UNIVERSITY of GREENWICH
Alliance with FPT Education

BTEC

Higher Nationals in Computing

Unit 04: Database Design and Development
ASSIGNMENT 1

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Class: GCS0801B.2

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Subject code: 1622

Assignment due: Assignment submitted:

ASSIGNMENT 1 FRONT SHEET

Qualification	**BTEC Level 5 HND Diploma in Computing**		
Unit number and title	**Unit 04: Database Design & Development**		
Submission date		**Date Received 1st submission**	
Re-submission Date		**Date Received 2nd submission**	
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Class	1622 GCS0801B.2	**Assessor name**	Phan Minh Tam
Student declaration I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.			
		Student's signature	

Grading grid

P1	M1	D1

☼ Summative Feedback:	☼ Resubmission Feedback:	
Grade:	**Assessor Signature:**	**Date:**
Signature & Date:		

ASSIGNMENT 1 BRIEF

Qualification	**BTEC Level 5 HND Diploma in Computing**		
Unit number	Unit 04: Database Design & Development		
Assignment title			
Academic Year	2019		
Unit Tutor	Phan Minh Tam		
Issue date		**Submission date**	
IV name and date			

Submission Format:

Format: This assignment is an Individual assignment and specifically including 1 document:

You must use font *Calibri size 12, set number of the pages and use multiple line spacing at 1.3. Margins must be: left: 1.25 cm; right: 1 cm; top: 1 cm and bottom: 1 cm.* The reference follows Harvard referencing system. The recommended word limit is *2.000-2.500 words*. You will not be penalized for exceeding the total word limit. The cover page of the report has to be the Assignment front sheet 1.

Submission Students are compulsory to submit the assignment in due date and in a way requested by the Tutors. The form of submission will be a soft copy posted on http://cms.greenwich.edu.vn/

Note: The Assignment *must* be your own work, and not copied by or from another student or from books etc. If you use ideas, quotes or data (such as diagrams) from books, journals or other sources, you must reference your sources, using the Harvard style. Make sure that you know how to reference properly, and that understand the guidelines on plagiarism. *If you do not, you definitely get fail*

Unit Learning Outcomes:

LO1 Use an appropriate design tool to design a relational database system for a substantial problem.

LO2 Develop a fully functional relational database system, based on an existing system design.

LO3 Test the system against user and system requirements.

LO4 Produce technical and user documentation

Assignment Brief and Guidance:

You are employed as a Database Developer for a large IT consultancy company. The company has been approached by FPT university which is expanding due to the growth of the number of students. FPT is currently facing difficulties in dealing with managing the university. It decided to develop several academic systems to manage the university easier including: **Online Library system, Student Grading System, Attendance System, CMS System, Scheduling System, Enrolment Systems, and so on.**

You are tasked to select one of those systems to develop database for FPT university. Your tasks are to:

Work with FPT to find out about current requirements for each system

Analyze the requirements and produce clear statements of user and system requirements.

Design a relational database system using appropriate design tools and techniques

Develop a fully functional relational database system, based on an existing system design.

Test the system against user and system requirements.

Produce technical and user documentation

Part 1 (assignment 1)

Before you start the development process, your manager has asked you to produce a report for the CEO of FPT, containing:

1. Clear statements of user and system requirements.

2. The design of the relational database system using appropriate design tools and techniques. It should contain at least four interrelated tables.

You would prefer to produce a more detailed document, so you will produce a comprehensive design for a fully functional system which will include interface and output designs, data validations and cover data normalisation.

Your manager would lik on the report your assessment of the effectiveness of the design in relation to user and system requirements.

Part 2 (Assignment 2)

Once the designs have been accepted by your manager you have been asked to:

1. develop the database system using evidence of user interface, output and data validations and querying across multiple tables.

You want to include more than just the basics so you will implement a fully functional database system which will include system security and database maintenance features.

You have decided to implement a query language into the relational database system.

The developed system will be demonstrated to your manager.

Your manager has asked you to include in the report:

2. Assessing whether meaningful data has been extracted through the use of query tools to produce appropriate management information.

3. Evaluating the effectiveness of the database solution in relation to user and system requirements, and suggest improvements.

4. Once the system has been developed, you will test the system and your manager will complete a witness statement indicating how your tests are performing against user and system requirements.

You will produce a brief report assessing the effectiveness of the testing, including an explanation of the choice of test data used.

Lastly you will produce technical and user documentation which will be given to the company.

You want to provide some graphical representations for ease of reference in the technical guide, so you have decided to produce a technical and user documentation for a fully functional system, including diagrams showing movement of data through the system, and flowcharts describing how the system works.

Learning Outcomes and Assessment Criteria		
Pass	**Merit**	**Distinction**
LO1 Use an appropriate design tool to design a relational database system for a substantial problem		
P1 Design a relational database system using appropriate design tools and techniques, containing at least four interrelated tables, with clear statements of user and system requirements.	**M1** Produce a comprehensive design for a fully functional system which includes interface and output designs, data validations and data normalisation.	**D1** Assess the effectiveness of the design in relation to user and system requirements.

