Assignment # 3

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To

Sir Bilal

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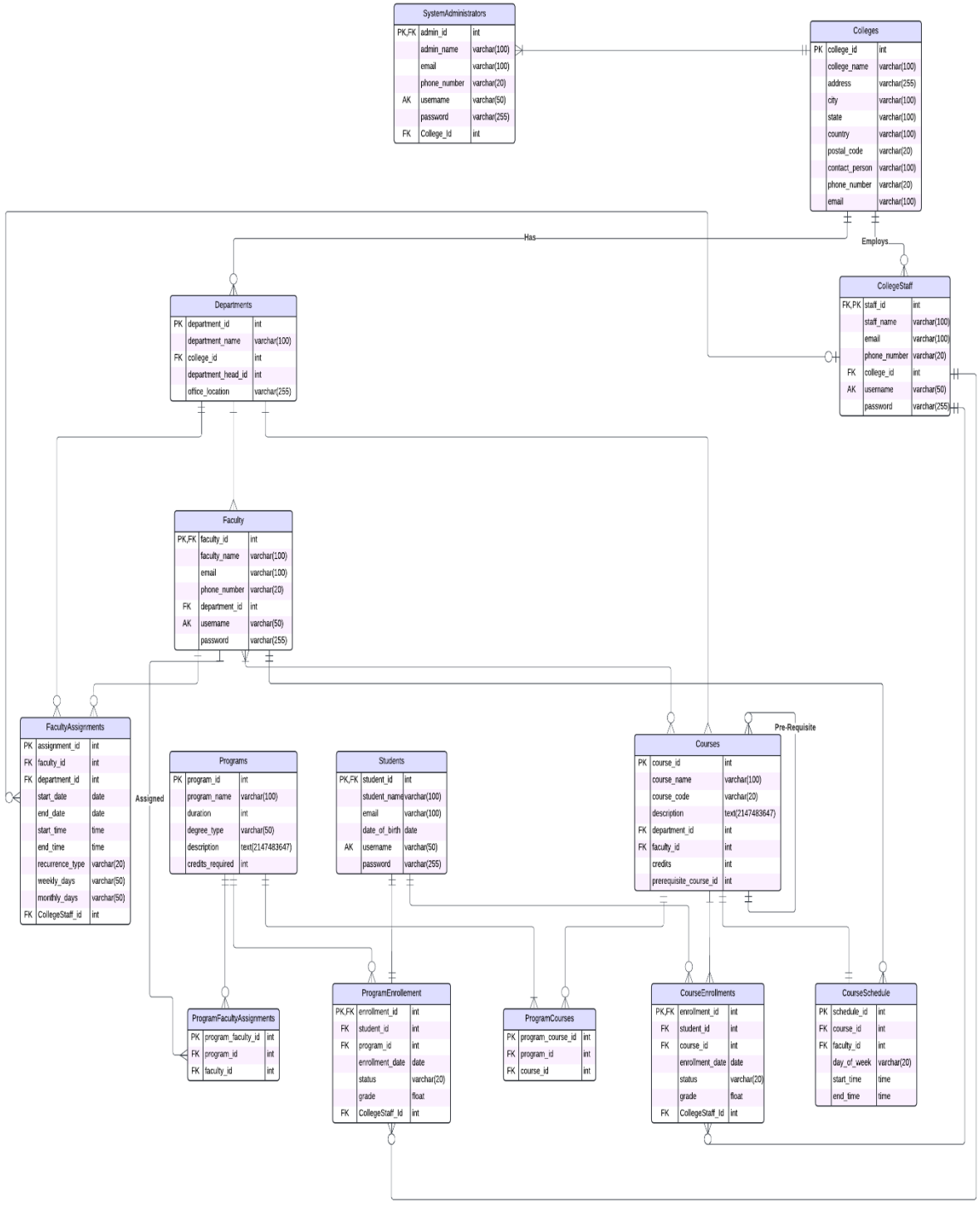
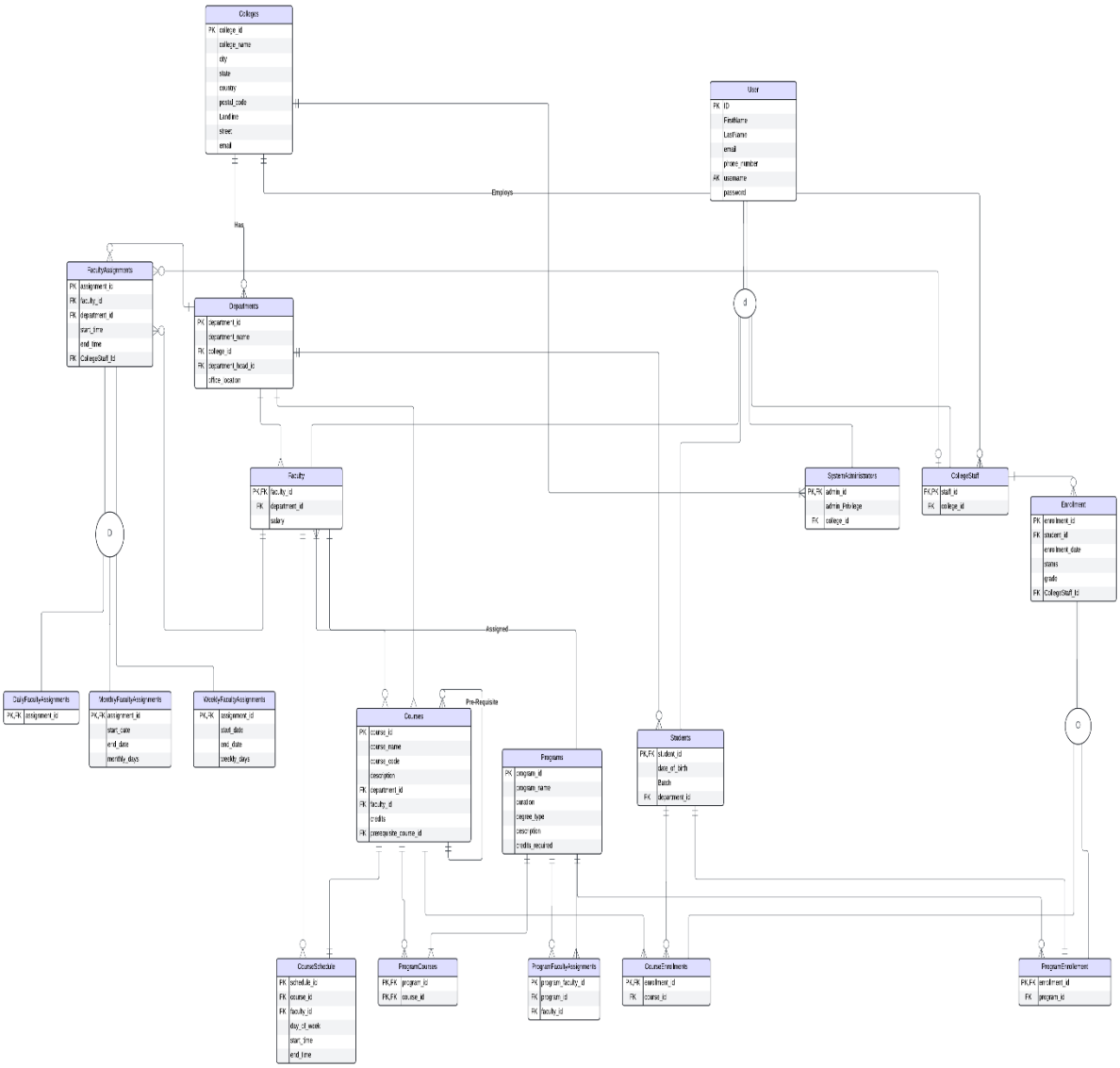
1 Question#1

