Mansoura Branch

Business Intelligence Developer Track

“Examination System”

JUL-OCT 2022

Team Members

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Introduction

Construct a fully automated examination system to perform online exams by instructors and students, in addition, to being automatically corrected based on stored questions and their model answers, using a desktop. Starting with making the business case itself followed by designing and building an SQL database, in addition to building software solutions, ending with system reports and dashboards that would help the managers in having clear insights about the organization so taking the best decisions for the organization.

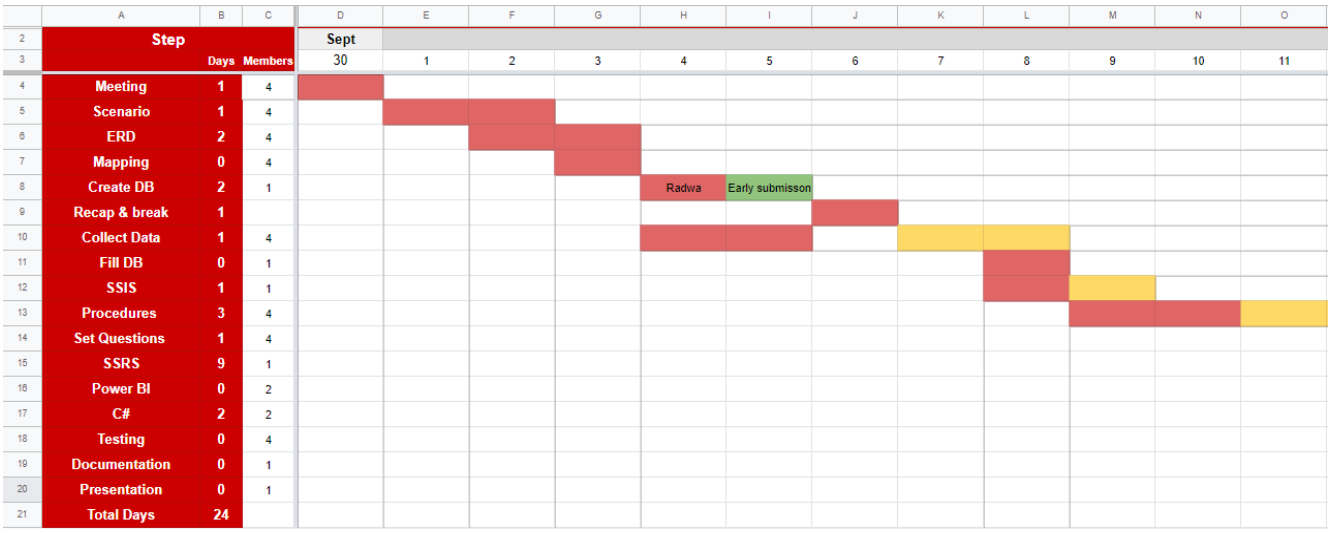
This project was done as a graduation project for the "information technology institute - ITI - MCIT" intensive training program, where me and my colleagues, Nada, Radwa, and Mohamed, contributed to making it.

Tools

1. Online Website "ERD Plus" for ER Diagram.
2. SQL server database for database schema, database, and scripts.
3. Red gate data generator for filling the data.
4. SSIS for data filling.
5. C# for examination application and instructor & student application.
6. Power BI for the dashboard.
7. SSRS for 6 reports connected to the instructors & student app.

Timeline

Using the Gantt chart was a very good selection to review a lot of important information like the sequence of the tasks with different types of sequence like an end to start and end-to-end tasks, task load so the number of members to work on it in further steps, task duration and finally the start and end of each task.



Tasks & Members

After listing the tasks and the load of each one the selection of each task per member were done in a good, flexible way between the team members then the tasks were documented using google spreadsheets for better collaboration, updating, and sharing between us.

	A	B	C	D	E	F
1	Task	Name	Start Date	Deadline	Submit Date	Done
2	Scenario Documents	Nada	10-1	10-2	10-2	☑
3	ERD Documents	Osama	10-2	10-3	10-3	☑
4	Mapping Document	Muslim	10-3	10-3	10-3	☑
5	Create DB	Radwa	10-4	10-5	10-4	☑
6	Collect Data (Main Tables + 1 Course)	Nada	10-4	10-8	10-8	☑
7	Collect Data (2 Courses)	Osama	10-4	10-8	10-8	☑
8	Collect Data (2 Courses)	Muslim	10-4	10-8	10-8	☑
9	Collect Data (1 Course)	Radwa	10-4	10-8	10-8	☑
10	Fill DB	Nada	10-7	10-8	10-8	☑
11	SSIS	Muslim	10-7	10-9	10-9	☑
12	Procedures (Exam Answers, Exam Correction, Courses, Topics)	Nada	10-9	10-12	10-13	☑
13	Procedures (instructors, insCourses,InsDept)	Radwa	10-9	10-12	10-13	☑
14	Procedures(Student, stCourses, Department, DeptCourses)	Osama	10-9	10-12	10-12	☑
15	Procedures(Question, QuesOptions, Exam generation)	Muslim	10-9	10-12	10-13	☑
16	Set Questions	Fantastic 4	10-13	10-14	10-13	☑
17	SSRS	Radwa	10-14	10-20	10-24	☑
18	Power BI	Osama	10-14	10-20	10-24	☑
19	Power BI	Nada	10-14	10-20	10-24	☑
20	C#	Nada	10-14	10-28	10-24	☑
21	C#	Muslim	10-14	10-28	10-24	☑
22	Documentation	Osama	10-24	10-27	10-27	☑
23	Presentation	Nada	10-28	10-29	10-29	☑

Business Case

After two meetings the team had a good perspective on the examination system and agreed that the system should include several entities which are the following:

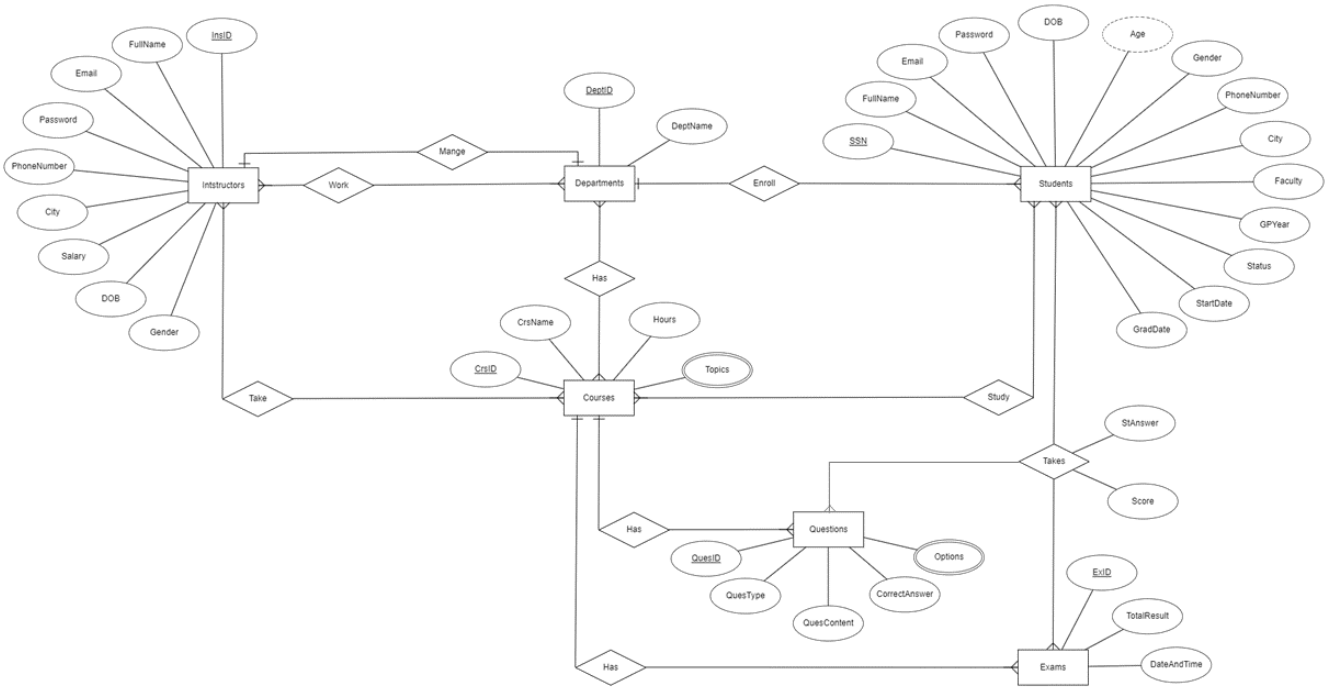
Students	Instructors	Departments
Exams	Questions	Courses

These entities have specific relations according to the following rules:

- Each student enrolls in one department, studies many courses, and takes many exams.
- Each instructor works in many depts and teaches many courses.
- Each Department is managed by one instructor and has many courses.
- Each course has many topics and has many exams, and many questions.
- Each Student can take many exams two trials per course, and each exam has many questions.
- Questions can appear in many exams.

