoud	mahmoud41@example.com	101	Networks
STU0047	Hussein	hussein47@example.com	101	Networks
STU0050	Hala	hala50@example.com	101	Networks
STU0059	Aya	aya59@example.com	101	Networks
STU0064	Ibrahim	ibrahim64@example.com	101	Networks
STU0068	Mohamed	mohamed68@example.com	101	Networks

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



The screenshot shows a report preview window with a 'Design' and 'Preview' tab. The 'Exam ID' parameter is set to '10'. The report displays two exam questions with their respective choices and a status indicator '1'.

177	<b>Which of the following is not a Java keyword?</b>	MCQ	d) package	1
201	<b>Oracle is a NoSQL database management system.</b>	True/False	b) False	1

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

Design Preview

Exam ID 1

Student ID STU0311

View Report

1 of 1 100% Find | Next

Question ID	Question text	correct answer	student answer	student mark in question
153	Is C# a case-sensitive language?	a)True	Wrong Answer	0
154	Which keyword is used to allow method overriding in C#?	b)Virtual	Wrong Answer	0
155	Which of the following is true about exceptions in C#?	c)Both a and b	c)Both a and b	1
157	Java is a markup language.	b) False	b) False	1
161	Java does not support exception handling.	b) False	Wrong Answer	0
165	Java does not support dynamic memory allocation.	b) False	b) False	1
171	Which of the following is not a primitive data type in Java?	d) boolean	Wrong Answer	0
206	Oracle Database supports distributed database systems.	a) True	a) True	1
237	Photoshop is a 3D	b) False	b) False	1

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

Design Preview	
Instructor ID <input type="text" value="INS4189"/>	<a href="#">View Report</a>
1 of 1 100% Find   Next	

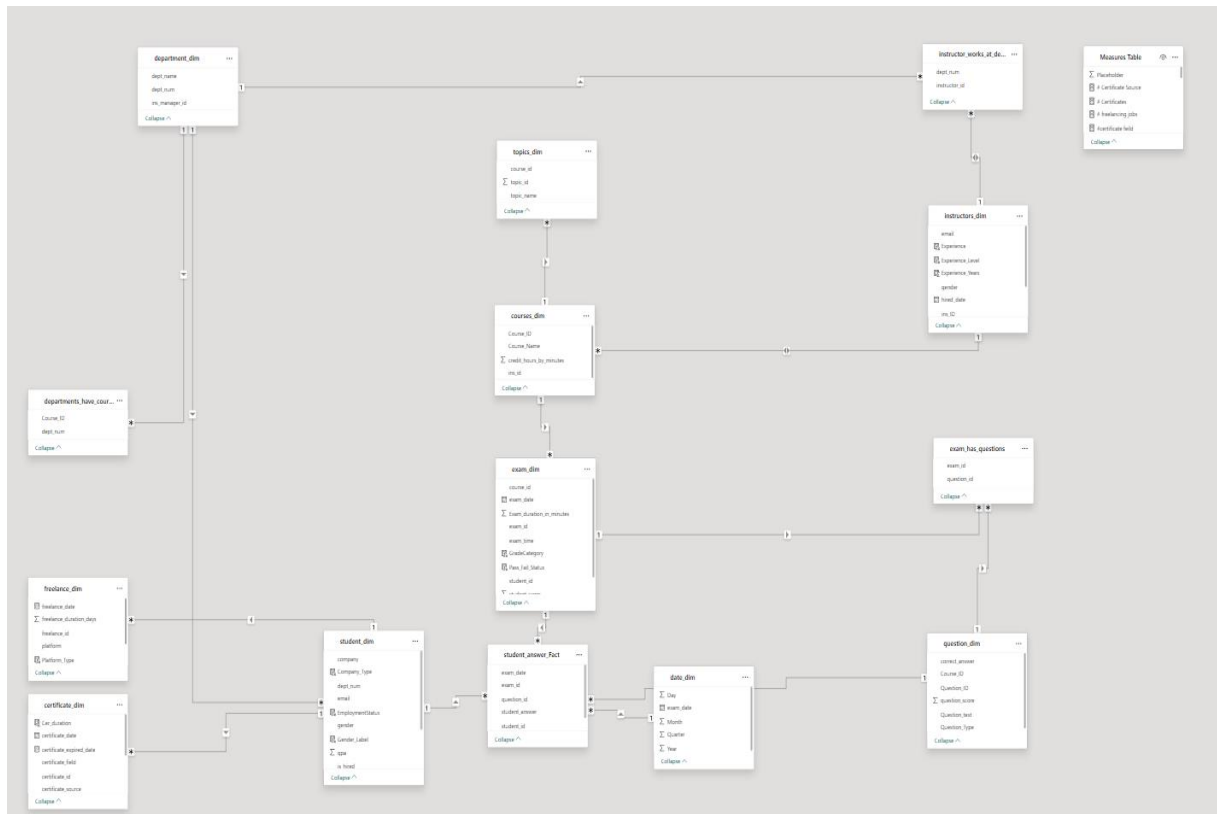
Course Name	Num Of Students
Hypertext Markup Language	169



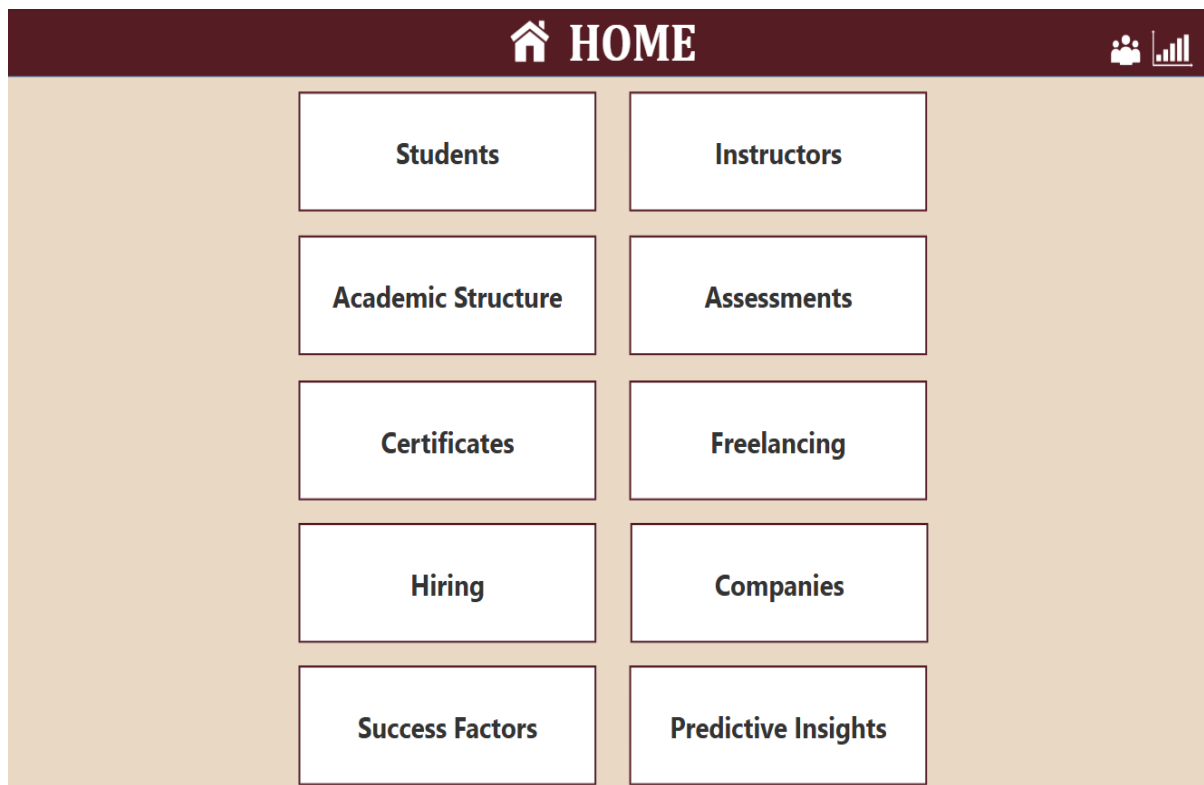
## 1.2 Power BI Dashboards

After making a snowflake schema to increase performance, we created 22 dashboards using Power BI, where the home dashboard includes navigation buttons that help users move between different dashboards. The Team dashboard displays our names along with LinkedIn and GitHub links. The remaining dashboards present analysis, insights, and KPIs related to students, instructors, courses, departments, freelancing, certificates, hiring status, companies, exams, questions, success factors, and predictive analysis.