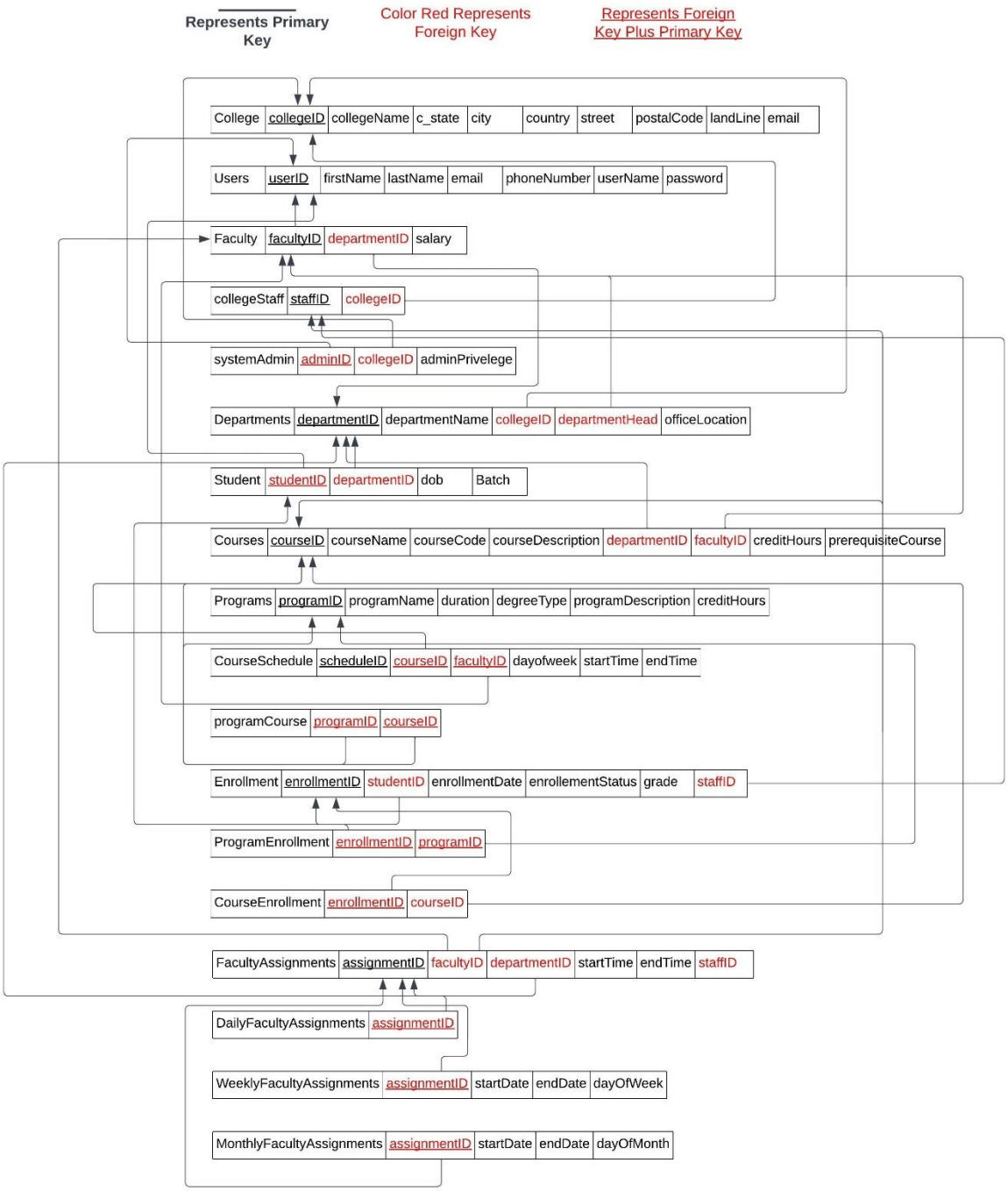
1.1 Entity Relation Diagram



1.2 Enhanced Entity Relation Diagram

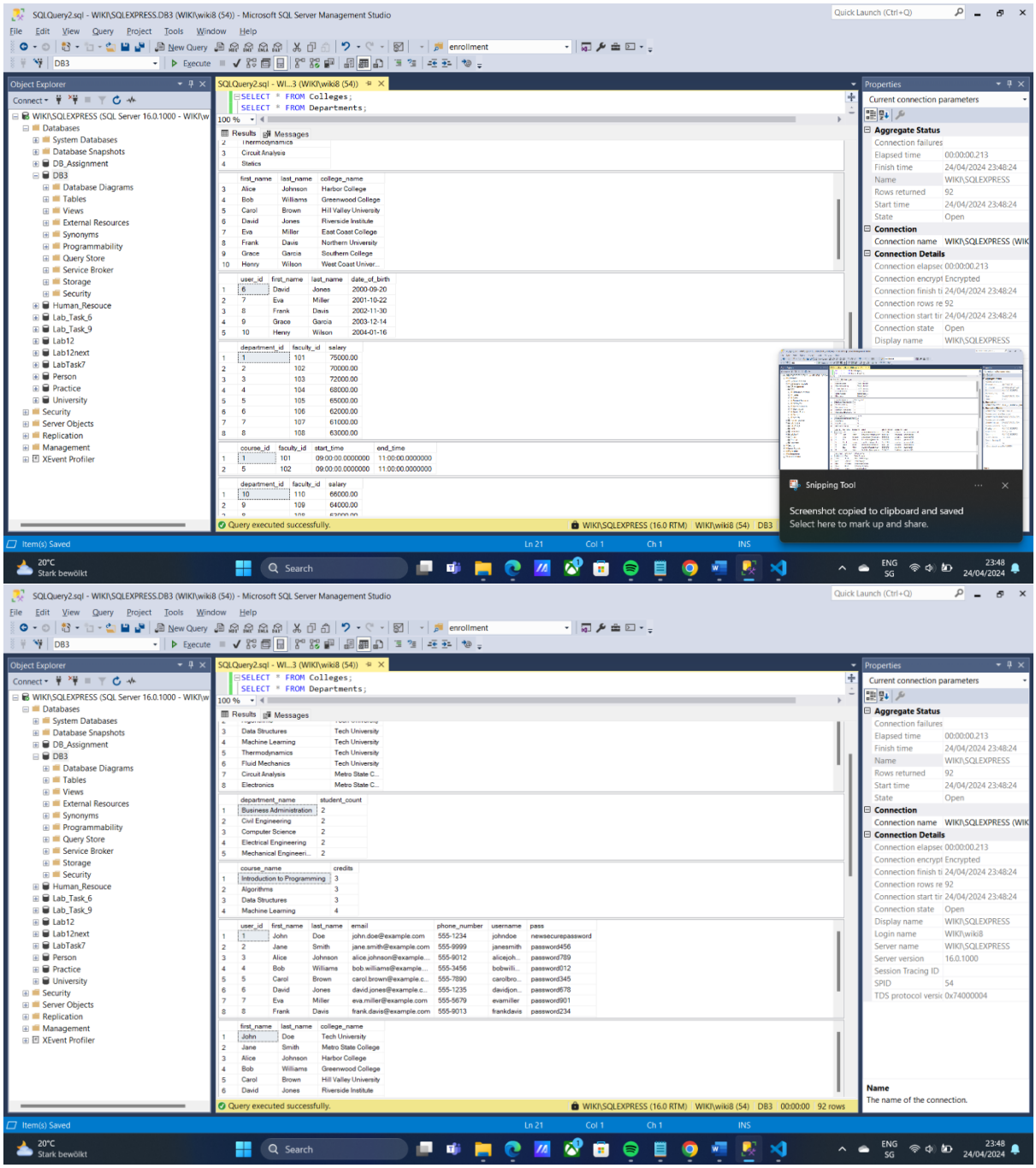


1.3 Relational Data Model

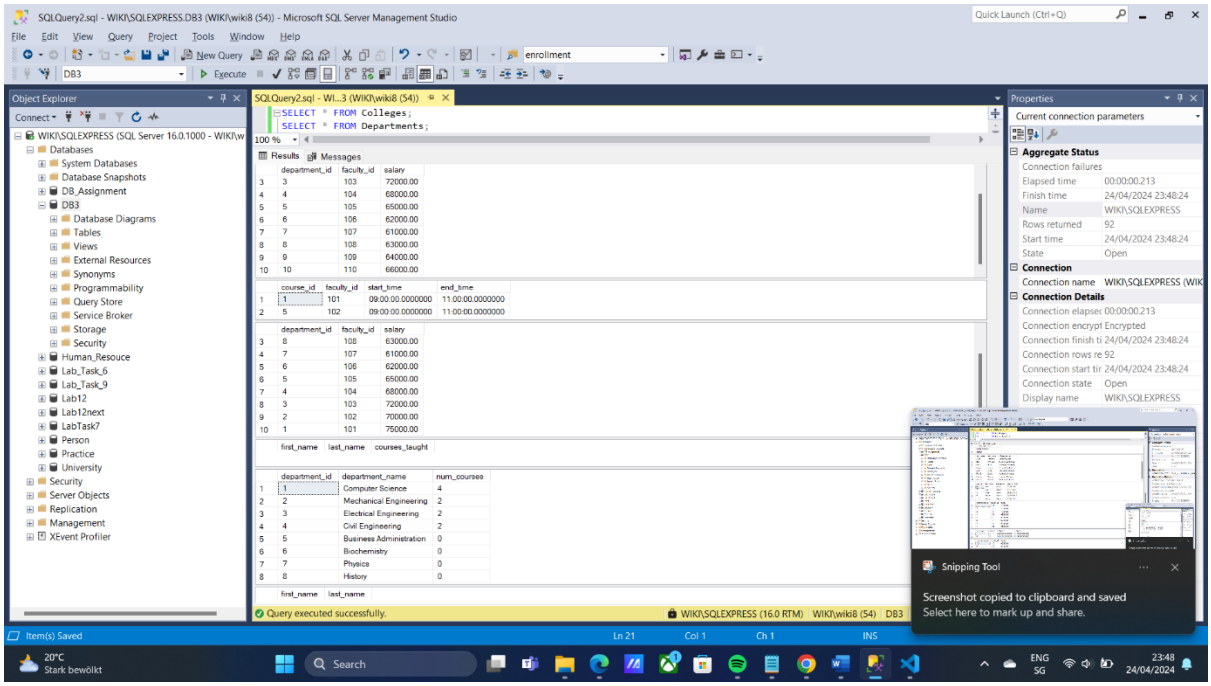


1.4 Queries

Our Queries:


SQLQuery2.sql - WIKI\SQLEXPRESS.DB3 (WIKI\wiki8 (54)) - Microsoft SQL Server Management Studio
SELECT * FROM Colleges;
SELECT * FROM Departments;
Snipping Tool
Screenshot copied to clipboard and saved
Select here to mark up and share.
Query executed successfully.

SQLQuery2.sql - WIKI\SQLEXPRESS.DB3 (WIKI\wiki8 (54)) - Microsoft SQL Server Management Studio
SELECT * FROM Colleges;
SELECT * FROM Departments;
Query executed successfully.



Results | Messages

	first_name	last_name	college_name	course_name	department_name	enrollment_date
3	Alice	Johnson	Tech University	Data Structures	Computer Science	2022-08-25
4	Bob	Williams	Tech University	Machine Learning	Computer Science	2022-08-25
5	Carol	Brown	Tech University	Thermodynamics	Mechanical Engineering	2022-08-25
6	David	Jones	Tech University	Fluid Mechanics	Mechanical Engineering	2022-08-25
7	Eva	Miller	Metro State College	Circuit Analysis	Electrical Engineering	2022-08-25