ERD

The team used an online website to have good representation of the idea and recheck the scenario correctness and validation using ERD plus website for quick drawing an ERD.



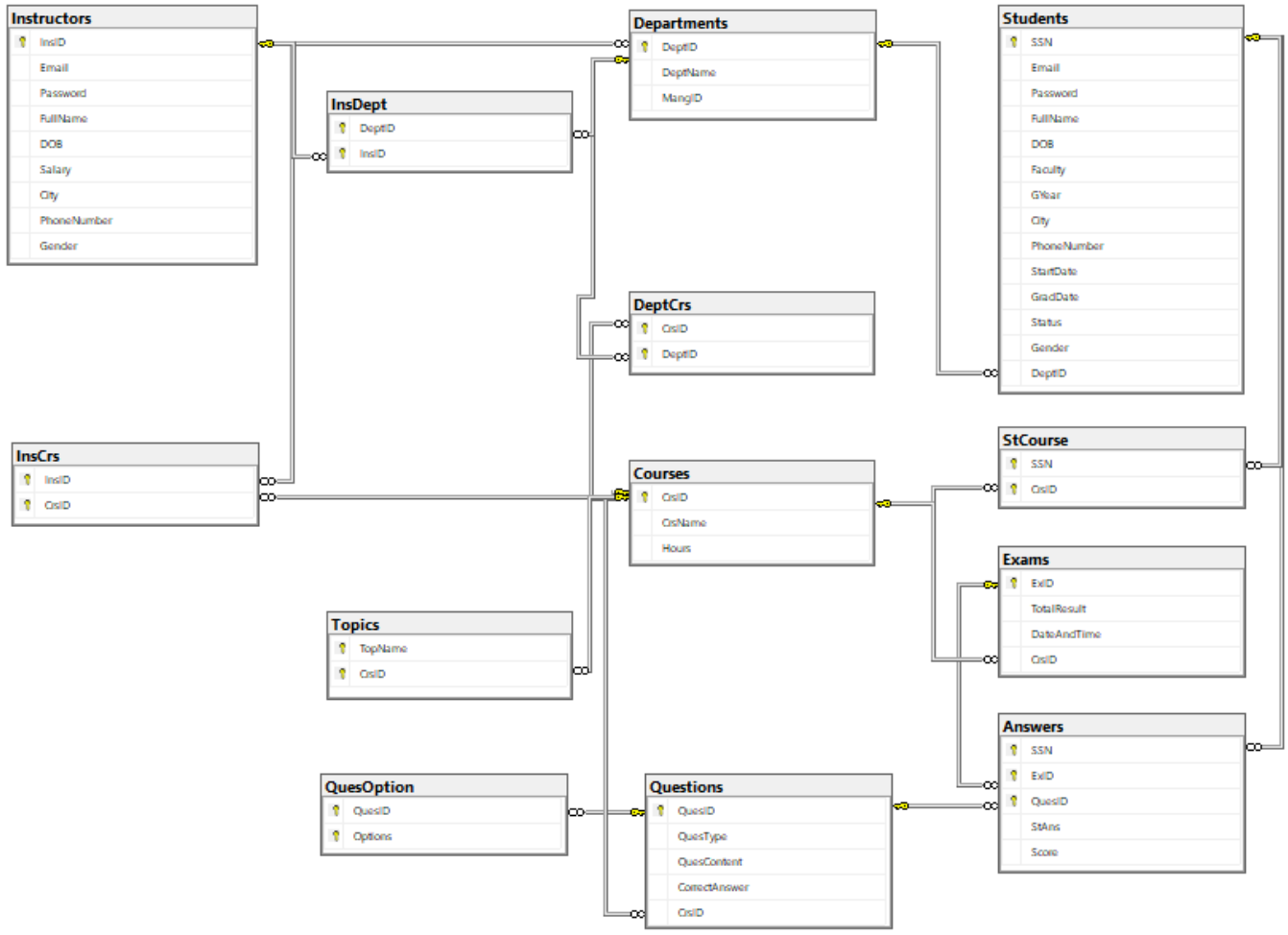
Mapping

This step was crucial for ensuring the idea rightness as a last check and defining the database tables according to the entity type, attributes type, cardinality and participations.

- Students: (SSN, Email, Password, FullName, DOB, Faculty, GYear, City, PhoneNumber, StartDate, GradDate, Status, Gender, DeptID)
- Instructors (InsID, Email, Password, FullName, DOB, Salary, City, PhoneNumber, Gender)
- Departments (DeptID, DeptName, MangID)
- Courses: (CrsID, CrsName, Hours)
- Topics: (CrsID, TopName)
- Exams: (ExID, TotalResult, DateAndTime, CrsID)
- Questions: (QuesID, QuesType, QuesContent, CorrectAnswer, CrsID)
- Answers: (SSN, ExID, QuesID, StAns, Score)
- StCourse: (SSN, CrsID)
- InsDept:(DeptID, InsID)
- DeptCrs: (DeptID, CrsID)
- InsCrs: (InsID, CrsID)
- QuesOption: (QuesID, Option)

Database Diagram

Data Base creation using the wizard tool for making the tables with specifying the properties according to our business cases scenario we made the diagram on SQL server management studio



Stored Procedures

Mainly five different types of stored procedures used for dealing with database through the C# also for handing database itself via SQL software in quick manner and for reporting purposes as well.

View	Insert	Update
Delete	Special stored procedures for the report	

- Choice

```
CREATE proc [dbo].[choise1] @quesid int
AS
BEGIN
WITH MyCte AS
(
   SELECT options,
    row_number() over (order by options desc) rank
    FROM quesoption
    WHERE quesid = @quesid
)
SELECT * FROM mycte
WHERE rank = 1
END
```

- Exam Result

```
CREATE PROC ExamResult @StID int, @ExID int
    AS
    BEGIN
        UPDATE Exams
        SET TotalResult = (SELECT SUM(Score) FROM Answers WHERE SSN = @StID AND ExID = @ExID)
        WHERE ExID = @ExID

        Select TotalResult FROM Exams WHERE  ExID = @ExID
    END
```

- Save and correct the answers

```
CREATE PROC [dbo].[SaveAndCorrectOneAnswer] @StID int, @ExID int, @QuesID int ,
@StAns varchar(700)
    AS
    BEGIN
        INSERT INTO  Answers (SSN,ExID,QuesID,StAns)
        VALUES (@StID,@ExID,@QuesID,@StAns)

        UPDATE Answers
        SET Score = 1
        WHERE StAns = @StAns
        AND
            StAns =
            (SELECT CorrectAnswer FROM Questions WHERE QuesID = @QuesID)
        AND SSN = @StID AND ExID = @ExID AND QuesID = @QuesID

        UPDATE Answers
        SET Score = 0
        WHERE StAns = @StAns AND SSN = @StID AND ExID = @ExID
        AND QuesID = @QuesID And Score !=1
    END
```

- Save Exam information

```
CREATE PROC [dbo].[SaveExamInfo] @CrsID int , @ExID INT
AS
BEGIN
    INSERT INTO Exams (ExID,DateAndTime,CrsID)
    Values
    (@ExID,GETDATE(),@CrsID)
END
```

- Select the MCQ Questions

```
CREATE PROC [dbo].[MCQues] @CrsID int
AS
BEGIN
    SELECT TOP (1) QuesContent , quesid
    FROM Questions
    WHERE QuesType = 'MCQ' AND CrsID = @CrsID
    ORDER BY NEWID()
END
```

SSIS

The team used the SQL Server Integration Service to add exam questions and question choices to the database from source text files and process them before transfer. The rest of data filling done using the red gate generation tool.