### Snowflake schema



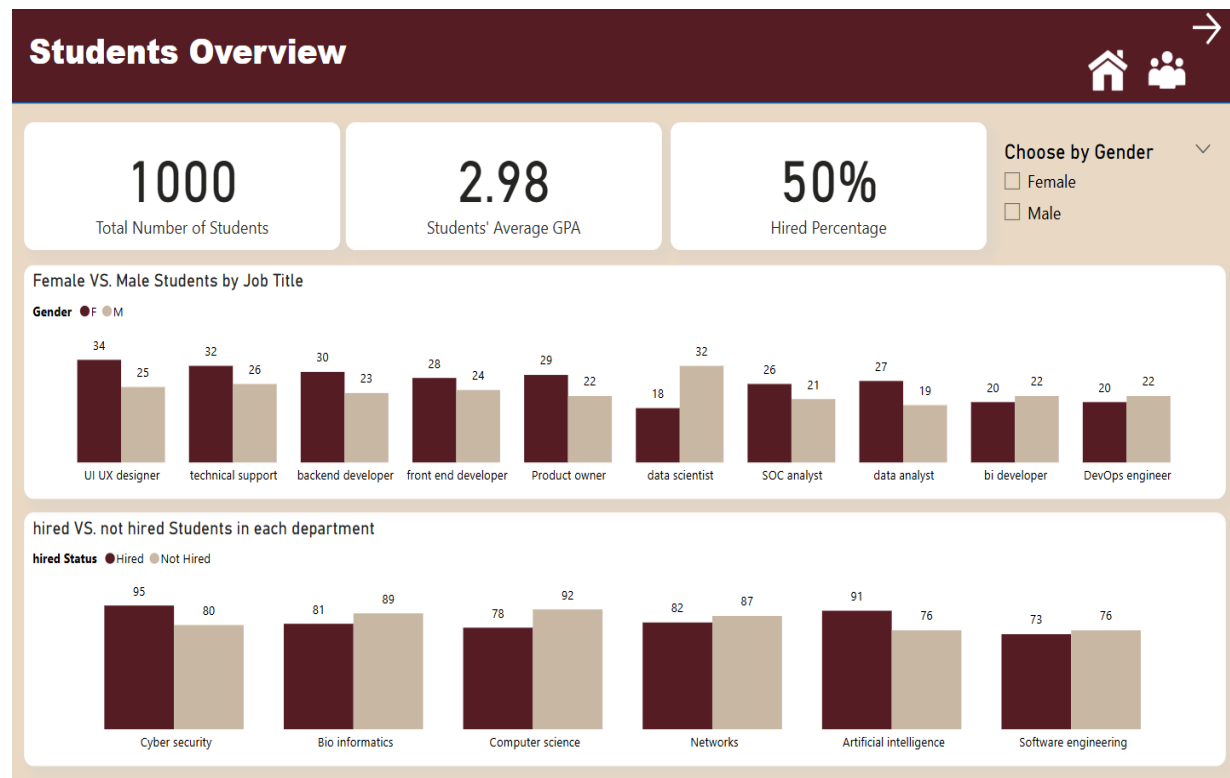
## Home



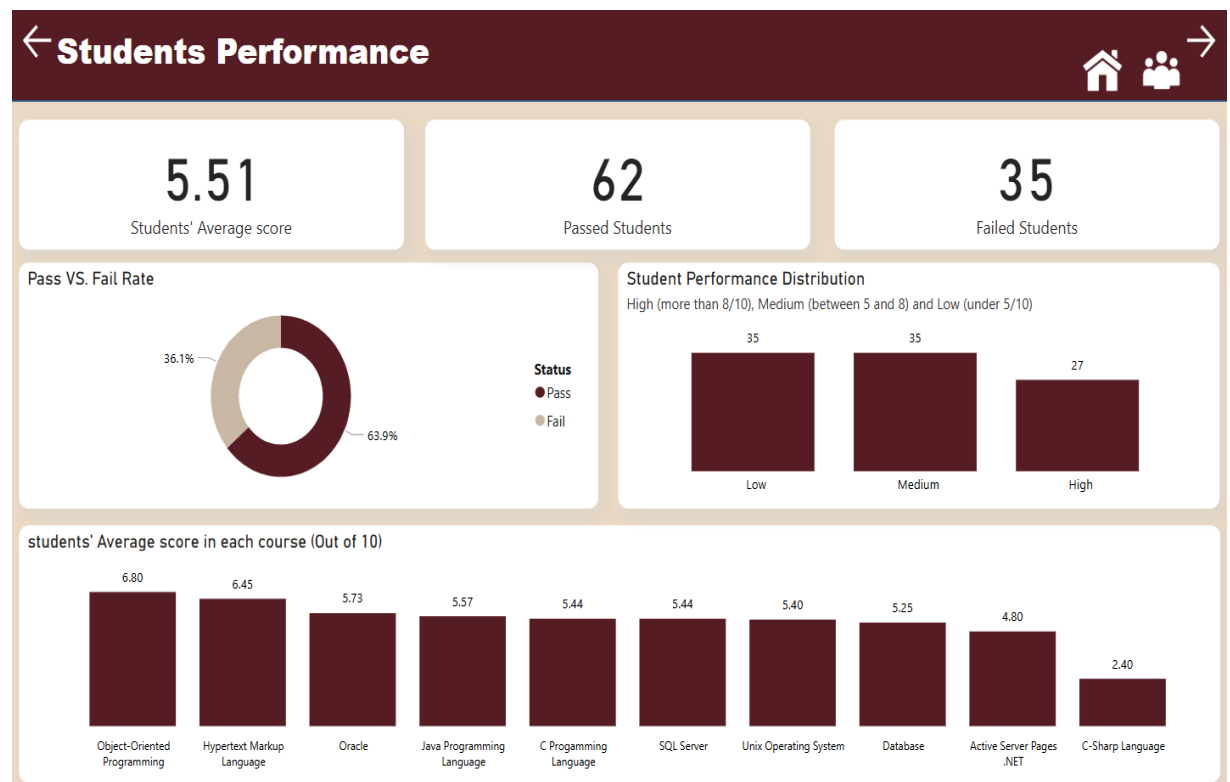
## Team



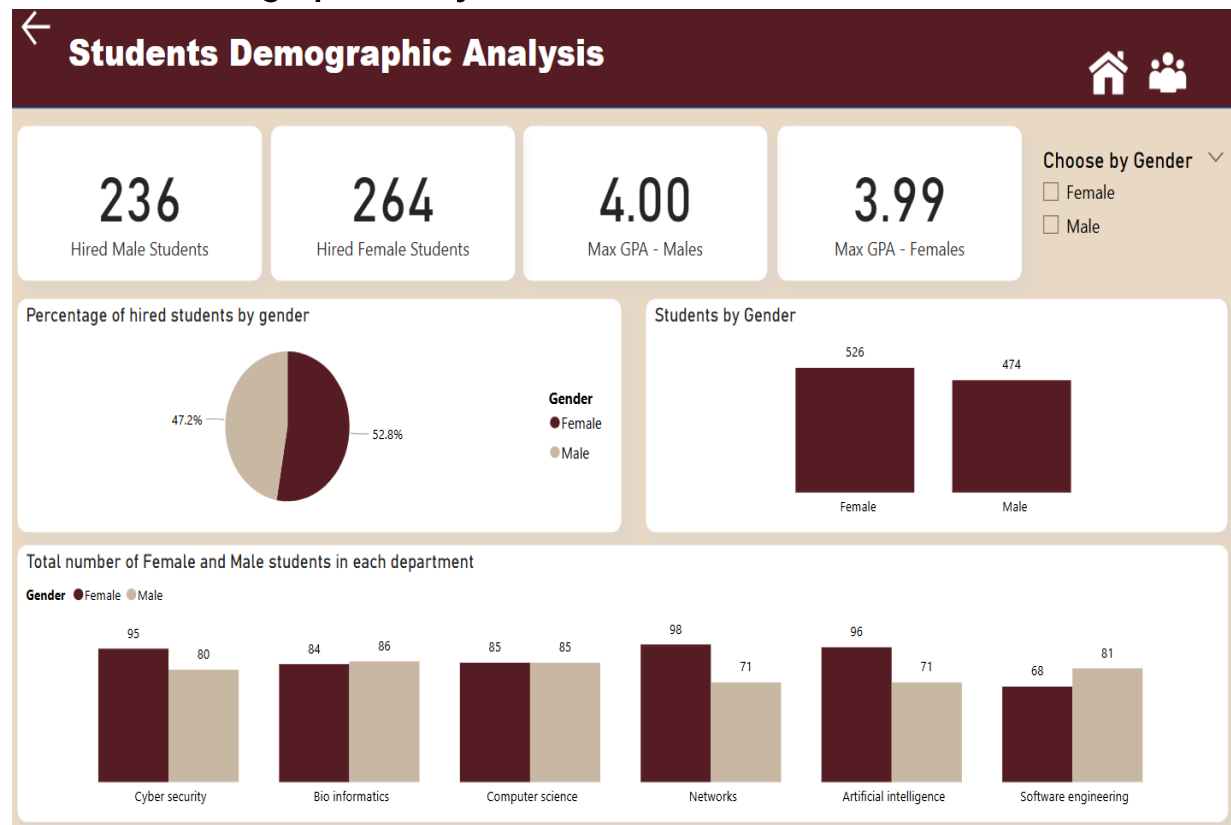
## Students Overview



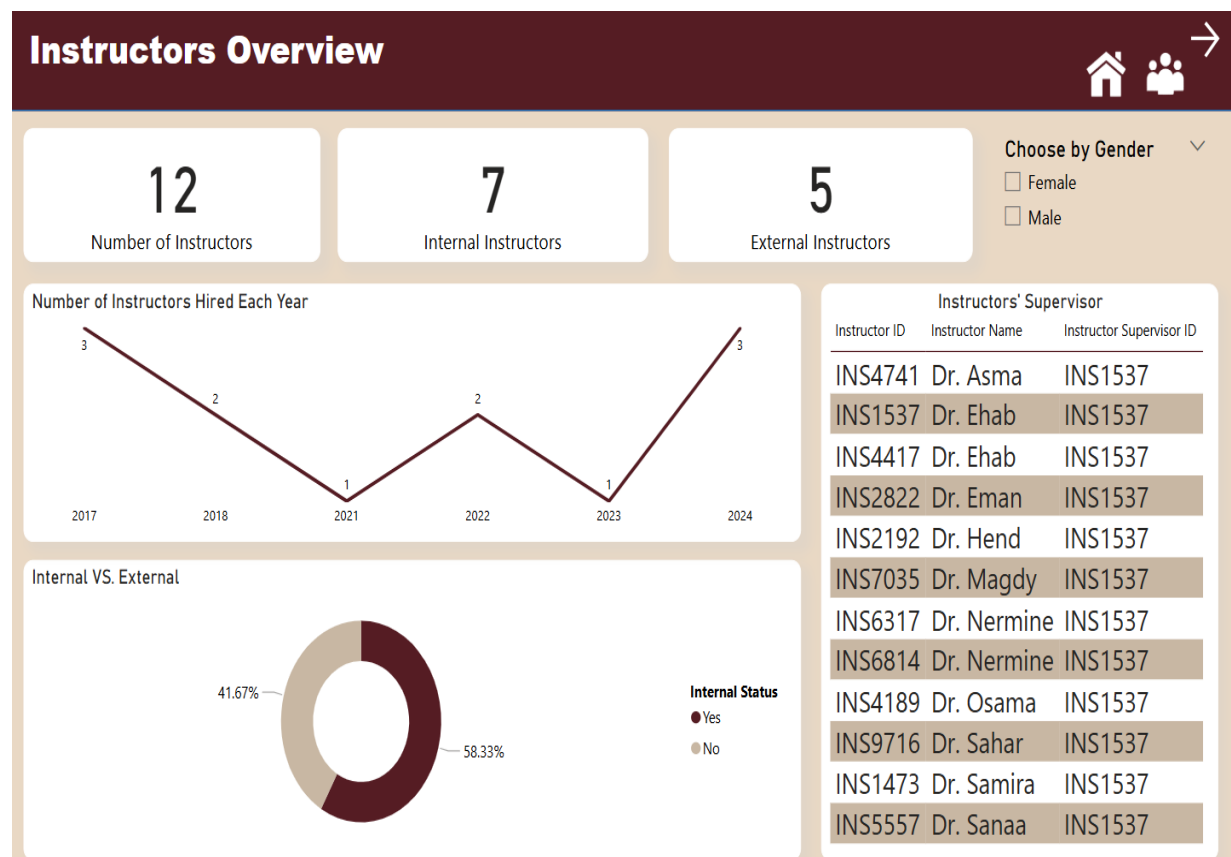
## Students Performance



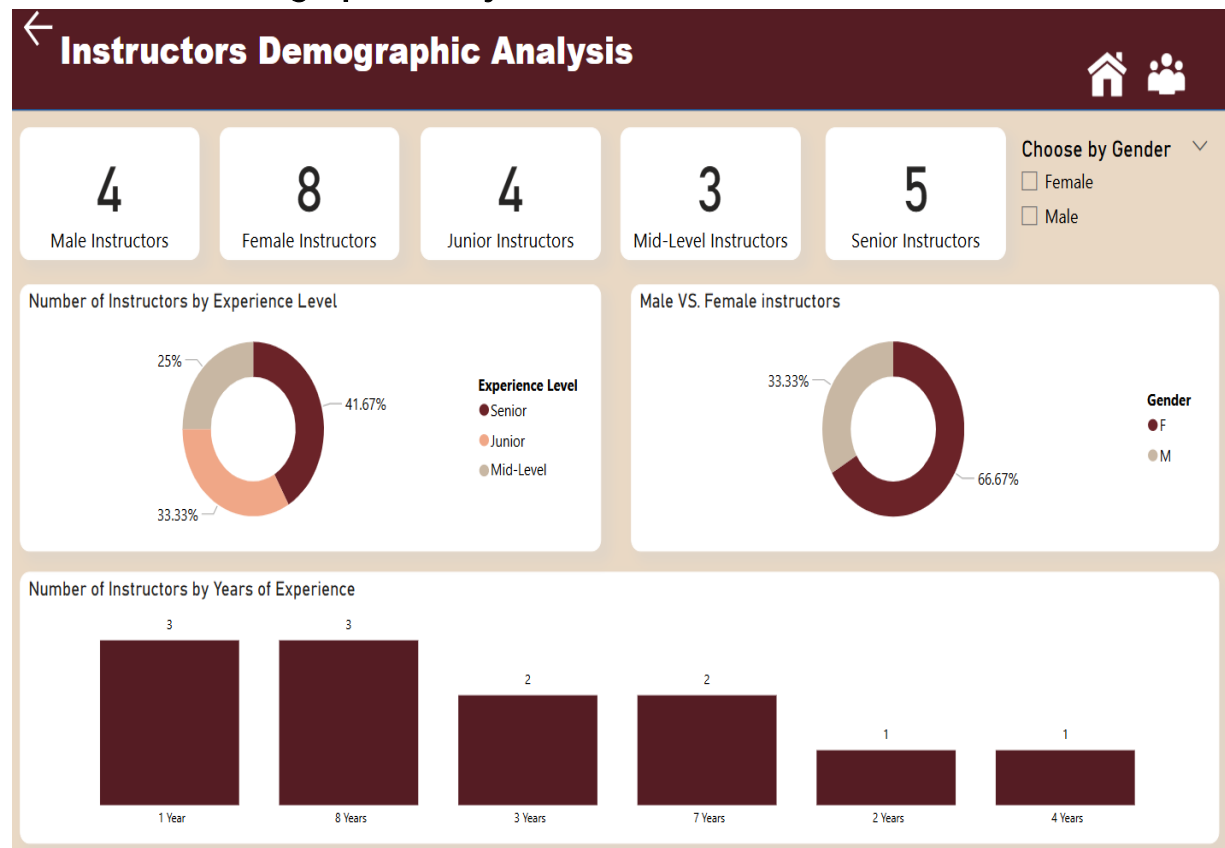
## Students' demographic analysis



## Instructors Overview



## Instructors' demographic analysis



#### Number of Instructors by Experience Level

Experience Level	Count	Percentage
Senior	5	41.67%
Junior	4	33.33%
Mid-Level	3	25%