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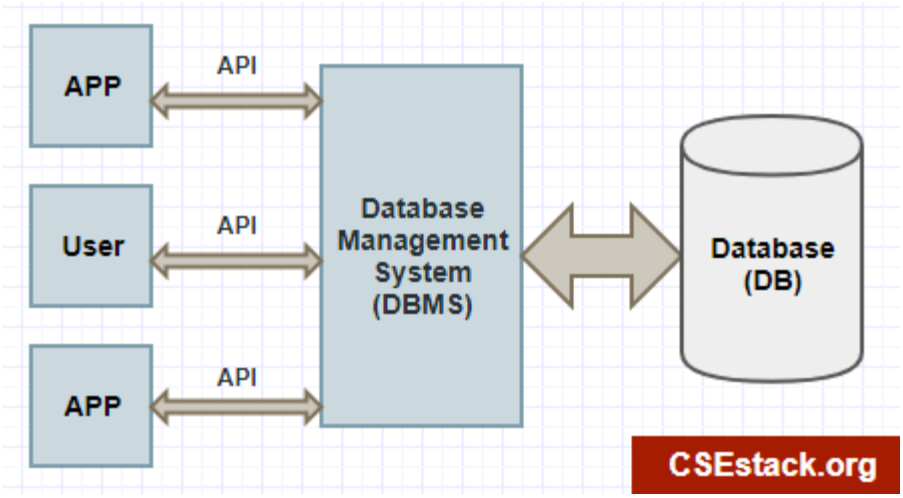
ASSIGNMENT 1 ANSWERS

LO1 Use an appropriate design tool to design a relational database system for a substantial problem.

P1 Design a relational database system using appropriate design tools and techniques, containing at least four interrelated tables, with clear statements of user and system requirements.

1. Introduction to database.

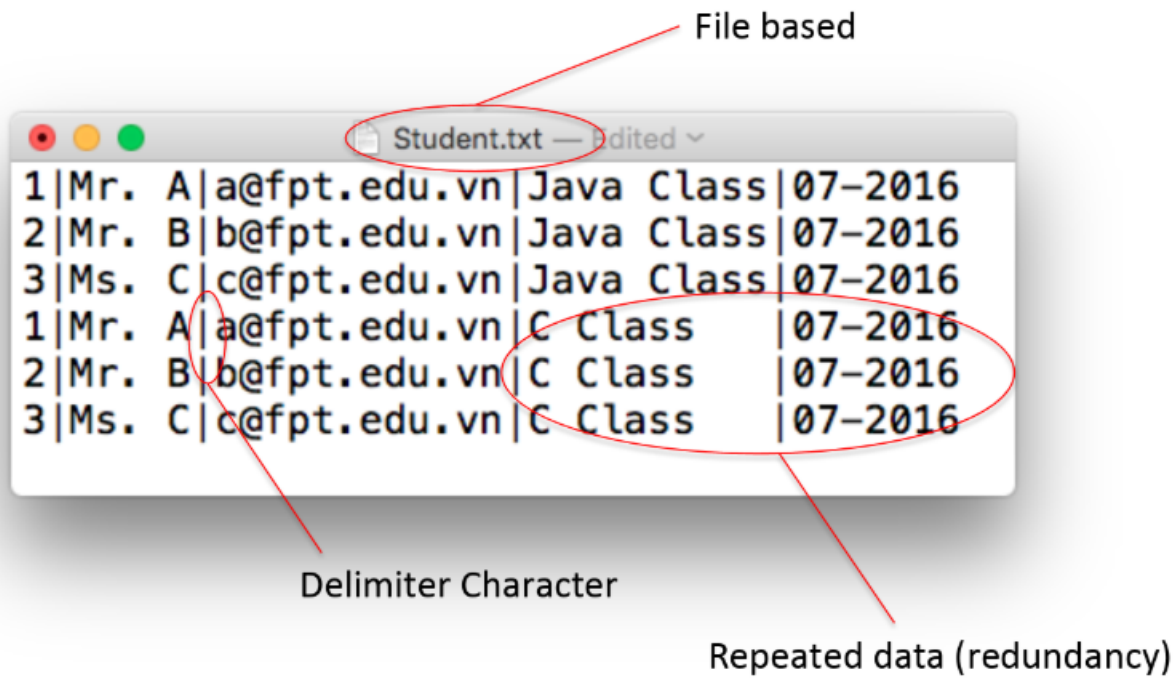
1.1. What is the database?



A database is an organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex, they are often developed using formal design and modeling techniques.

1.2. Types of database

1.2.1. Flat File Databases



Flat file databases

- ✓ Simplest form of an electronic database is the flat file database
- ✓ Consist of a file which stores data in a structured way
- ✓ A common format is the delimited file

Delimited files

- ✓ These have some sort of character separating columns of data
- ✓ Delimiter is a coma/tab (or any non-alphanumeric character)

Disadvantages

- ✓ Have almost no protection for data integrity and security
- ✓ Often contain many redundancy (repeated data)

Data Integrity, Redundancy?