Reports

Detailed reports were made using the SQL Server Reporting Service SSRS to answer the following:

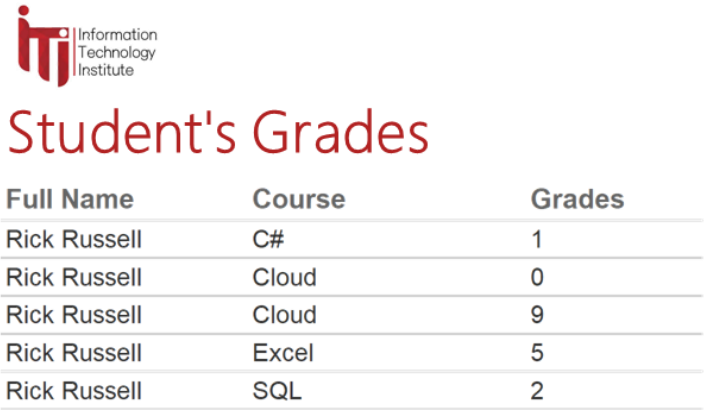
- Returns the students information according to Department No parameter.

Information Technology Institute

Department's Students

Department	Full Name	DOB	Faculty	Graduate Year
BI	Rick Russell	4/7/1997 12:00:00 AM	Computer Science	2014
BI	Tonya Mann	3/8/1997 12:00:00 AM	Computer Science	2015
BI	Summer Weiss	4/3/1999 12:00:00 AM	Computer Science	2022
BI	Alejandro Davis	9/2/2000 12:00:00 AM	Arts	2016
BI	Alma Mathis	5/15/1994 12:00:00 AM	Commerce	2013
BI	Miriam Savage	4/7/1999 12:00:00 AM	Law	2022
BI	Tia Navarro	6/11/1998 12:00:00 AM	Law	2012
BI	Gloria Houston	5/11/1997 12:00:00 AM	Engineering	2021
BI	Fredrick Roberts	10/23/1995 12:00:00 AM	Arts	2013
BI	Sheldon Guerra	8/14/1996 12:00:00 AM	Computer Science	2015
BI	Gabrielle Campos	3/29/1996 12:00:00 AM	Arts	2012
BI	Derrick Vazquez	6/12/1993 12:00:00 AM	Law	2019
BI	Christine Mc Lean	10/30/1998 12:00:00 AM	Commerce	2016
BI	Mindy Baxter	11/7/1993 12:00:00 AM	Engineering	2015
BI	Donald Griffin	4/28/1999 12:00:00 AM	Law	2013
BI	Monte Zamora	11/16/1996 12:00:00 AM	Science	2017
BI	Christine Orozco	5/13/2000 12:00:00 AM	Arts	2017
BI	Tom Mcpherson	9/19/1993 12:00:00 AM	Law	2020
BI	Bridgette Bridges	10/9/1998 12:00:00 AM	Law	2013
BI	Kendrick Abbott	7/14/1999 12:00:00 AM	Computer Science	2021
BI	Sonia Kaufman	7/13/1994 12:00:00 AM	Law	2020
BI	Timothy Jimenez	12/15/1998 12:00:00 AM	Arts	2020

- Take the student ID and returns the grades of the student in all courses.

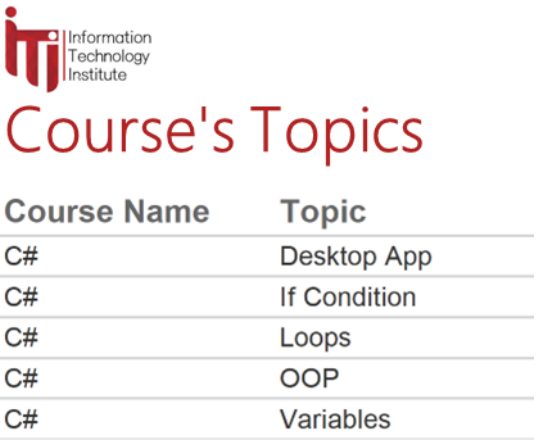


Full Name	Course	Grades
Rick Russell	C#	1
Rick Russell	Cloud	0
Rick Russell	Cloud	9
Rick Russell	Excel	5
Rick Russell	SQL	2

- Take the instructor ID and returns the name of the courses that he teaches and the number of students per course.

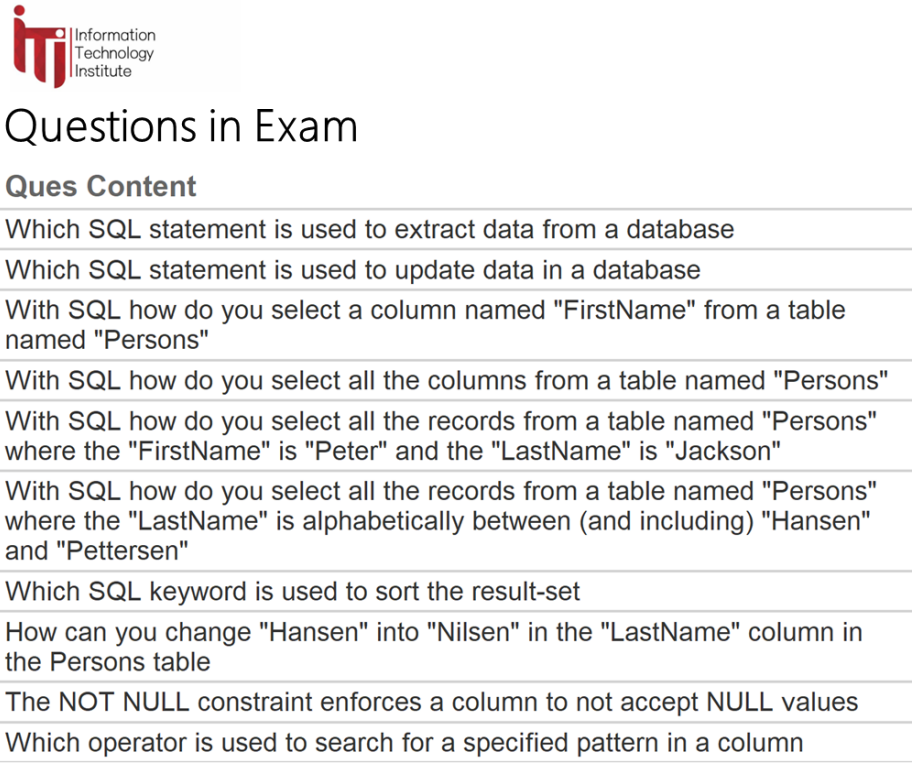
ID	Full Name	Course Name	No.Student
10	Hesham Mamdouh	C#	15
10	Hesham Mamdouh	Cloud	5