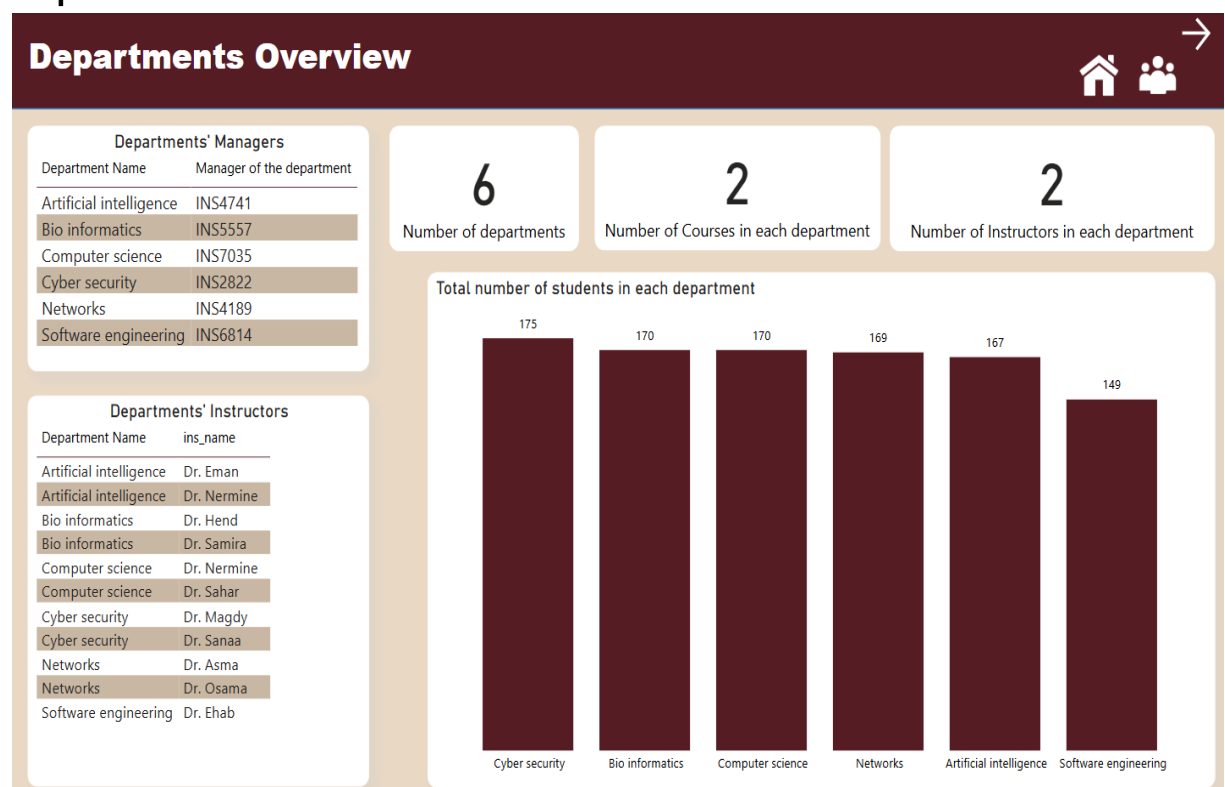
#### Male VS. Female instructors

Gender	Count	Percentage
Female	8	66.67%
Male	4	33.33%

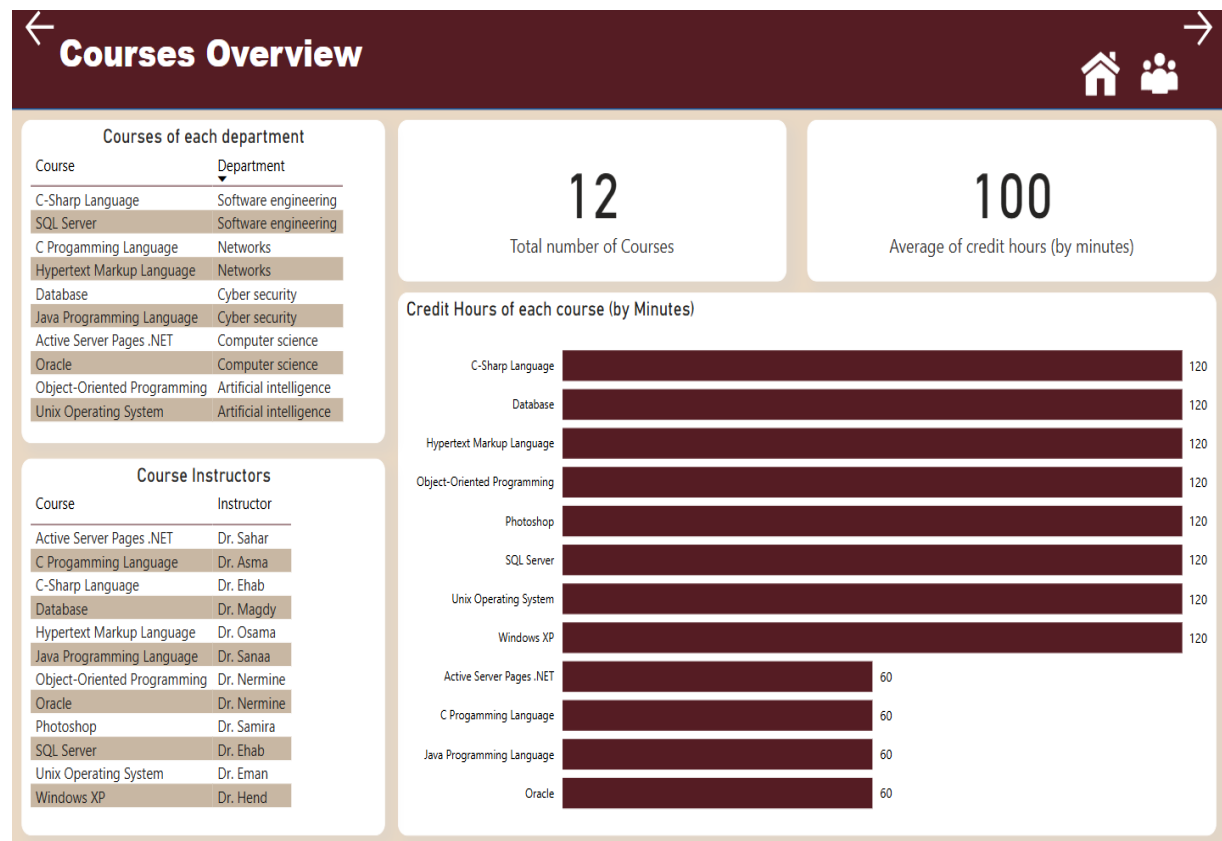
#### Number of Instructors by Years of Experience

Years of Experience	Count
1 Year	3
8 Years	3
3 Years	2
7 Years	2
2 Years	1
4 Years	1