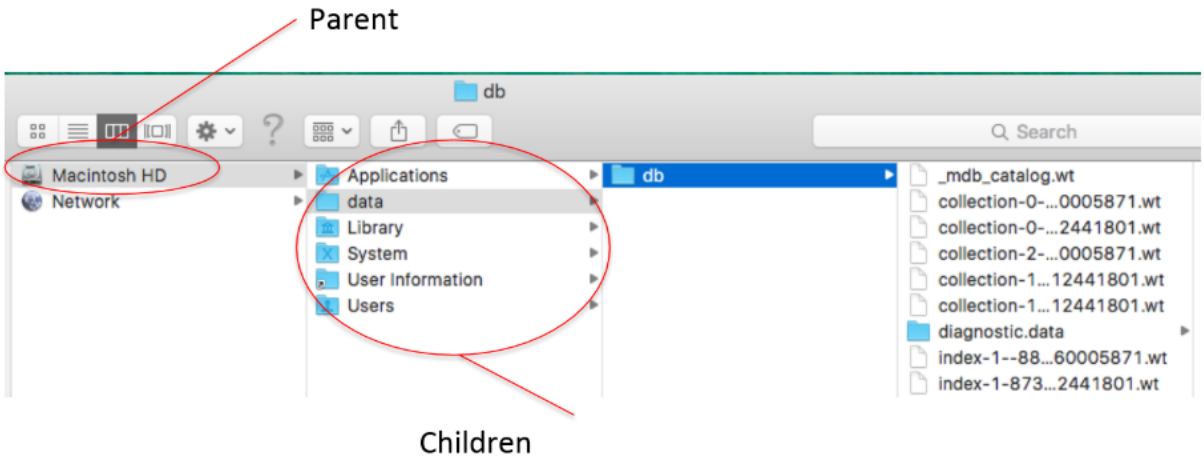
Data integrity

- ✓ Accuracy/correctness of the data in the database
- ✓ E.g., age must be integers

Redundancy

- ✓ Storing the same data in more than one place

1.2.2. Hierarchical Databases



Hierarchical databases are organized in a tree-like structure

- ✓ Parent table can have many child tables
- ✓ No child table can have more than one parent
- ✓ They are connected to one another through links

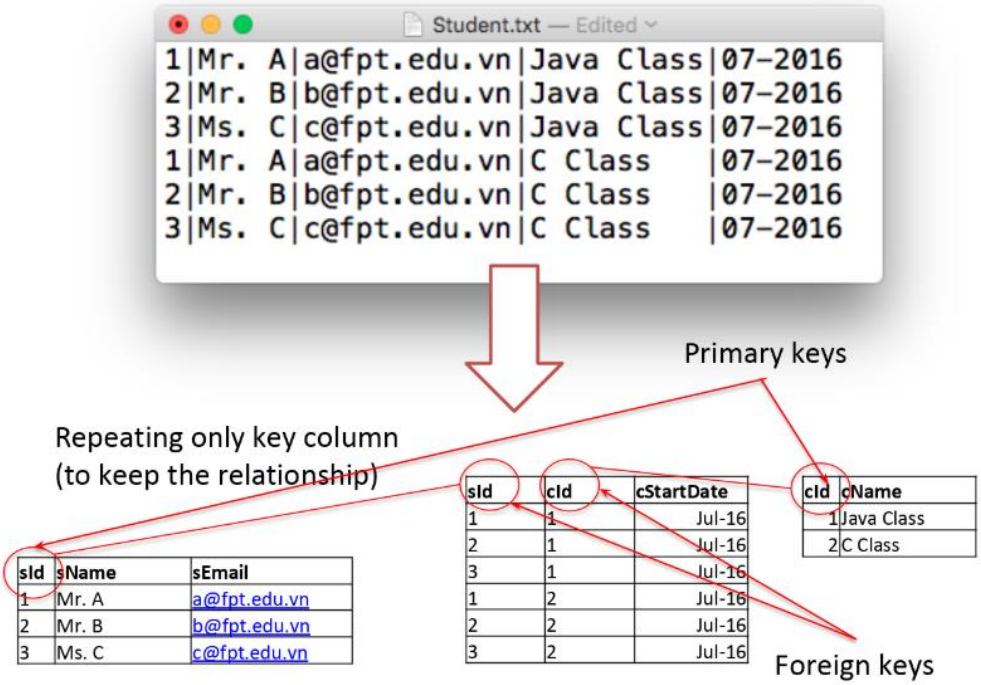
E.g.,

- ✓ Directories/Sub directories/Files hierarchies in OS

Disadvantages

- ✓ It does present the same problems of redundancy, data integrity, and comparability of data

1.2.3. Relational Databases



sId	sName	sEmail
1	Mr. A	a@fpt.edu.vn
2	Mr. B	b@fpt.edu.vn
3	Ms. C	c@fpt.edu.vn

sId	cId	cStartDate
1	1	Jul-16
2	1	Jul-16
3	1	Jul-16
1	2	Jul-16
2	2	Jul-16
3	2	Jul-16

cId	cName
1	Java Class
2	C Class

In relational model, data is organized into tables

- ✓ Even the info about the tables is stored in tables

Relationship among tables

- ✓ Defined by repeating column(s) from one in another table
- ✓ These repeating columns are called “keys”

This solved many problems

- ✓ One of those is data redundancy

Keys?