8	Frank	Davis	Metro State College	Electronics	Electrical Engineering	2022-08-25
9	Grace	Garcia	Metro State College	Statics	Civil Engineering	2022-08-25
10	Henry	Wilson	Metro State College	Dynamics	Civil Engineering	2022-08-25

	course_name	course_code	description	department_name	college_name	day_of_week	start_time	end_time	assignment_type
1	Introduction to Programming	CS101	Learn the basics of programming.	Computer Science	Tech University	Monday	09:00:00.0000000	11:00:00.0000000	1
2	Algorithms	CS201	Study of algorithms	Computer Science	Tech University	Wednesday	10:00:00.0000000	12:00:00.0000000	1
3	Data Structures	CS202	Organizing data for efficient access and modificati...	Computer Science	Tech University	Friday	13:00:00.0000000	15:00:00.0000000	1
4	Machine Learning	CS303	Introduction to machine learning concepts and al...	Computer Science	Tech University	Tuesday	14:00:00.0000000	16:00:00.0000000	1

	first_name	last_name	course_name	description	enrollment_date	grade	Assignment_Frequency
1	John	Doe	Introduction to Programming	Learn the basics of programming.	2022-08-25	A	Daily
2	Jane	Smith	Algorithms	Study of algorithms	2022-08-25	B	Daily

	course_name	day_of_week	start_time	end_time	faculty_id	department_name	college_name