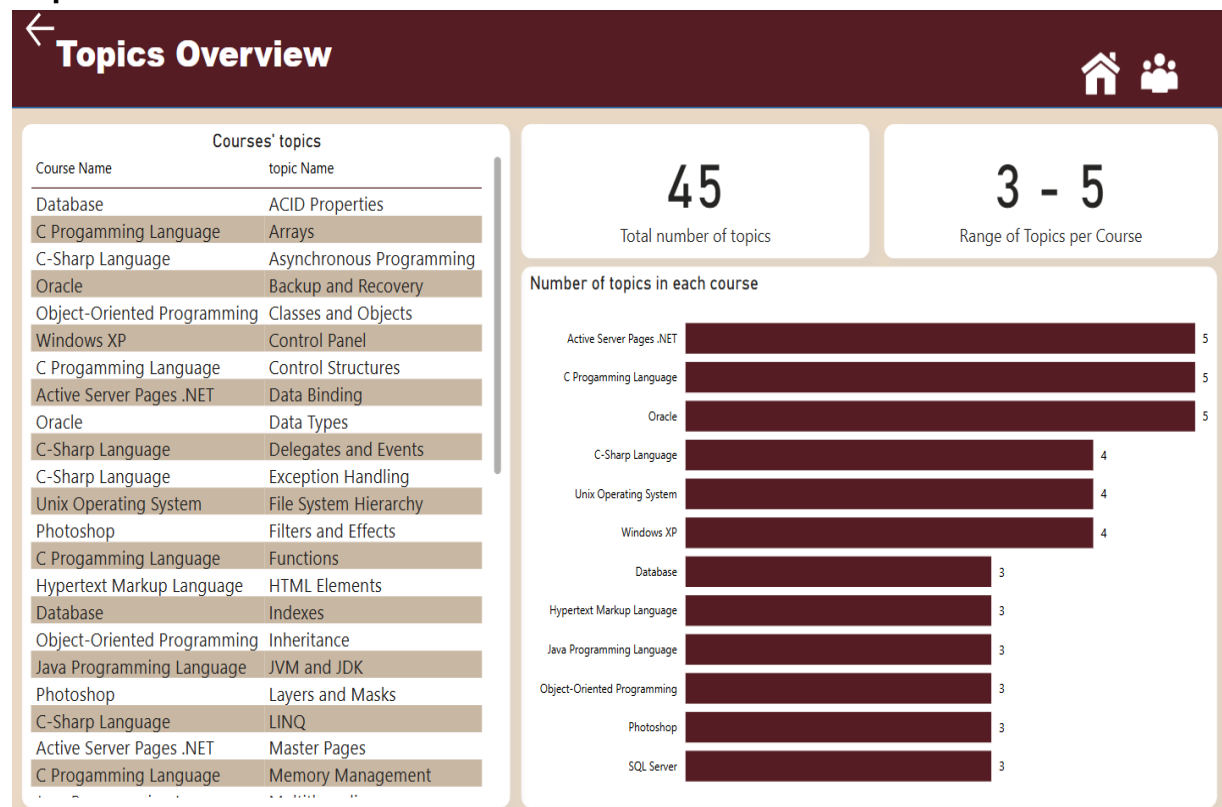
## Departments Overview



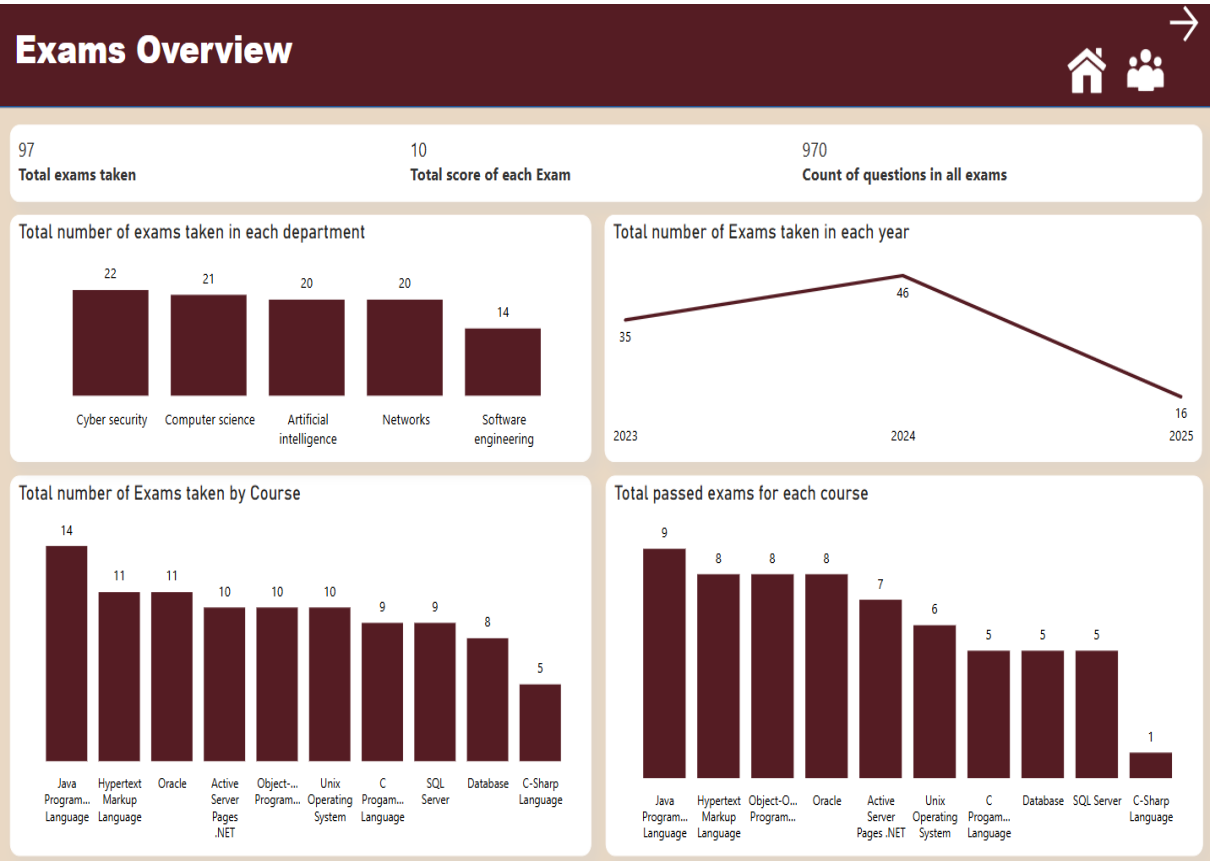
## Courses Overview



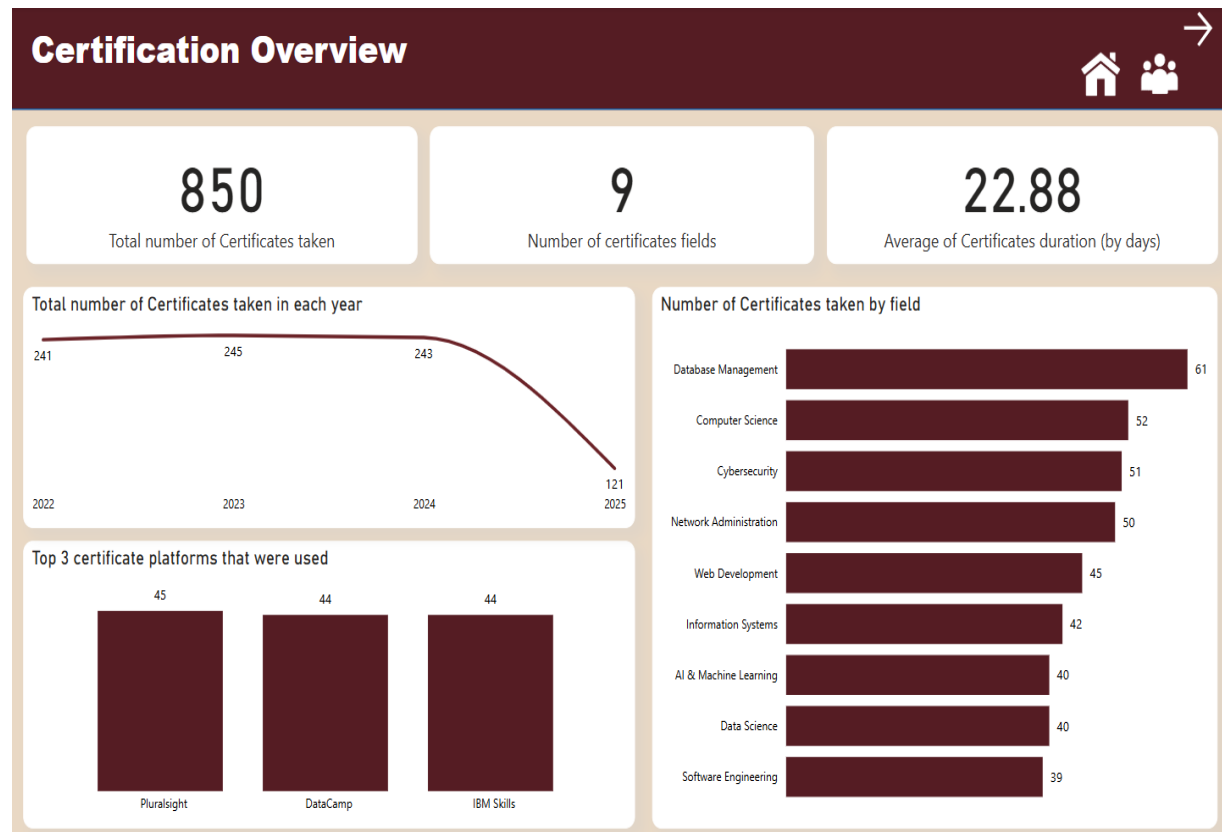
## Topics Overview



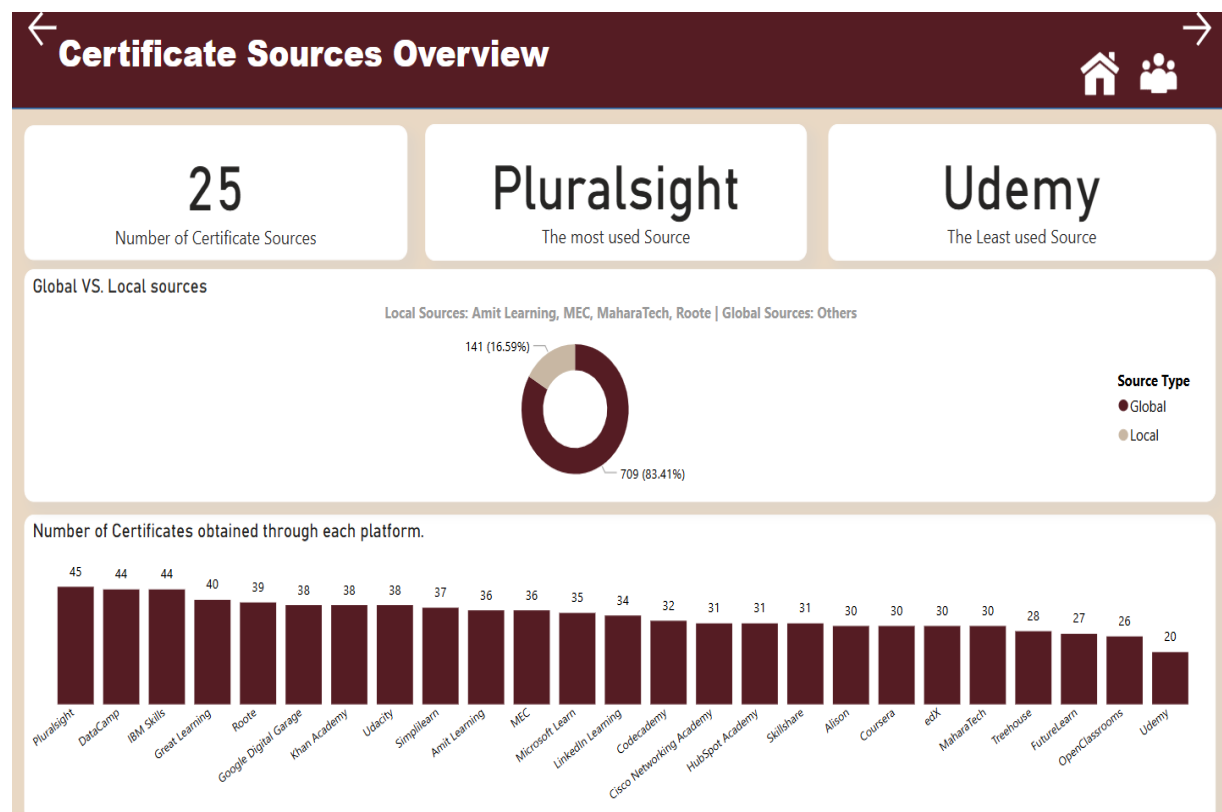
Exams Overview



## Certification overview

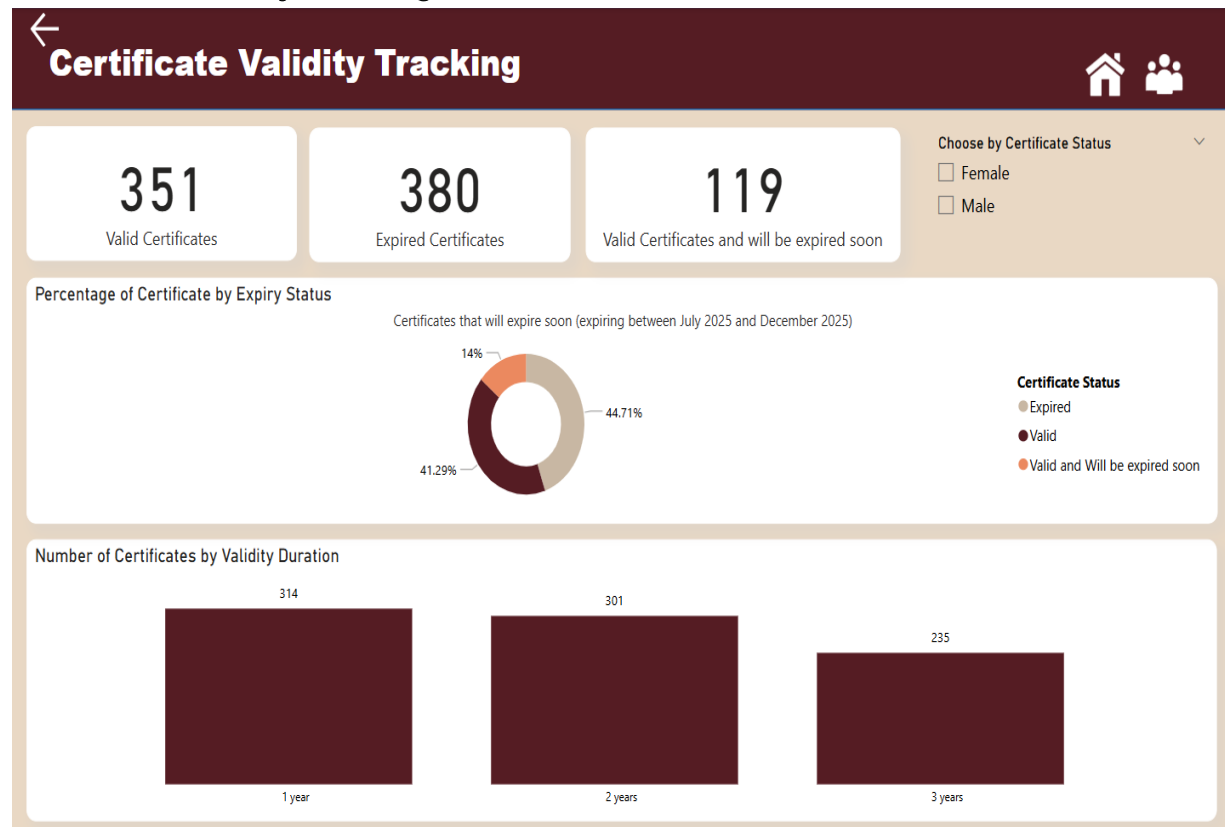


## Certificate sources overview

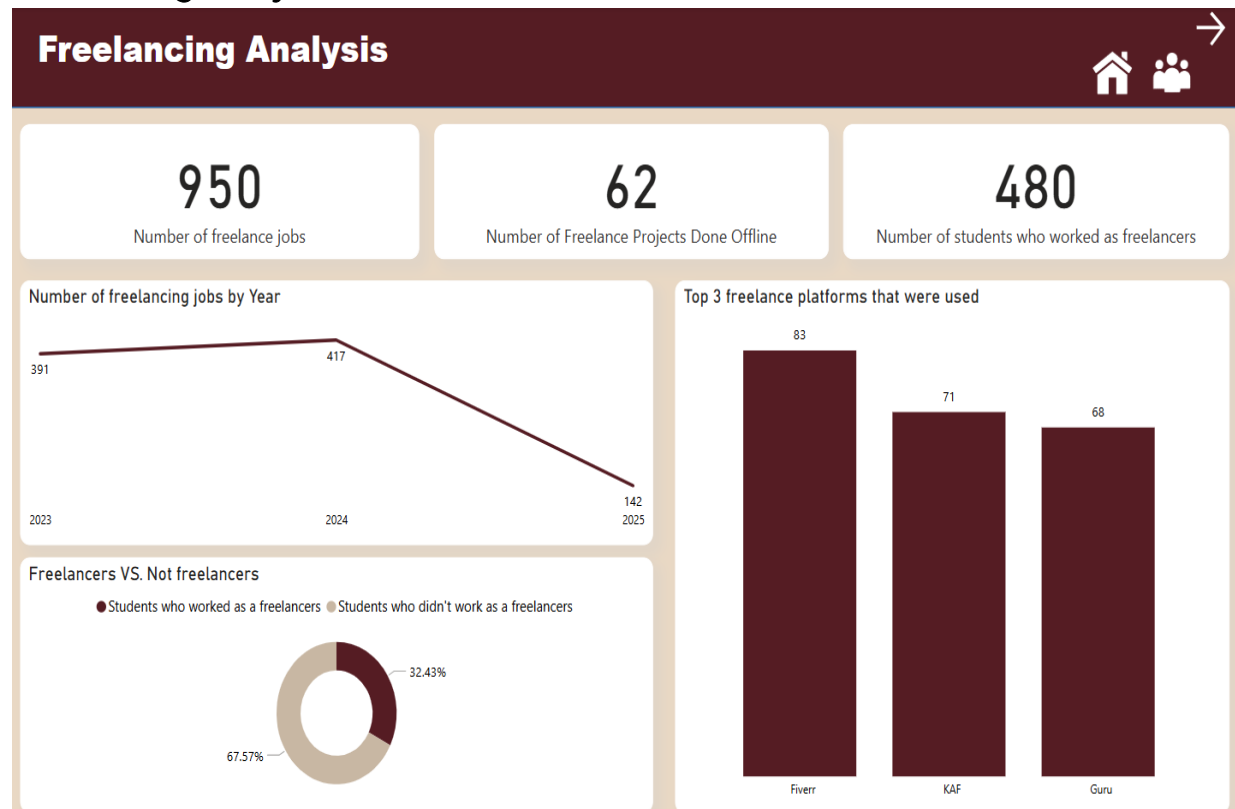




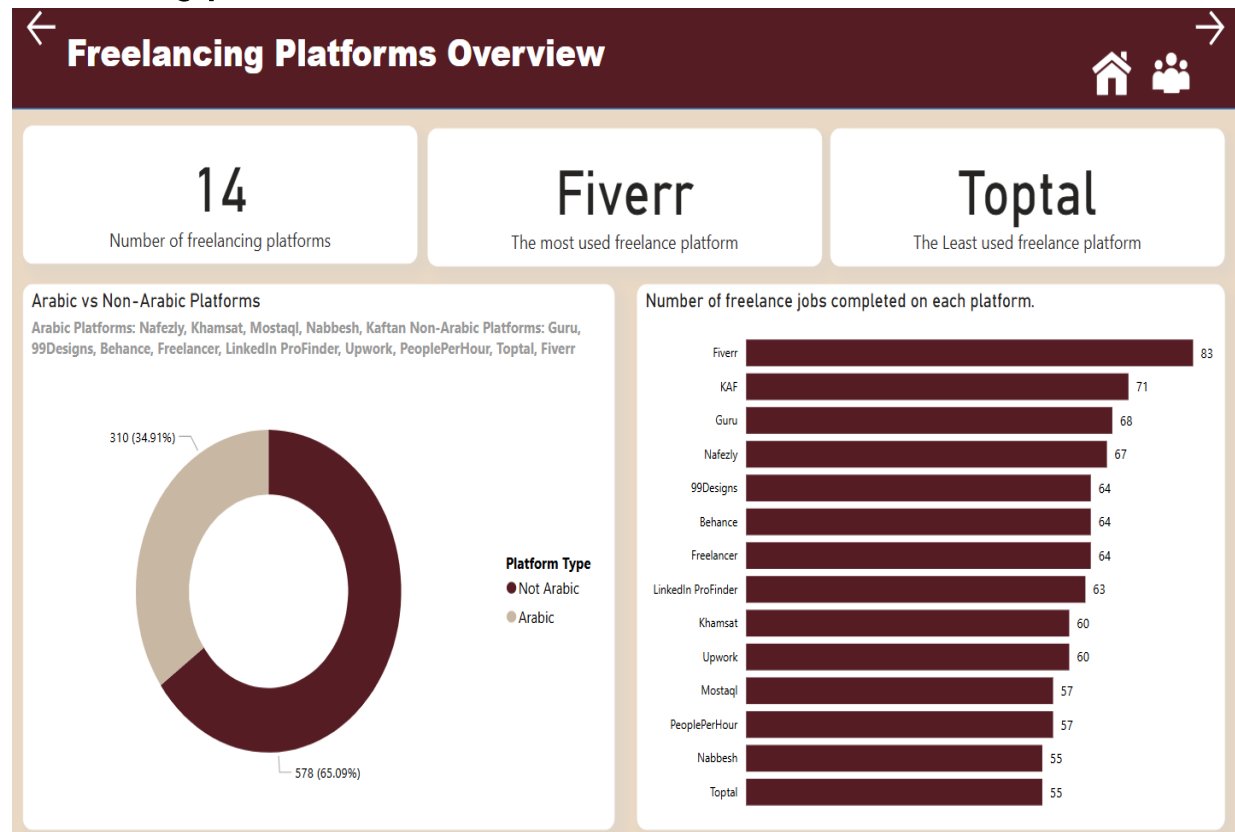
## Certificate validity tracking



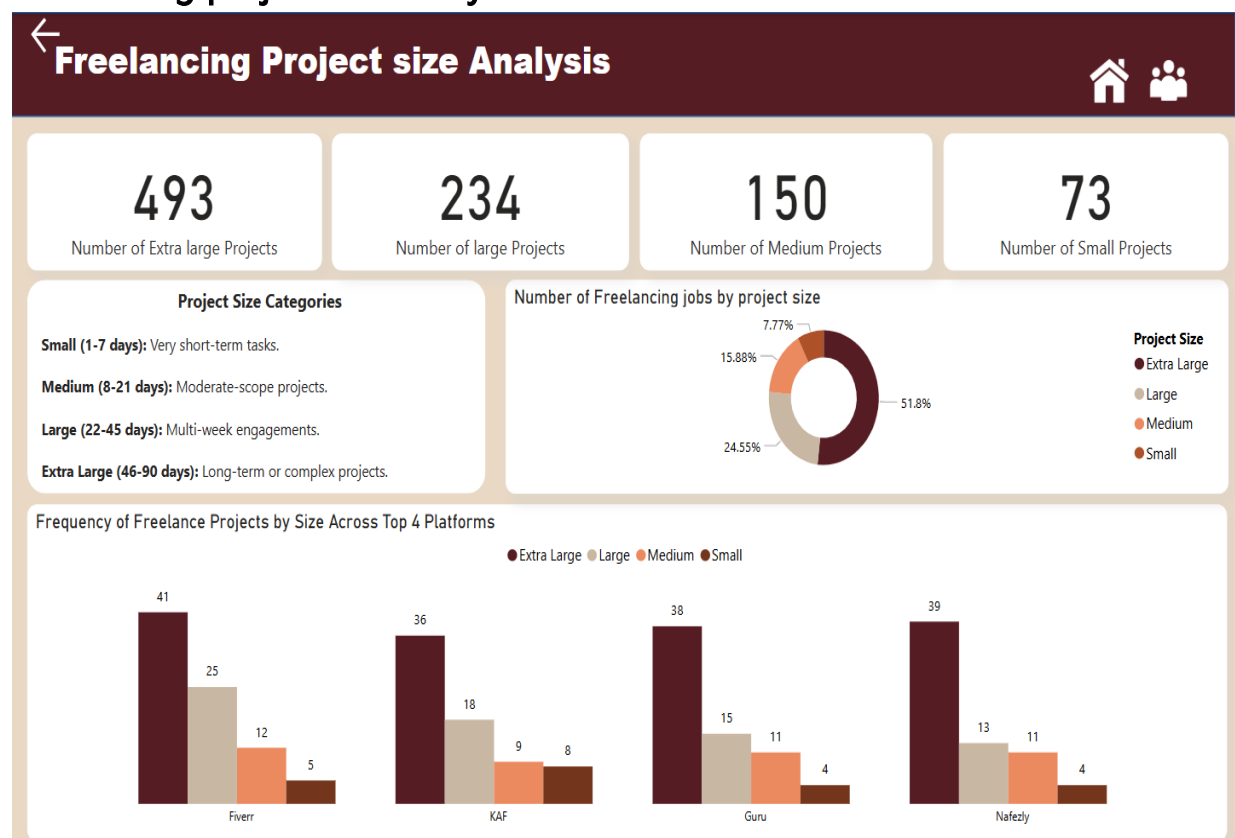
## Freelancing analysis



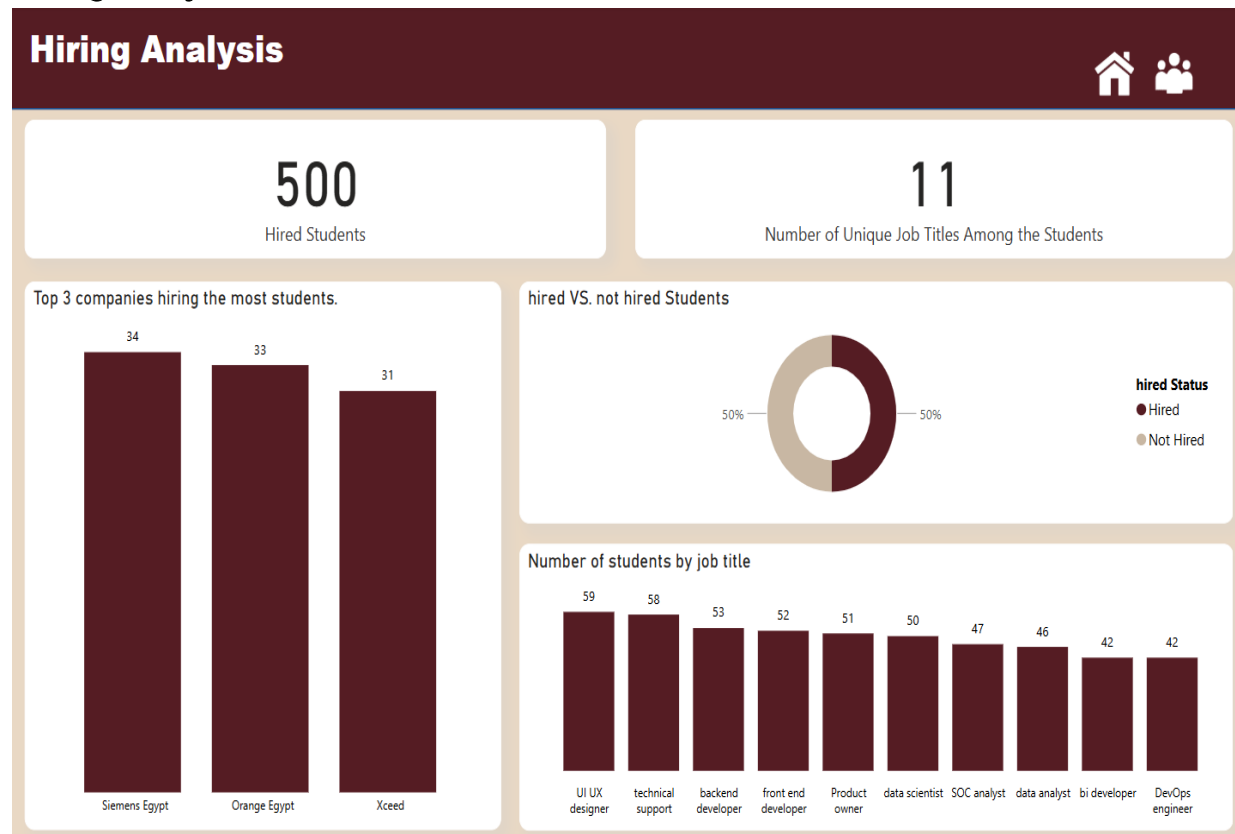
## Freelancing platforms overview



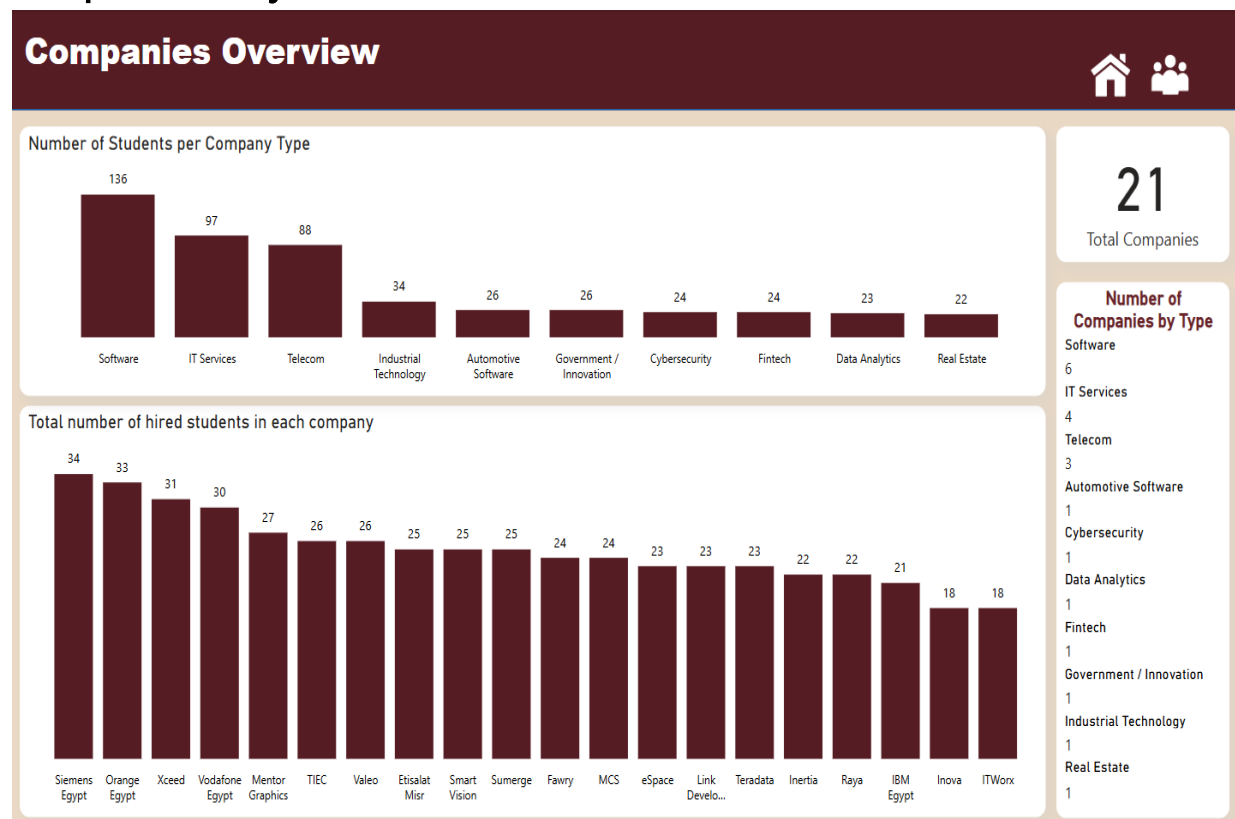
## Freelancing project size analysis



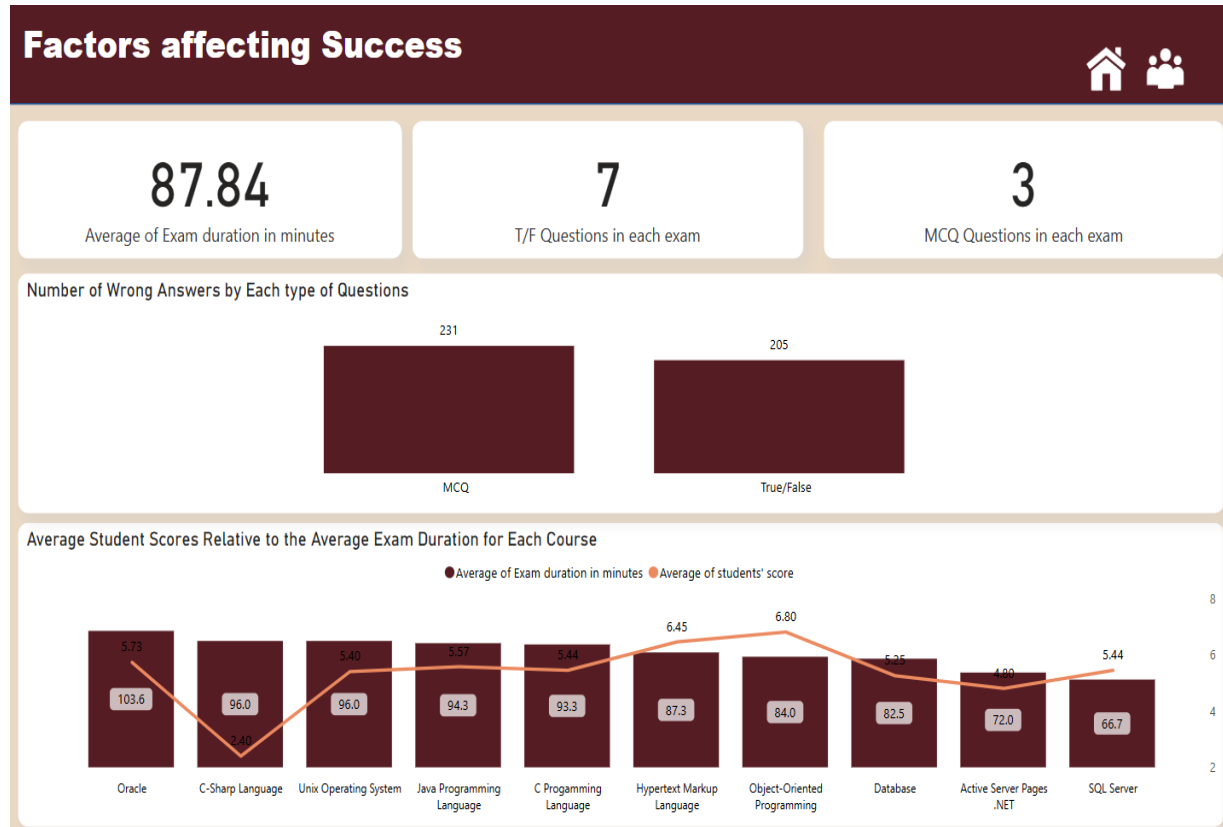
## Hiring analysis



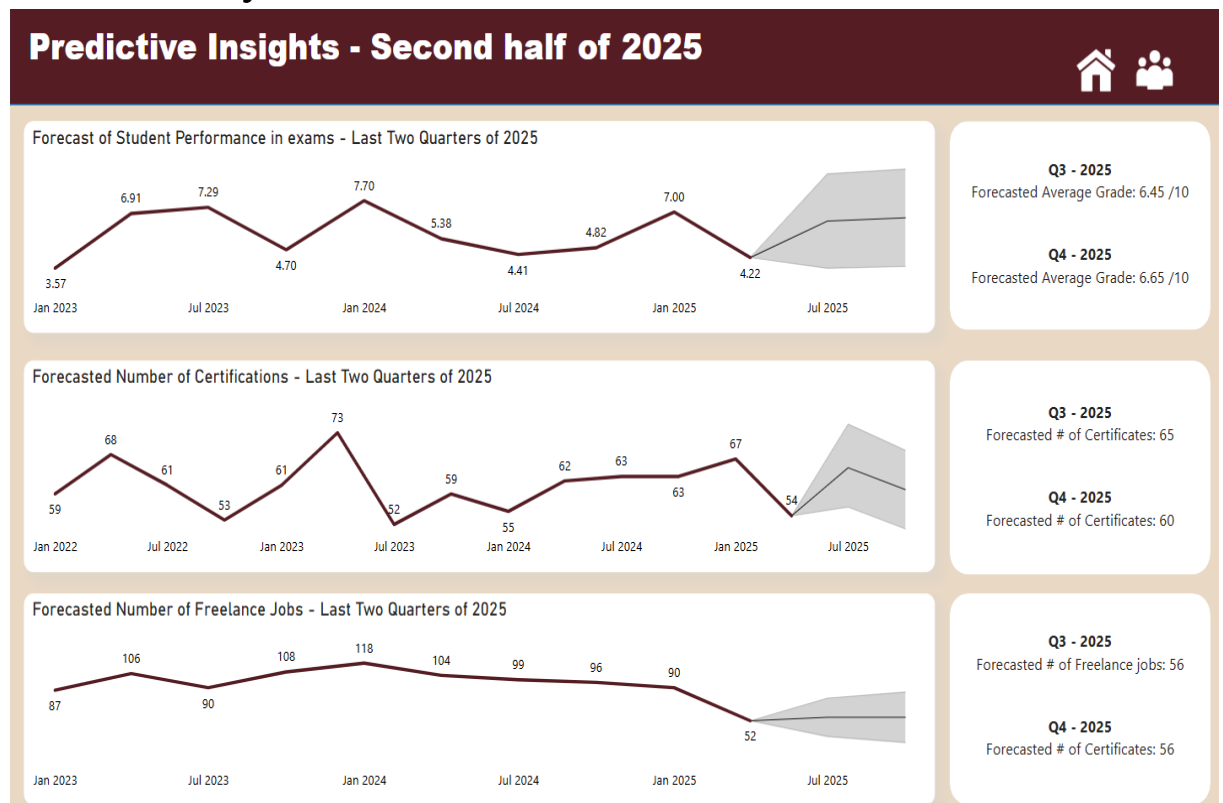
## Companies Analysis



## Factors affecting success



## Predictive analysis




## 4. Web and desktop application

online examination system to serve the student needs and taking their exams and analysis about their grades. Also, we have created an interface for the instructors so they can generate exams and get insights and analysis for each student performance, we have linked the Power BI reports and the database along with the web app to interact with each other's across the system.

### Tools & libraries:

Tool/Library	Web application	Desktop application
Flask	Used	Used
Flask-sqlalchemy	Used	Indirect
Flask-login	Used	Indirect
pywebview	Used	Used
pyodbc	Used	Indirect
SQLAlchemy	Used	Indirect
Jinja2	Used	Indirect
Bootstrap/JS	Used	Used




Information  
Technology  
Institute


Student Login

Instructor Login

Email

lina1@example.com