- In RDBs, each table usually has one (or more) column(s) designated as a primary key

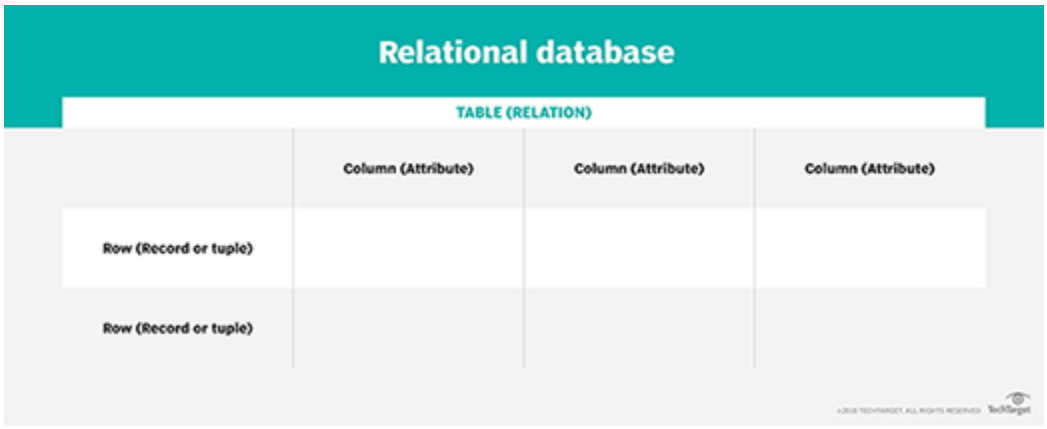
- A key uniquely identifies each row in a table

- ✓ Giving one of its values, you can find exactly one row in the table

- This key becomes a foreign key when it is repeated in another table

- ✓ To create relationship between the tables

1.3. Relational databases

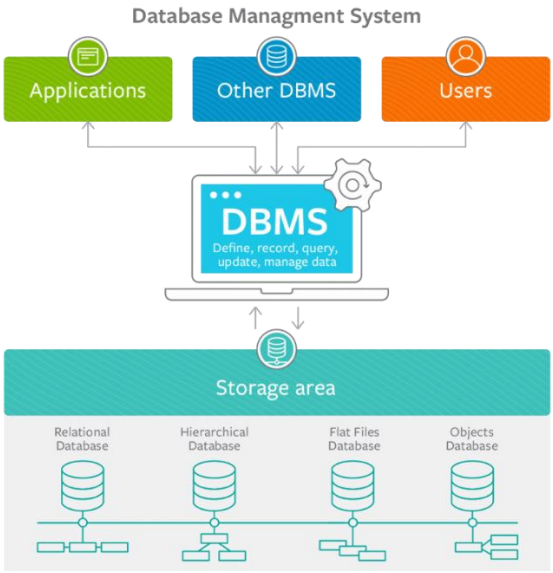


- A relational database is a type of database that stores and provides access to data points that are related to one another. Relational databases are based on the relational model, an intuitive, straightforward way of representing data in tables.

- In a relational database, each row in the table is a record with a unique ID called the key. The columns of the table hold attributes of the data, and each record usually has a value for each attribute, making it easy to establish the relationships among data points.

=> In conclusion, a relational database is a digital database based on the relational model of data (as proposed by E. F. Codd in 1970). In relational model, data is organized into tables. Relationship among tables defined by repeating column(s) from one in another table and these repeating columns are called "keys".

1.4. Database Management Systems (DBMS)



- A DBMS is a system for managing database. Is a software package designed to define, manipulate, retrieve and manage data in database. It generally manipulates the data itself, the data format,

field names, record structure and file structure. It also defines rules to validate and manipulate this data. DBMS also relieves users of framing programs for data maintenance.

- Existing DBMSs provide various functions that allow management of a database and its data which can be classified into four main functional groups:

- ✓ *Data definition*
- ✓ *Update*
- ✓ *Retrieval*
- ✓ *Administration*

- A DBMS always provides data independence. Any change in storage mechanism and formats are performed without modifying the entire application. There are four main types of database organization:

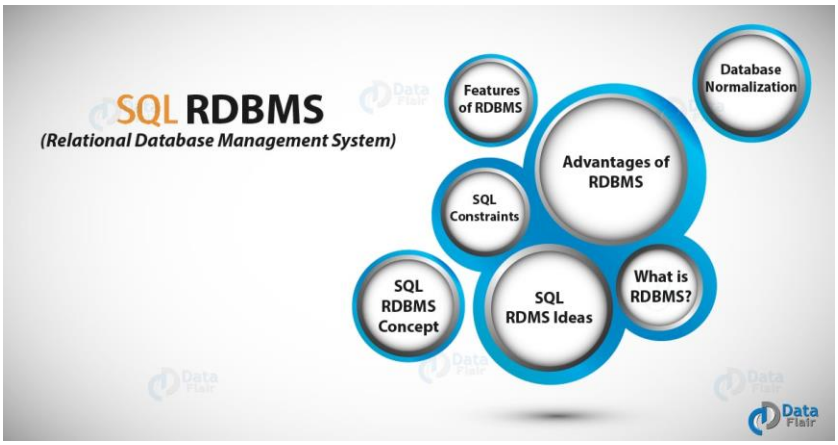
- ✓ *Relational Database*
- ✓ *Flat Database*
- ✓ *Object-Oriented Database*
- ✓ *Hierarchical Database.*

- Some other DBMS examples include:

- ✓ *MySQL*
- ✓ *SQL Server*
- ✓ *Oracle*
- ✓ *D-BASE*
- ✓ *FoxPro*

2. Introduction to RDBMS.

2.1. What is the RDBMS?



RDBMS stands for Relational Database Management System. RDBMS data is structured in database tables, fields and records. Each RDBMS table consists of database table rows. Each database table row consists of one or more database table fields. It stores the data into collection of tables, which might be related by common fields (database table columns). RDBMS also provide relational operators to manipulate the data stored into the database tables. Most RDBMS use SQL as database Query-language. The most popular RDBMS are MS SQL Server, DB2, Oracle and MySQL.