1	Dynamics	Thursday	12:00:00.0000000	14:00:00.0000000	104	Civil Engineering	Metro State College
2	Statics	Thursday	09:00:00.0000000	11:00:00.0000000	104	Civil Engineering	Metro State College
3	Circuit Analy...	Varies	12:00:00.0000000	14:00:00.0000000	103	Electrical Engine...	Metro State College
4	Electronics	Varies	12:00:00.0000000	14:00:00.0000000	103	Electrical Engine...	Metro State College
5	Algorithms	Wednesday	10:00:00.0000000	12:00:00.0000000	101	Computer Science	Tech University
6	Algorithms	Varies	08:00:00.0000000	10:00:00.0000000	101	Computer Science	Tech University
7	Data Structu...	Varies	08:00:00.0000000	10:00:00.0000000	101	Computer Science	Tech University
8	Introduction ...	Monday	09:00:00.0000000	11:00:00.0000000	101	Computer Science	Tech University

	faculty_id	start_time	end_time	first_department	second_department

	faculty_id	assignment_count	department_name
1	105	1	Business Administration

	faculty_id	assignment_count	department_name
1	105	1	Business Administration

	student_id	first_name	last_name	course_id	course_name	times_enrolled

Query executed successfully. | DESKTOP-GDUKF66\SQLEXPRESS ... | DESKTOP-GDUKF66\Abdull... | sss | 00:00:00 | 32 rows