Password

.....

Login as Student

New Volume (D:) > ITI > Graduation Project > Ex project > desktop\_dist > dist

Exam Management System

Exam System

Hello, dr.samira1473@university.edu Logout Instructor Dashboard BI Reports

Instructor Dashboard

Welcome, dr.samira1473@university.edu! Here you can manage courses, questions, and generate exams.

Quick Actions

Create Exam

Manage Courses

Manage Question Bank

Exam Answers Report

Recent Exams

Course	Questions	Duration	Available Students	Taken	Date Created	Actions
1 - Hypertext Markup Language	4	3 min	169 students	1 taken	2025-07-04	Add Question
1 - Hypertext Markup Language	6	7 min	169 students	1 taken	2025-07-04	Add Question
1 - Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	Add Question
1 - Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	Add Question
1 - Hypertext Markup Language	6	3 min	169 students	1 taken	2025-06-27	Add Question

View All Exams

Exam Management System

Exam System

Hello, dr.samira1473@university.edu
Logout
Instructor Dashboard
BI Reports

Create New Exam

Select Course:

Choose a course...

Number of True/False Questions:

0

Number of MCQ Questions:

0

Exam Duration (minutes):

Create Exam

Quick Actions

Manage Courses

Manage Question Bank

Manage Students

All Exams

Exam ID	Course	Questions	Duration	Available Students	Taken	Date Created	Actions
1751599546633	Hypertext Markup Language	4	3 min	169 students	1 taken	2025-07-04	<div>Add Question</div> <div>Delete</div>
1751590449014	Hypertext Markup Language	6	7 min	169 students	1 taken	2025-07-04	<div>Add Question</div> <div>Delete</div>