2.2. Popular RDBMSs:

2.2.1. Oracle:

2.2.1.1.Introductions:

Oracle Database (commonly referred to as Oracle RDBMS or simply as Oracle) is a proprietary multi-model database management system produced and marketed by Oracle Corporation. It is a database commonly used for running online transaction processing (OLTP), data warehousing (DW) and mixed (OLTP & DW) database workloads.

2.2.1.2.Features:

- ✓ SQL and PL/SQL Support
- ✓ Heterogeneous Replication
- ✓ Passthrough SQL

- ✓ Result Set Support
- ✓ Data Dictionary Translations
- ✓ Date-Time Data Types
- ✓ Two-Phase Commit Protocol
- ✓ Piecewise LONG Data Type
- ✓ SQL*Plus DESCRIBE Command
- ✓ Constraints on SQL in a Distributed Environment
- ✓ Oracle's Optimizer and Heterogeneous Services

2.2.1.3. Advantages:

- Reliable
- Has major advantages in terms of locking and concurrency.
- Lots of scope for tuning in that there are hundreds of tunable parameters.
- New versions of Oracle databases provide new features while keep the popular features from older versions.
- Used for practically all corporation level applications.
- Flashback Technology: allows for efficient recovery of data incorrectly deleted or lost.
- Portability: Oracle run on more than 100 hardware platforms and 20 networking protocols.
- Oracle is by far the largest RDBMS Vendor, and spends more on R&D than most of its competitors earn in total revenue. Oracle has the largest independent RDBMS market share in VMS, UNIX and OS/2 Server fields.
- Version Changes: Oracle informing you in detail as to what is not going to be supported in the next major release.

2.2.1.4. Disadvantages:

- Oracle complex or difficult to manage for certain activities.
- The price of Oracle usually changes over time.
- The cost of operating Oracle SQL big.

- Difficult to learn and difficult operate.

2.2.2. Microsoft SQL Server:

2.2.2.1.Introductions:

Microsoft SQL Server is a relational database management system developed by Microsoft. As a database server, it is a software product with the primary function of storing and retrieving data as requested by other software applications—which may run either on the same computer or on another computer across a network (including the Internet). Microsoft markets at least a dozen different editions of Microsoft SQL Server, aimed at different audiences and for workloads ranging from small single-machine applications to large Internet-facing applications with many concurrent users.

2.2.2.2.Features:

- ✓ No.1 in price and performance—with massive scale
- ✓ Highest performing data warehouses
- ✓ Least vulnerable database
- ✓ Mission-critical availability
- ✓ End-to-end mobile BI
- ✓ Built-in analytics
- ✓ Consistent experience

2.2.2.3.Advantages:

- Installation is streamlined
- Security features good

- Enhanced performance
- Low cost of ownership

2.2.2.4.Disadvantages:

- Expensive enterprise edition ($14,256 for a per-core license)
- Difficult licensing process that's always changing
- Complex performance tuning features
- No native support for source control

2.2.3. MySQL:

2.2.3.1.Introductions:

MySQL is open-source relational database management system (RDBMS). Is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses. Is a component of the LAMP web application software stack (and others), which is an acronym for Linux, Apache, MySQL, Perl/PHP/Python. MySQL is used by many database-driven web applications, including Drupal, Joomla, phpBB, and WordPress. MySQL is also used by many popular websites, including Facebook, Flickr, Media Wiki, Twitter, and YouTube.

2.2.3.2.Features:

- SSL support

- Query caching

- Built-in replication support

- Full-text indexing and searching

- Embedded database library

- Unicode support

- Partitioned tables with pruning of partitions in optimizer

- Shared-nothing clustering through MySQL Cluster

- Multiple storage engines, allowing one to choose the one that is most effective for each table in the application.

- Commit grouping, gathering multiple transactions from multiple connections together to increase the number of commits per second.

2.2.3.3.Advantages:

- Data Security good
- Have on-Demand Scalability
- High Performance
- Round-the-clock Uptime
- Comprehensive Transactional Support
- Complete Workflow Control
- Reduced Total Cost of Ownership
- The Flexibility of Open Source

2.2.3.4.Disadvantages:

- Does not support a very large database size as efficiently.
- Does not support ROLE, COMMIT, and Stored procedures in versions less than 5.0.
- Transactions are not handled very efficiently.
- There are a few stability issues.
- It suffers from poor performance scaling.
- The development is not community driven so it has lagged behind.
- The functionality tends to be heavily dependent on the addons.
- Developers may find some of its limitations very frustrating.

2.2.4. PostgreSQL:

2.2.4.1.Introductions:

[Source: (Postgresqltutorial.com, 2020)**]**

PostgreSQL, also known as Postgres, is a free and open-source relational database management system (RDBMS) emphasizing extensibility and technical standards compliance. It is designed to handle a range of workloads, from single machines to data warehouses or Web services with many concurrent users. It is the default database for macOS Server, and is also available for Linux, FreeBSD, OpenBSD, and Windows.

2.2.4.2.Features:

- PostgreSQL features transactions with Atomicity, Consistency, Isolation, Durability (ACID) properties, automatically updatable views, materialized views, triggers, foreign keys, and stored procedures.