- Take course ID and returns its topics



Course Name	Topic
C#	Desktop App
C#	If Condition
C#	Loops
C#	OOP
C#	Variables

- Takes exam number and returns the Questions in it

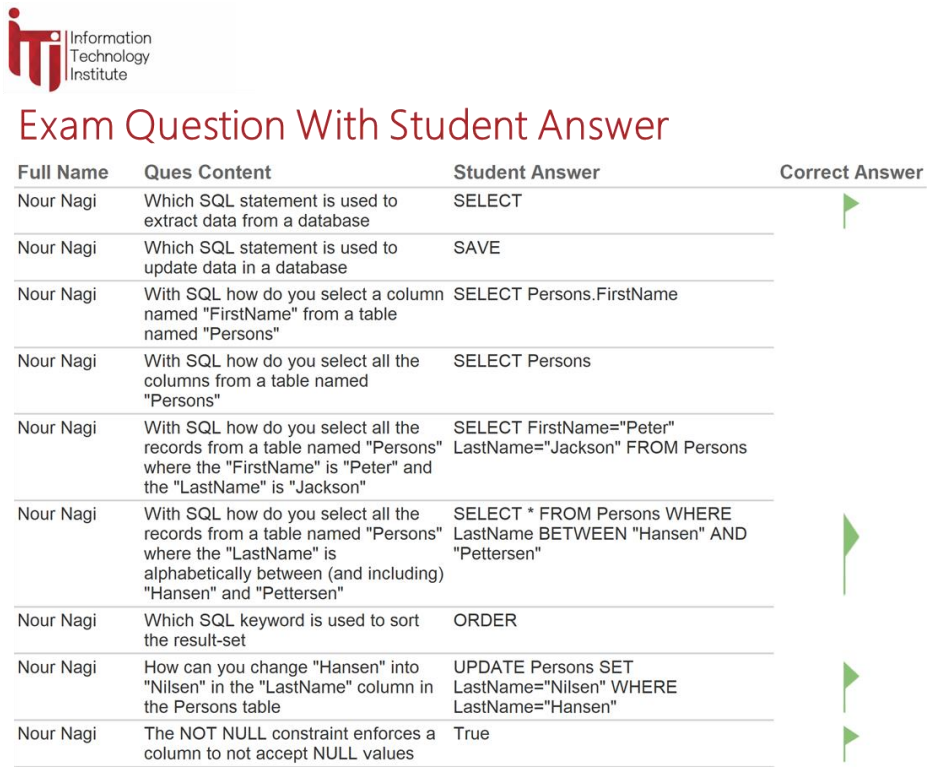


Information Technology Institute

Questions in Exam

Ques Content
Which SQL statement is used to extract data from a database
Which SQL statement is used to update data in a database
With SQL how do you select a column named "FirstName" from a table named "Persons"
With SQL how do you select all the columns from a table named "Persons"
With SQL how do you select all the records from a table named "Persons" where the "FirstName" is "Peter" and the "LastName" is "Jackson"
With SQL how do you select all the records from a table named "Persons" where the "LastName" is alphabetically between (and including) "Hansen" and "Pettersen"
Which SQL keyword is used to sort the result-set
How can you change "Hansen" into "Nilsen" in the "LastName" column in the Persons table
The NOT NULL constraint enforces a column to not accept NULL values
Which operator is used to search for a specified pattern in a column

- Take exam number and the student ID then returns the Questions with the student answers.