1751586266797	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	<div>Add Question</div> <div>Delete</div>
1751585920499	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	<div>Add Question</div> <div>Delete</div>

Create New Exam

Select Course:

Hypertext Markup Language

Number of True/False Questions:

5

Number of MCQ Questions:

5

Exam Duration (minutes):

60

Create Exam

Quick Actions

Manage Courses

Manage Question Bank

Manage Students

23

Name

Date modified

Type

Size

Exam Management System

Exam System

Hello, dr.samira1473@university.edu Logout Instructor Dashboard BI Reports

All Courses

Course ID	Course Name	Credit Hours	Instructor ID
1	Hypertext Markup Language	120	INS4189
10	Active Server Pages .NET	60	INS9716
11	Windows XP	120	INS2192
12	Photoshop	120	INS1473
2	C Progammig Language	60	INS4741
3	Object-Oriented Programming	120	INS6814
4	Unix Operating System	120	INS2822
5	SQL Server	120	INS4417
6	C-Sharp Language	120	INS1537
7	Database	120	INS7035
8	Java Programming Language	60	INS5557
9	Oracle	60	INS6317

Back to Admin Panel

All Exams

Exam ID	Course	Questions	Duration	Available Students	Taken	Date Created	Actions
1751599546633	Hypertext Markup Language	4	3 min	169 students	1 taken	2025-07-04	<a>Add Question</a> <a>Delete</a>
1751590449014	Hypertext Markup Language	6	7 min	169 students	1 taken	2025-07-04	<a>Add Question</a> <a>Delete</a>
1751586266797	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	<a>Add Question</a> <a>Delete</a>
1751585920499	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-07-04	<a>Add Question</a> <a>Delete</a>
1750979017718	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-06-27	<a>Add Question</a> <a>Delete</a>