- ✓ This supports the locking mechanism.
- ✓ It has high availability.
- ✓ It is free and open source software.
- ✓ This is ACID compliant.
- ✓ It has the capacity for fault tolerance.
- ✓ It also supports image, video, audio storage and also supports graphical data.
- ✓ It requires very low maintenance.
- ✓ It supports Multi-version concurrency control (MVCC).
- ✓ Recovery is high.

- ✓ It has user defined data-types.
- ✓ Table inheritance.
- ✓ It runs on all operating systems.

2.2.4.3.Advantages:

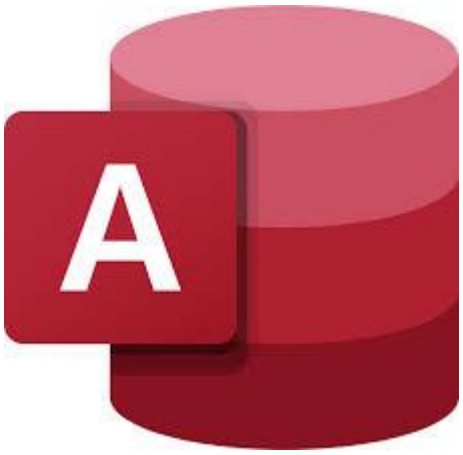
- Easy to use.
- Has user-defined data type.
- Open source.
- A lot of community support.
- Make use of Stored procedures.
- It supports ACID i.e. Atomicity, Consistency, Isolation, Durability.

2.2.4.4.Disadvantages:

- A lot of memory utilization.
- Not good performance.
- It is not much popular than other database management systems.
- Lack of skilled professionals.
- When it comes to speed PostgreSQL is not worthy as compared to other tools.
- Making replication is more complex.
- Installation is not easy for the beginner.

2.2.5. Access:

2.2.5.1.Introductions:



[Source: (Commons.wikimedia.org, 2020)**]**

Microsoft Access is a database management system (DBMS) from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It is a member of the Microsoft Office suite of applications, included in the Professional and higher editions or sold separately. Microsoft Access stores data in its own format based on the Access Jet Database Engine. It can also import or link directly to data stored in other applications and databases.

2.2.5.2.Features:

- ✓ Create tables, queries, forms and reports, and connect them together with macros. Use VBA to write rich solutions with advanced data manipulation and user control. Access also has report creation features that can work with any data source that Access can access.
- ✓ Microsoft Access offers parameterized queries. These queries and Access tables can be referenced from other programs like VB6 and .NET through DAO or ADO. From Microsoft Access, VBA can reference parameterized stored procedures via ADO.
- ✓ Access Services and Web database.
- ✓ Import or link sources.

2.2.5.3.Advantages:

- Data structure and normalization through multiple tables
- Scalability: adding more records is free
- Data and Referential Integrity
- Queries and Reports

- Automation through Macros and VBA Modules
- Table Structures and Validation databases make it easy to store information in one place and reference it in multiple places.
- Records are Free in Databases
- With Office/Excel automation, can open an existing Excel spreadsheet from Microsoft Access, and place data in specific cells, thereby automating the updates of the data there.

2.2.5.4.Disadvantages:

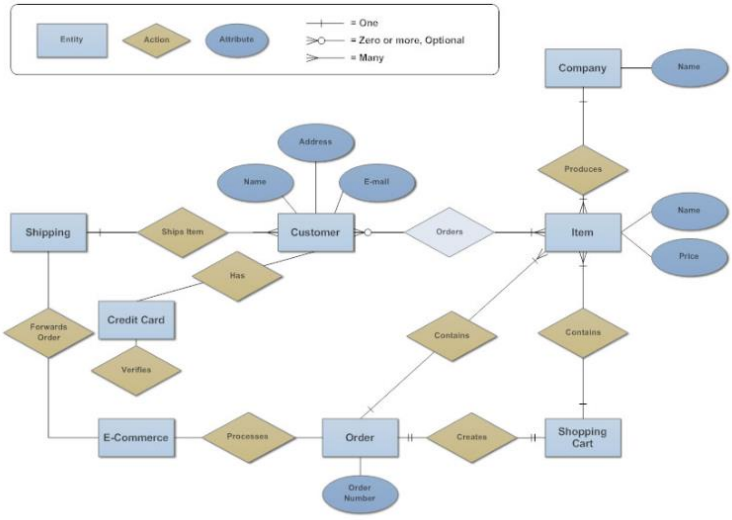
- Concurrent users limit
- Multiple Windows Operating Systems
- Novice User – Design and Development Limitations
- Sensitive Data Needs
- Internet Limitations
- Remote Access not good
- Unable to install Access on a Mac (Apple)

2.3. Select the specific RDBMS apply to given scenario.

Use Microsoft SQL Server for the scenario because it installs easily, reputable and good security. Performance and quality very good. Low cost of ownership. In addition, the excellent data recovery mechanism and contains many sophisticated features that allow you to recover data that has been lost or damaged.

3. Conceptual Database Design.

3.1. Entity Relationship Diagrams.



[Source: (Smartdraw.com, 2020)**]**

- An entity relationship diagram (ERD) is one common method of depicting entities and relationships in a diagram. ER diagram illustrates the logical structure of databases. Are used to sketch out the design of a database. Is a means of visualizing how the information a system produces related. There are five main components of an ERD.