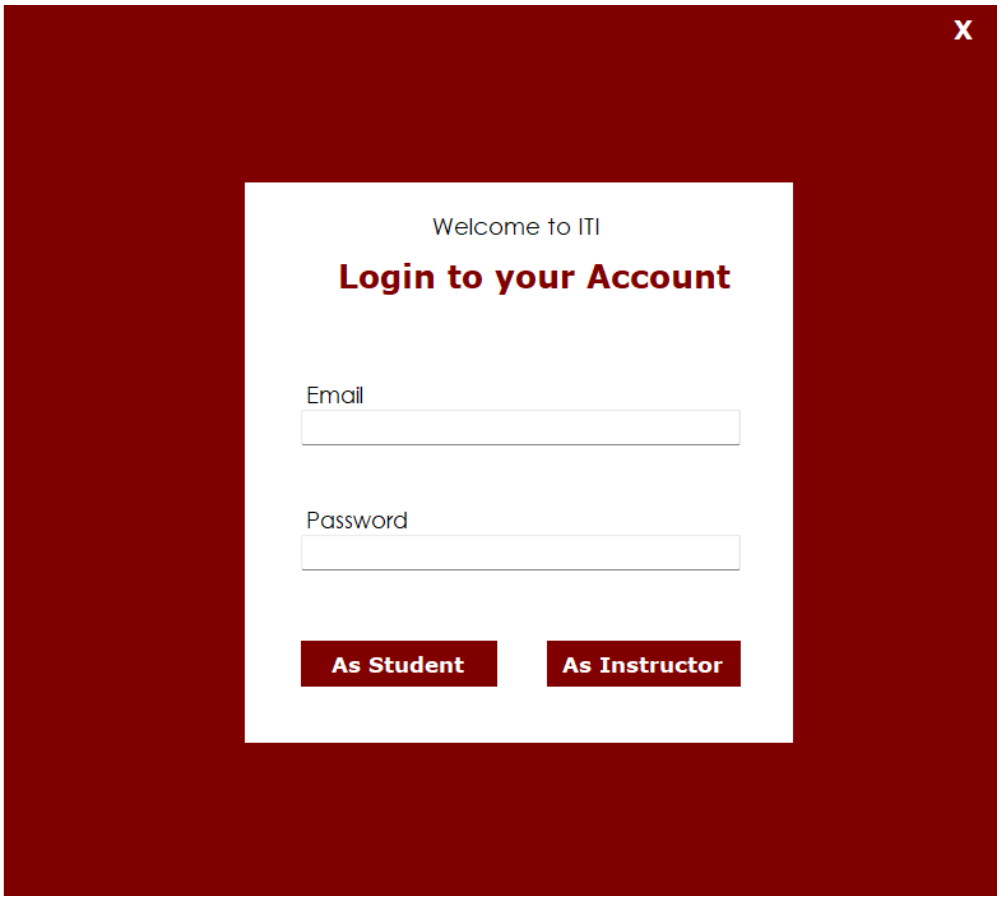
Information Technology Institute

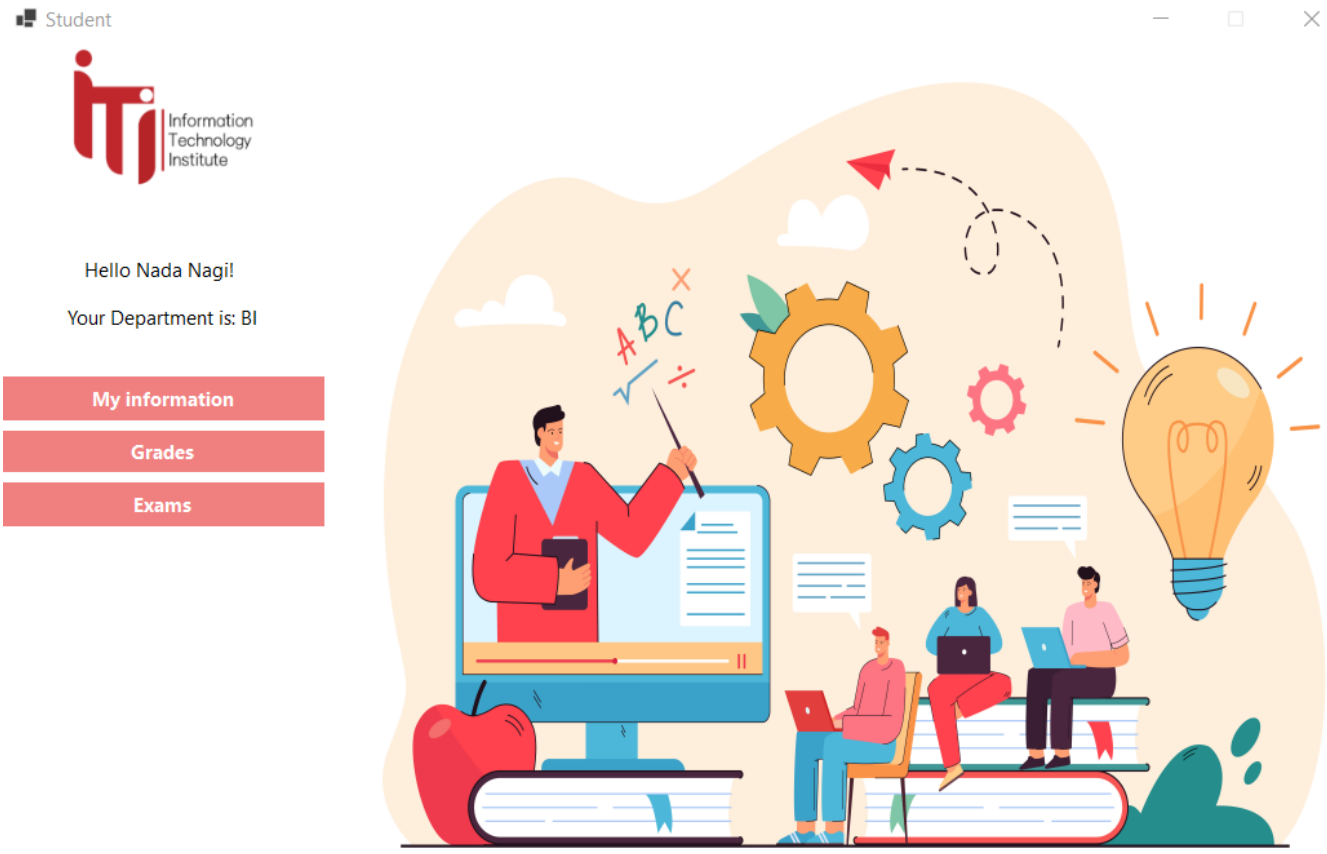
Exam Question With Student Answer

Full Name	Ques Content	Student Answer	Correct Answer
Nour Nagi	Which SQL statement is used to extract data from a database	SELECT	
Nour Nagi	Which SQL statement is used to update data in a database	SAVE	
Nour Nagi	With SQL how do you select a column named "FirstName" from a table named "Persons"	SELECT Persons.FirstName	
Nour Nagi	With SQL how do you select all the columns from a table named "Persons"	SELECT Persons	
Nour Nagi	With SQL how do you select all the records from a table named "Persons" where the "FirstName" is "Peter" and the "LastName" is "Jackson"	SELECT FirstName="Peter" LastName="Jackson" FROM Persons	
Nour Nagi	With SQL how do you select all the records from a table named "Persons" where the "LastName" is alphabetically between (and including) "Hansen" and "Pettersen"	SELECT * FROM Persons WHERE LastName BETWEEN "Hansen" AND "Pettersen"	
Nour Nagi	Which SQL keyword is used to sort the result-set	ORDER	
Nour Nagi	How can you change "Hansen" into "Nilsen" in the "LastName" column in the Persons table	UPDATE Persons SET LastName="Nilsen" WHERE LastName="Hansen"	
Nour Nagi	The NOT NULL constraint enforces a column to not accept NULL values	True	

Application Interface

The team developed a desktop application to be a link between the database, the student, and the instructors. So, the student can perform his exams through it and know the grade at the same time once he has finished, and Instructor knows how to add and modify his courses and see his data. These features appear in the following screens.





Exam

Exam No.84673

1- Which of the following are building blocks of Power BI?
- (•) Visualizations- datasets- reports- dashboards- tiles
- ( ) Visual Studio- C#- and JSON files
- ( ) Tiles- dashboards- databases- mobile device
- ( ) None of the above

2- Type of data modeling in Power BI that Uses Data Analysis Expressions and similar to Excel formulas___
- ( ) Query
- ( ) None
- ( ) Model
- ( ) DAX

3- What symbol would you use for multiplication in Power BI in a DAX formula?
- ( ) /
- ( ) -
- ( ) +
- ( ) *

4- What DAX function can be used to return a value in a column if a condition is met?
- ( ) VLOOKUP
- ( ) SUM
- ( ) IF
- ( ) COUNT

5- What are the group of data sources can Power BI connect to
- ( ) Files- SQL- Azure
- ( ) Files- Content Packs- Connectors
- ( ) Databases- SQL- Azure
- ( ) Content Packs- Connectors- SQL

6- A customer may purchase 1 or many products. So the relationship between the customer table and the products table will be_
- ( ) One to One
- ( ) One to Many
- ( ) Many to One
- ( ) Many to Many

7- Berikut contoh fungsi COUNTING kecuali_____
- ( ) None
- ( ) MAX
- ( ) COUNTROWS
- ( ) COUNT

8- A function that can only work on numeric fields is_____
- ( ) ISNUMBER
- ( ) CONCATENATE
- ( ) AVERAGE
- ( ) AND

9- Contains transactional data or facts of a business process_____
- ( ) Query table
- ( ) Power BI table

10- Tooltips appear when the user hovers over part of a visual (e.g. pie segment) even when there are no fields in the Tooltip data
- ( ) True
- ( ) False

Finish

Result

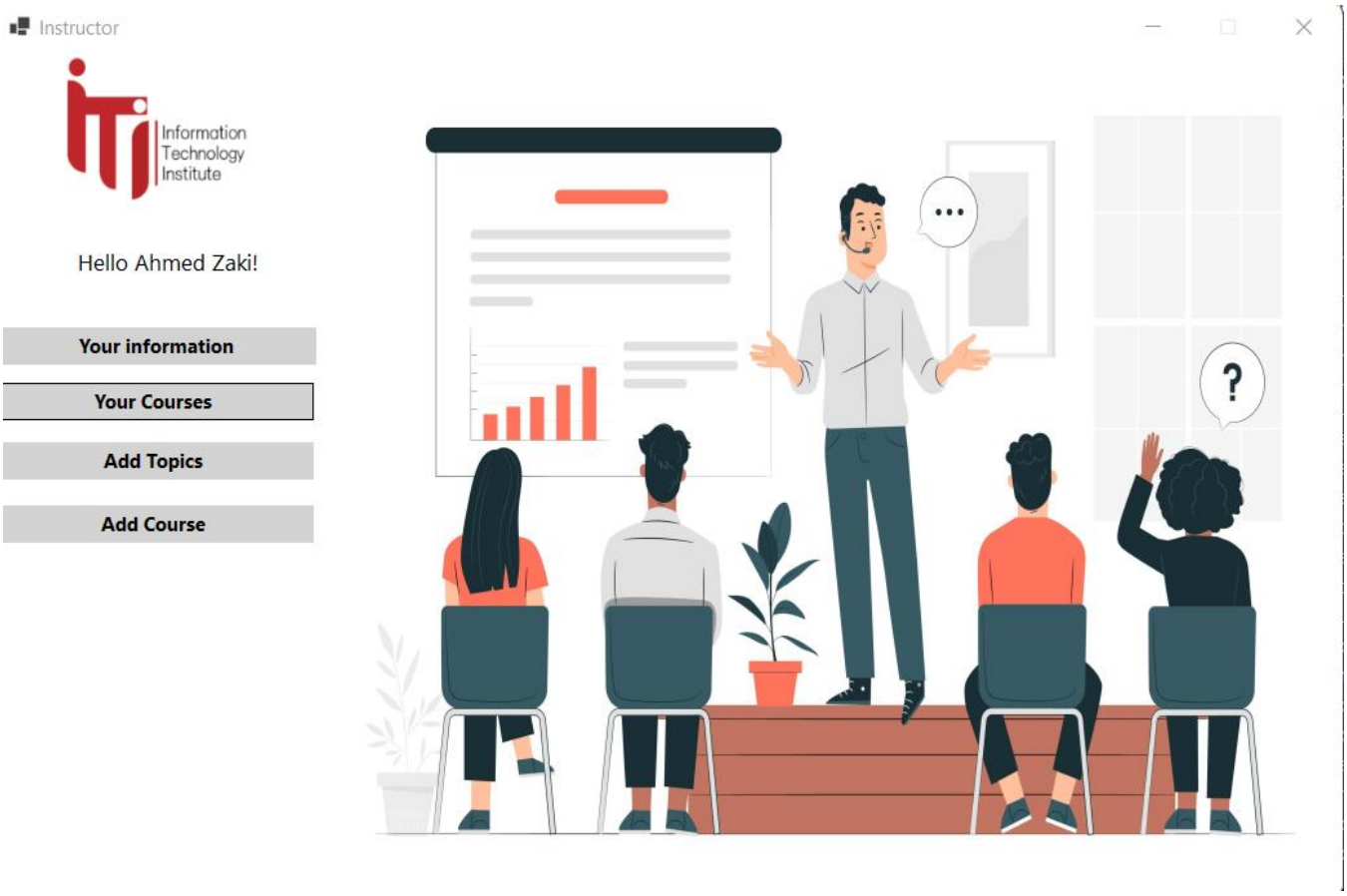
Try Again! You Can Do It!