1750978393751	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-06-27	<a>Add Question</a> <a>Delete</a>
1750977846209	Hypertext Markup Language	6	5 min	169 students	1 taken	2025-06-27	<a>Add Question</a> <a>Delete</a>
1750889325475	Hypertext Markup Language	10	10 min	169 students	1 taken	2025-06-26	<a>Add Question</a> <a>Delete</a>
1750851463234	Hypertext Markup Language	8	6 min	169 students	1 taken	2025-06-25	<a>Add Question</a> <a>Delete</a>
1750850257433	Hypertext Markup Language	10	5 min	169 students	1 taken	2025-06-25	<a>Add Question</a> <a>Delete</a>
1750768867500	Hypertext Markup Language	10	4 min	169 students	1 taken	2025-06-24	<a>Add Question</a> <a>Delete</a>
1750695937985	Hypertext Markup Language	6	3 min	169 students	1 taken	2025-06-23	<a>Add Question</a> <a>Delete</a>



## Manage Question Bank

Add new questions and view all questions in the system. Use the form to add MCQ or True/False questions. \* indicates required fields.

### Add New Question

**Course \***  
Choose a course...

**Question Type \***  
Multiple Choice

**Question Text \***  
Enter the question here...

**Option A \***  
Option A

**Option B \***  
Option B

**Option C \***  
Option C

**Option D \***  
Option D

**Correct Option \***  
Choose correct answer...

Add Question

### Question Bank

Search questions...

Type All

Course	Question	Type	Correct Answer
Course ID: 7	The ability to query data as well a...	MCQ	d) DML (Data Manipulation Language)
Course ID: 7	Relative URLs are used to	MCQ	a) link other pages within the same site
Course ID: 2	Unix is only compatible with Win...	True/False	b) False