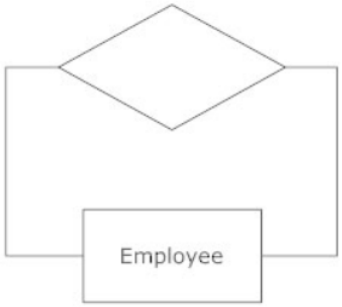
✓ *Entities.*

Which are represented by rectangles. An entity is an object or concept about which you want to store information.

A weak entity is an entity that must defined by a foreign key relationship with another entity as it cannot be uniquely identified by its own attributes alone.

✓ *Actions.*

Which are represented by diamond shapes, show how two entities share information in the database. In some cases, entities can be self-linked. For example, employees can supervise other employees.



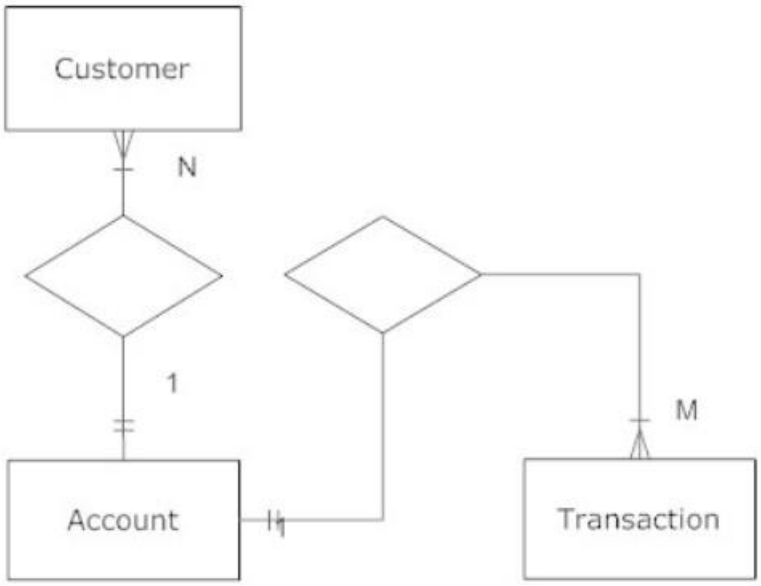
✓ *Attributes:* which are represented by ovals. A key attribute is the unique, distinguishing characteristic of the entity. For example, an employee's social security number might be the employee's key attribute.

A multivalued attribute can have more than one value. For example, an employee entity can have multiple skill values.

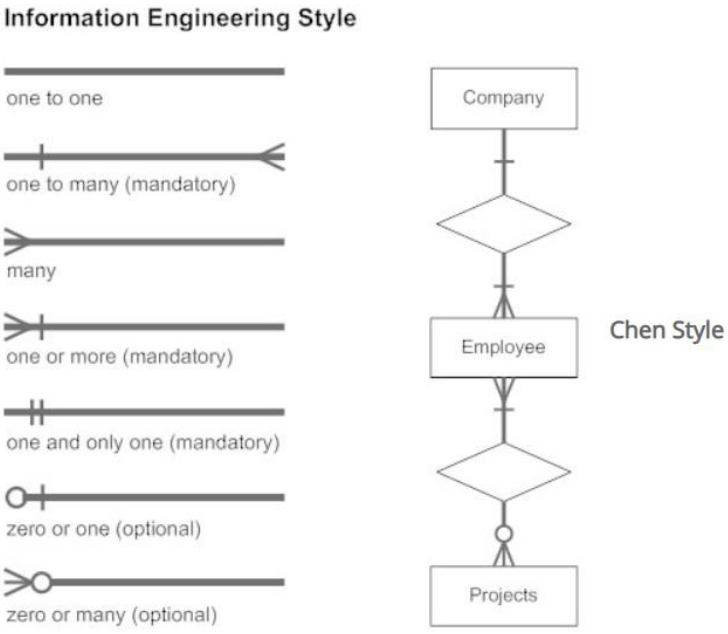
A derived attribute is based on another attribute. For example, an employee's monthly salary is based on the employee's annual salary.

✓ *Connecting lines:* solid lines that connect attributes to show the relationships of entities in the diagram.

✓ *Cardinality:* specifies how many instances of an entity relate to one instance of another entity. Ordinality is also closely linked to cardinality. While cardinality specifies the occurrences of a relationship, ordinality describes the relationship as either mandatory or optional. In other words, cardinality specifies the maximum number of relationships and ordinality specifies the absolute minimum number of relationships.



- There are many notation styles that express cardinality.



Chen Style

Ordinality - describes the minimum (optional vs mandatory)

M:N

Cardinality - describes the maximum

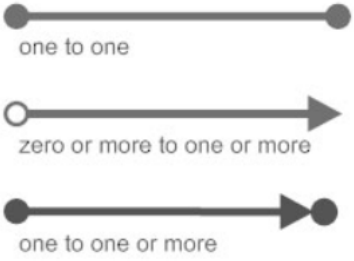
1:N (n=0,1,2,3...)
one to zero or more

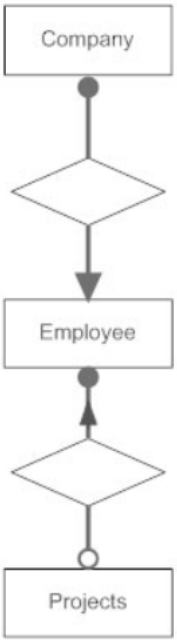
M:N (m and n=0,1,2,3...)
zero or more to zero or more
(many to many)