You Score is 1 / 10

Result

Congratiolations!

You Score is 10 / 10



Dashboard

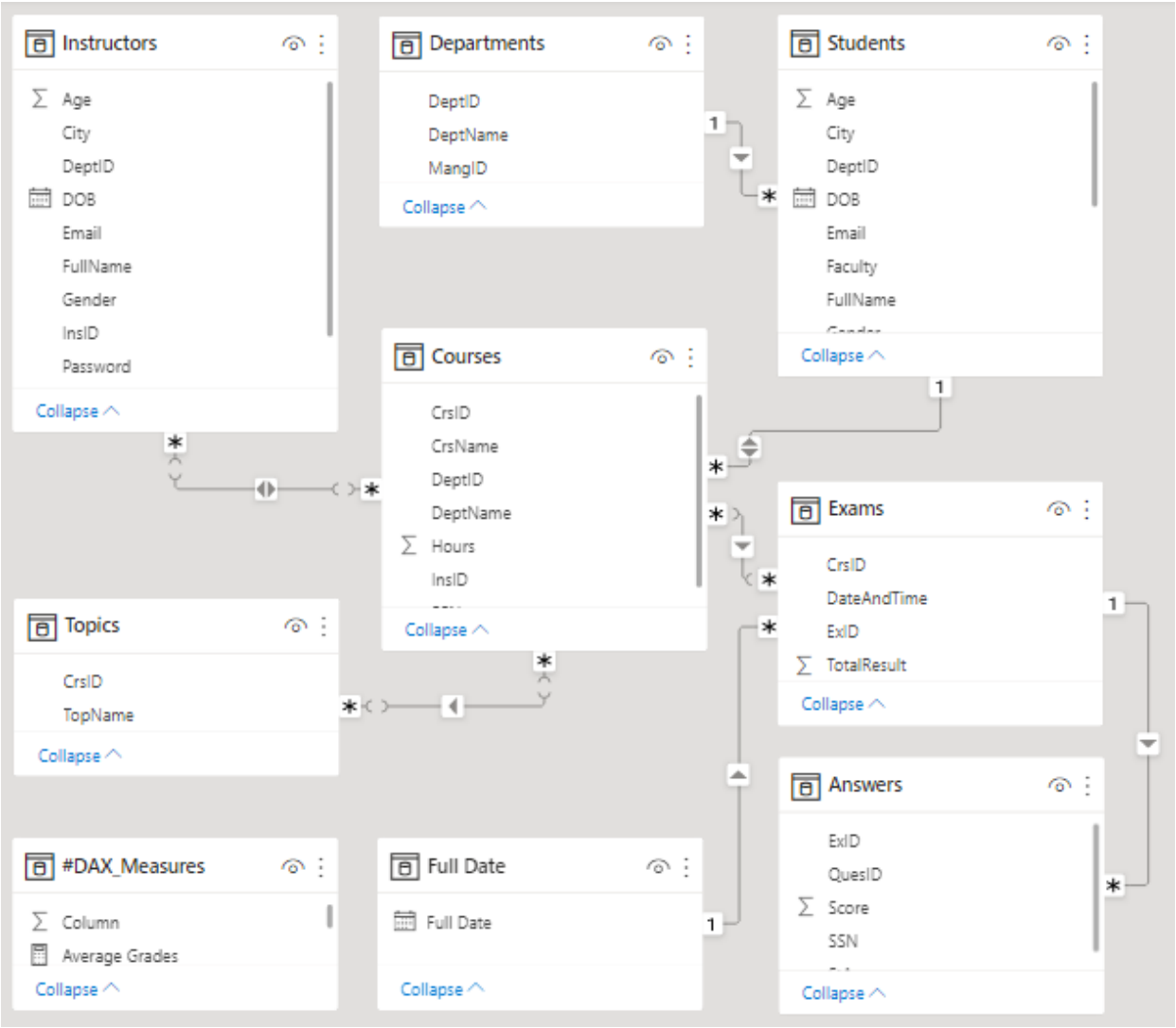
In This final step the moved further to analyze the data existed to evaluate the performance of the student, the instructor as well and getting insights about the ITI as an organization mainly through the student and the instructor.

The first step included brain storming to define the questions we interested to answer as a step in the Exploratory Data Analysis EDA process.

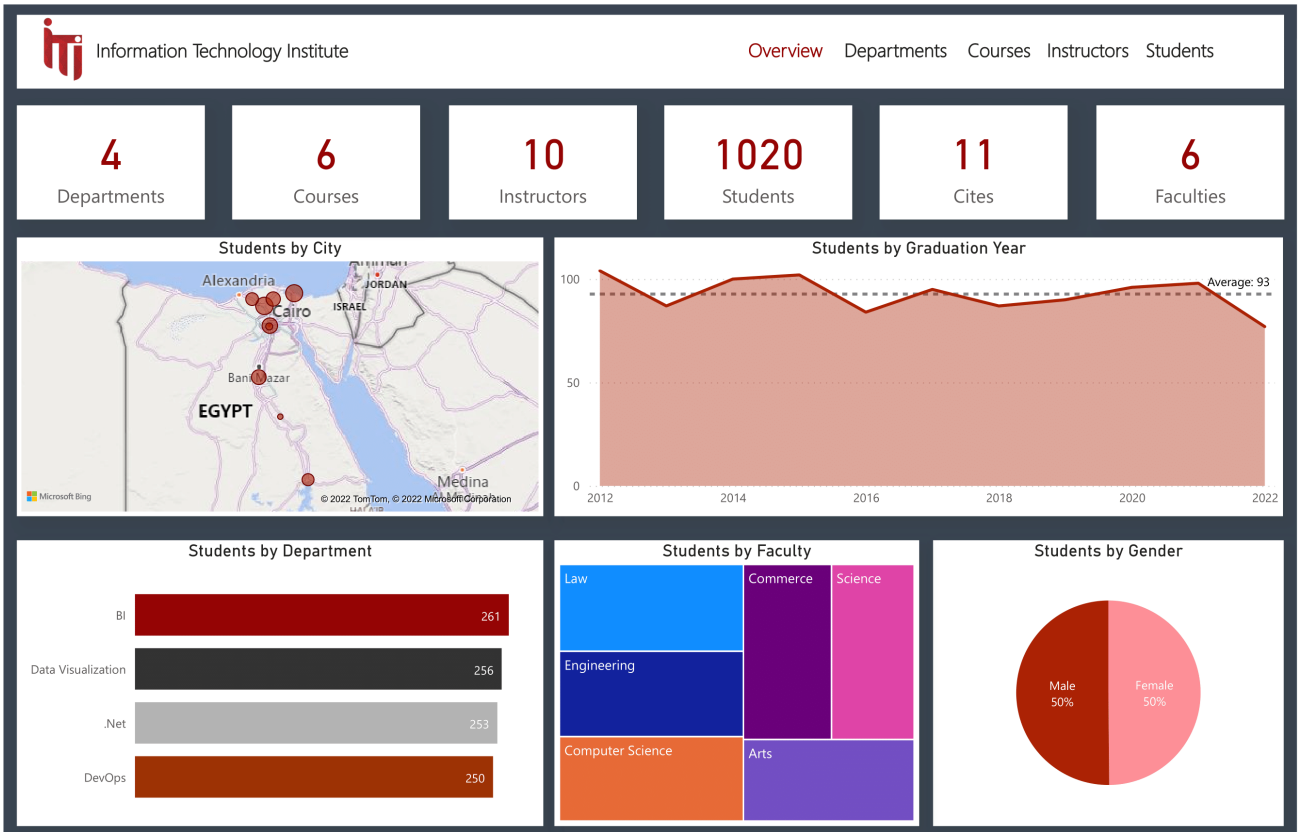
These are some of the asked questions:

- The most popular track and the distribution of the students in all tracks
- The contribution of each faculty students in each track
- The average of grades per each course
- The relation between the salary and the age of the instructor
- The geographic distribution of the students

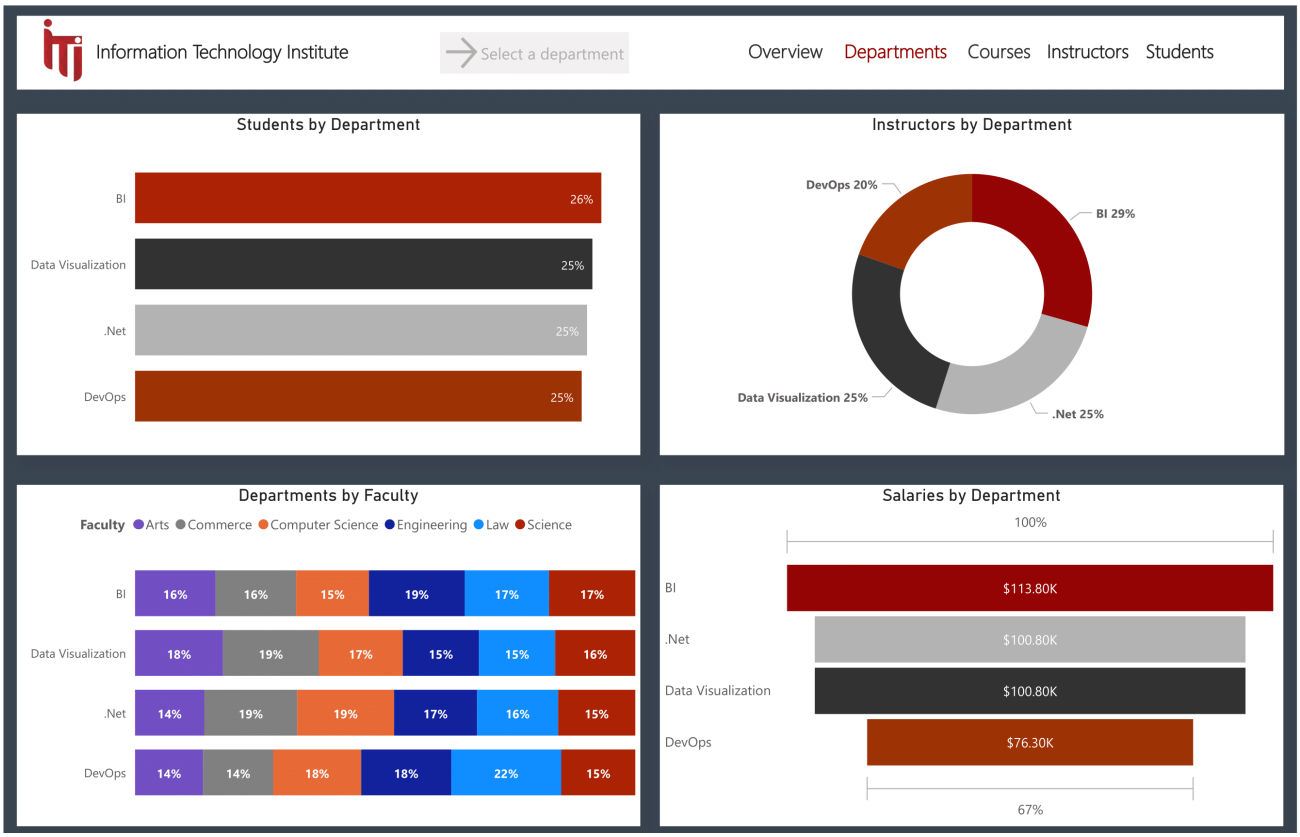
  Then the data imported from the database into Power BI after that some modifications made using the power query in the table and model to be able to answer the previous questions and much more.


Instructors
Age
City
DeptID
DOB
Email
FullName
Gender
InsID
Password
Collapse
Departments
DeptID
DeptName
MangID
Collapse
Students
Age
City
DeptID
DOB
Email
Faculty
FullName
Collapse
Courses
CrsID
CrsName
DeptID
DeptName
Hours
InsID
Collapse
Exams
CrsID
DateAndTime
ExID
TotalResult
Collapse
Topics
CrsID
TopName
Collapse
Answers
ExID
QuesID
Score
SSN
Collapse
#DAX_Measures
Column
Average Grades
Collapse
Full Date
Full Date
Collapse