Course ID: 2	Unix commands are case-sensitive.	True/False	b) False
Course ID: 2	Unix provides multi-user capabilit...	True/False	a) True
Course	Relative URLs are used to	True/False	a) True

[Back to Admin Panel](#)

## Add Question to Course 1

### Question Type

Multiple Choice

### Question Text

### Option A

### Option B

### Option C

### Option D

### Correct Option

Choose correct answer...

[Back to Admin Panel](#)

Add Question

Exam System

Hello, lina1@example.com Logout Student Dashboard

Information Technology Institute

Welcome, lina1!

Here you can view your upcoming exams, grades, and more.

Email: lina1@example.com

Student ID: STU0001

Department: Networks

Your Exam Analysis

Avg:

Average score across all taken exams

Upcoming Exams

Upcoming

Hypertext Markup Language (4 Qs, 3 min)

Date: 2025-07-04

Take Exam

Upcoming

Hypertext Markup Language (6 Qs, 7 min)

Date: 2025-07-04

Take Exam

Upcoming

Hypertext Markup Language (6 Qs, 3 min)

Date: 2025-07-04

Take Exam

Upcoming

Hypertext Markup Language (6 Qs, 3 min)

Date: 2025-07-04

Take Exam

Upcoming

Hypertext Markup Language (8 Qs, 6 min)

Date: 2025-06-25

Take Exam

Upcoming

Hypertext Markup Language (6 Qs, 9 min)

Date: 2025-06-23

Take Exam

Upcoming

C Programming Language (10 Qs, 10 min)

Date: 2025-06-23

Take Exam

Previous Exams

Taken

Hypertext Markup Language

Score:

0

0.0%

Date: 2025-06-27 02:06

Hypertext Markup Language

02:53

4 Questions

True/False

1. Photoshop can work with multiple image formats.

☐ a) True

☐ b) False

MCQ

2. Which of the following is not a valid data type in SQL?

☐ a) df

☐ b) CHARACTER

☐ c) t

☐ d) Deletes a database table

26