2 Question#2

2.1 Examples for Anomalies

2.1.1 Insertion Anomaly

An insertion anomaly occurs when some data cannot be inserted into a table without the presence of other data.

1. If we want to insert a student into the table it would not be possible without inserting the course offer id and course id and course details will be repeated. This leads to inefficiency and redundancy.
2. For each course to be added there needs to be a student and course offer id otherwise the course cannot be inserted and in this way student data will be repeated many times leading to redundancy and inefficiency.
3. If we want to offer a course then it cannot be done without inserting data of the student and course leading to inefficiency and redundancy.

2.1.2 Deletion Anomaly

A deletion anomaly occurs when one row is deleted and it leads to deletion of other rows also.

1. If a course being offered by course offer id is decided to be no longer offered and removed by let's say the HOD then all the rows with the course offer id leading to loss of data of students and courses.
2. If a course is decided to be removed from the program and decided to be never offered again let's say by the HEC then the student data and historical data will be lost.

3. If suppose in summer semester courses were offered but nobody took any courses then deleting the semester data will lead to loss of other data in table.

2.1.3 Update Anomaly

An update anomaly occurs when a modification is made in one row and as a result multiple rows are affected.

1. If the name of course is changed as a result all the rows with the course name will be affected.
2. If a student changes his city as a result all the rows with his data will be affected.
3. If by mistake at insertion time the course offered year was entered wrong and now has to be corrected so as a result multiple rows will be affected.

2.2 Normalization

1st Normal Form:

Requirements:

1. No multivalued attribute must exist if so, they will be broken and moved to a new table and a foreign key will be set in the original first table. (All fields scalar values)
2. A primary key must be defined based on the condition it could be composite primary key keeping minimum number of columns possible.

Composite Primary Key: Student_Id, Course_Offer_Id

Reason: As student id will always be unique with the combination of course offer id because a student cannot take same course offer id more than once.

Now 1NF achieved.

Student_Id	Student_City	Student_Name	Course_Offer_Id	Course_Semester	Course_Offered_Year	Course_Grade	Course_Id	Course_Name

2NF:

Requirements:

1. Remove partial dependencies by making a new table if the primary key is composite and the primary key of new table will be foreign key in original old table.

Functional Dependencies:

1. {Student_Id} -> {Student_City}
2. {Student_Id} -> {Student_Name}

1. {Course_Offer_Id} -> {Course_Semester}
2. {Course_Offer_Id} -> {Course_Offered_Year}
3. {Course_Offer_Id} -> {Course_Id}
4. {Course_Offer_Id} -> {Course_Name}

5. 1. {Student_Id, Course_Offer_Id} -> {Course_Grade}

We have named the original table as Enrollment which has student id and course offer id as both primary and foreign keys coming from respective tables.

In 2NF two new tables have been created each with their primary key underlined.

Enrollment

Student_Id ----------	Course_Offer_Id ----------	Course_Grade

Student

Student_Id	Student_City	Student_Name

Course_Offer

Course_Offer_Id	Course_Semester	Course_Offered_Year	Course_Id	Course_Name

Now 2NF achieved.

3NF:

Requirements:

1. Remove transitive dependencies meaning no attribute depends on a non-primary key attribute which depends on a primary key. If so, the attributes which depend on the non-primary key attribute will be moved to a new table where the non-primary key attribute in the old table will be a primary key in the new table and foreign key in the old table.

The course id and course name attributes were moved to a new table and course id was made primary key in the new table namely Course. In the course offer table, the course id attribute is now a foreign key linked to Course table.

Enrollment

Student_Id ----------	Course_Offer_Id ----------	Course_Grade

Student

Student_Id	Student_City	Student_Name

Course_Offer

Course_Offer_Id	Course_Semester	Course_Offered_Year	Course_Id ----------

Course

Course_Id	Course_Name

Now 3NF achieved.