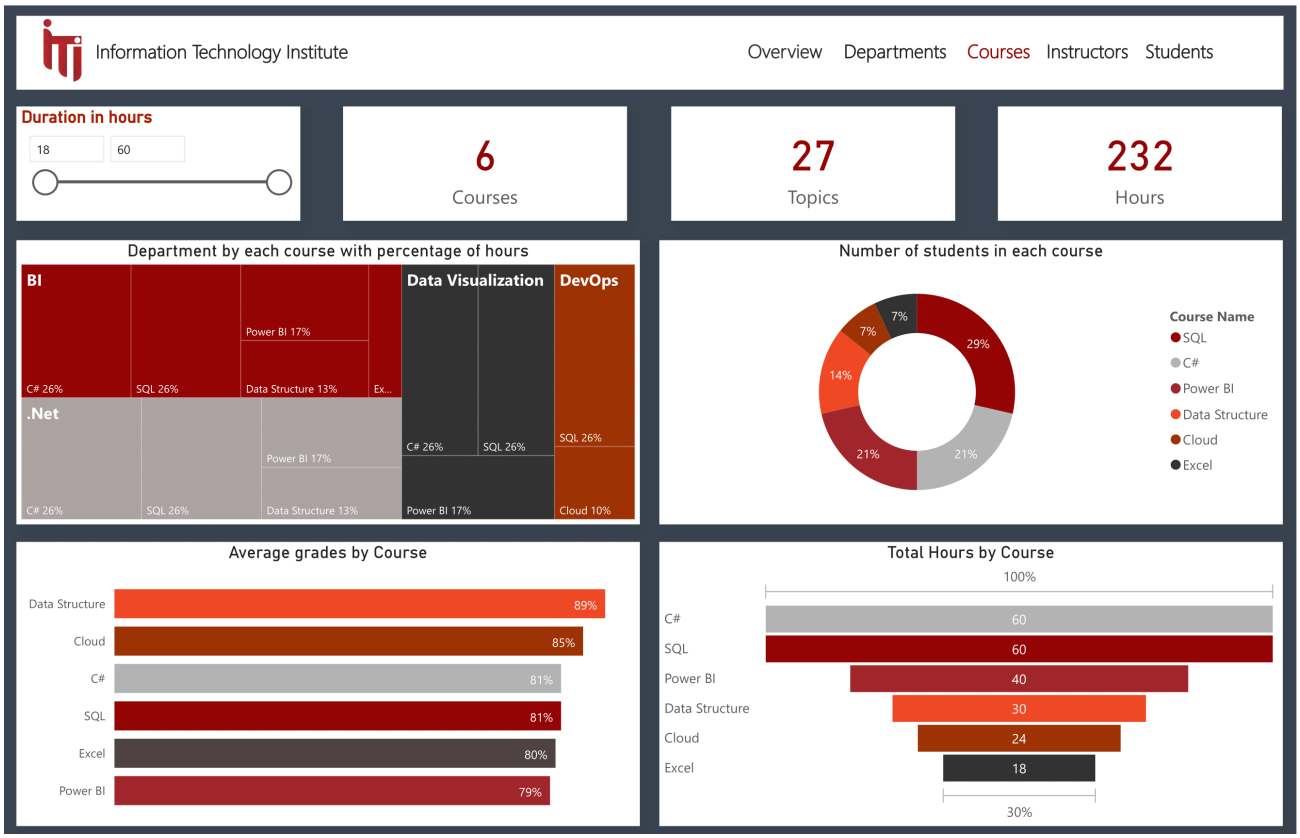
Overview



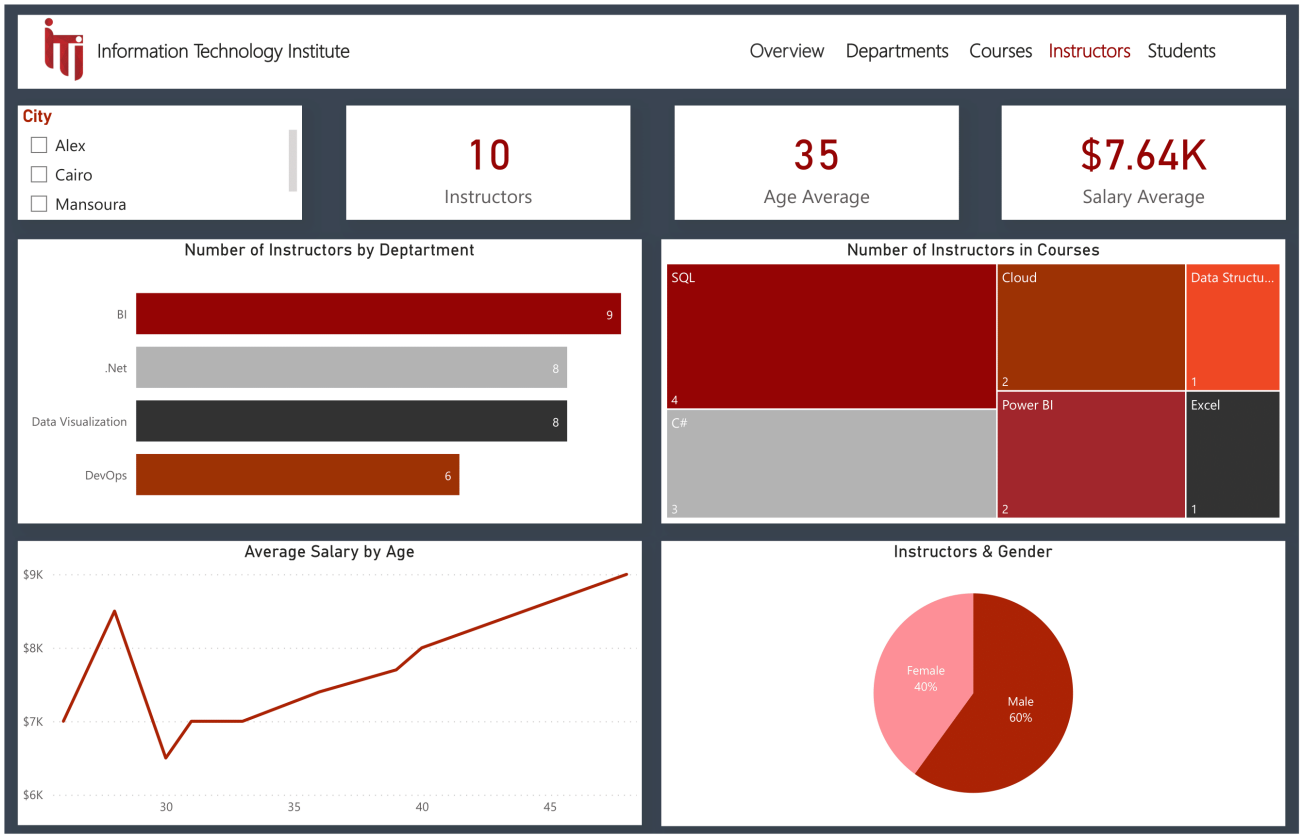
Departments



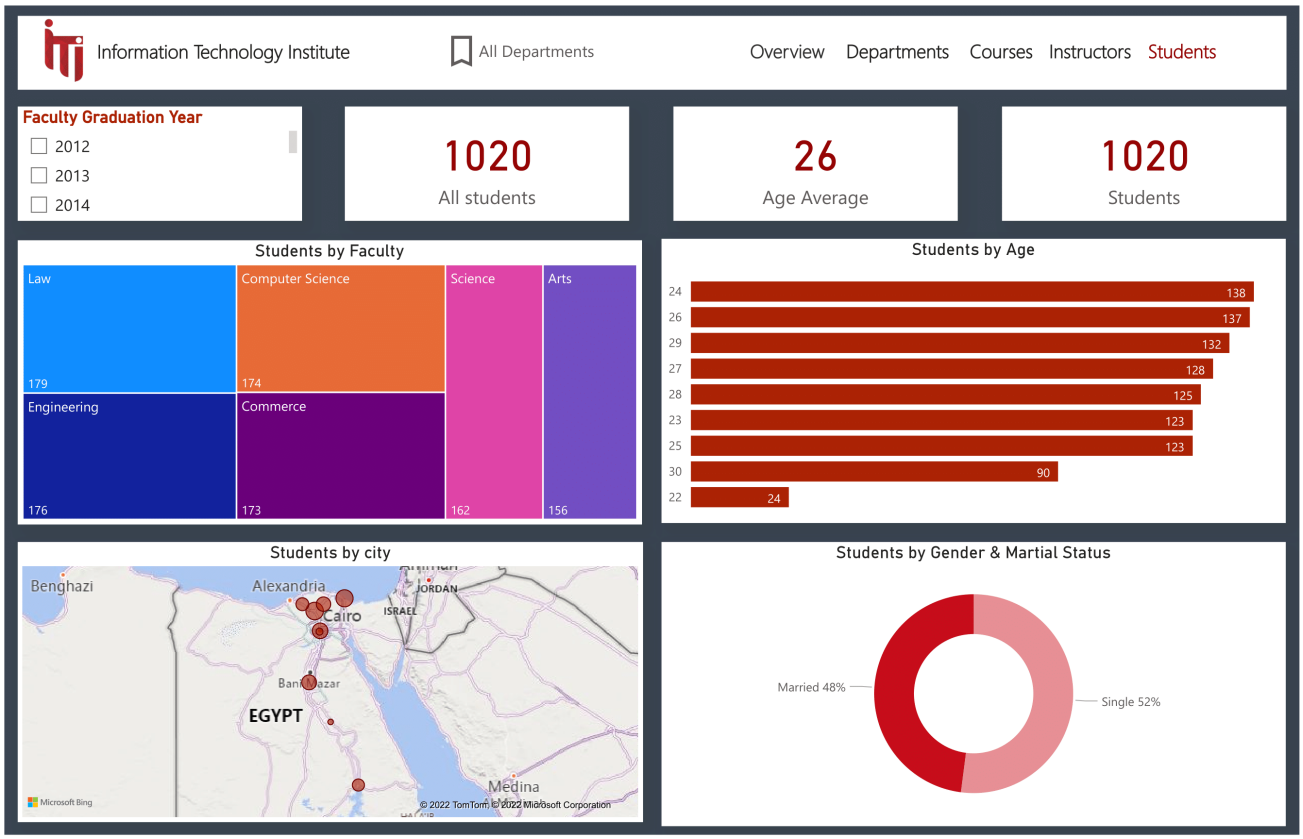
Courses



Instructors



Students



Acknowledgment

I'm grateful to have the opportunity to learn and work with unique minds, characters. Not only in the final graduation project but in most of my colleagues in the internship.

I'm also thankful for everyone help us during the internship from the technical knowledge area or if even further to help us in the new career. All these efforts will gain great impact one day.

It's the end of this project but it is actually the start of a new professional career.