1:1
one to one

Bachman

Bachman Style





Martin Style

Martin Style

1 - one, and only one (mandatory)

* - many (zero or more - optional)

1...* - one or more (mandatory)

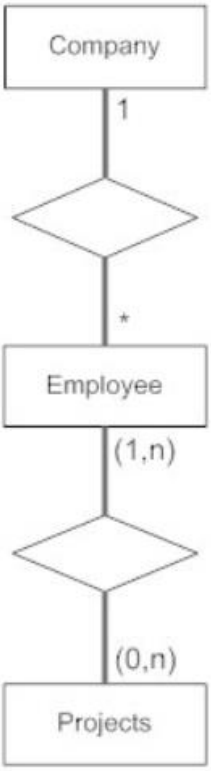
0...1 - zero or one (optional)

(0,1) - zero or one (optional)

(1,n) - one or more (mandatory)

(0,n) - zero or more (optional)

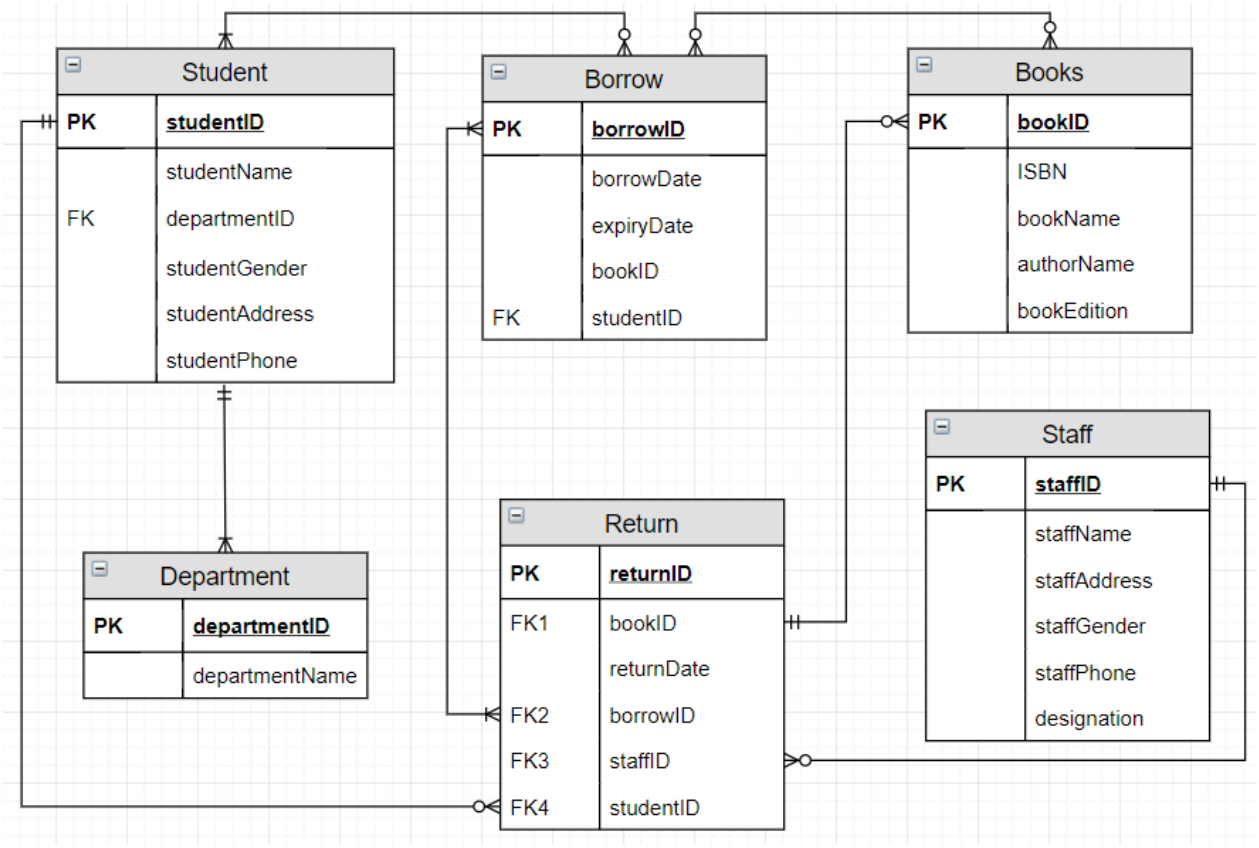
(1,1) - one and only one (mandatory)



3.2. Present the scenario.

Research and create a library management system at school to handle all transactions at the library. It must be suitable for use by small to medium sized libraries. It is used by library administrators and librarians to manage libraries using computer systems. Problems like file loss will not occur.

3.3. ERD for scenario.



Entity descriptions:

- ✓ Books: bookID, ISBN, bookName, authorName, bookEdition.
- ✓ Student: studentID, studentName, departmentID, studentAddress, studentGender, studentPhone.
- ✓ Staff: staffID, staffName, staffAddress, staffGender, staffPhone, designation.
- ✓ Department: departmentID, departmentName.
- ✓ Borrow: borrowID, borrowDate, expiryDate, bookID, studentID.
- ✓ Return: returnID, bookID, returnDate, borrowID, staffID, studentID.

M1 Produce a comprehensive design for a fully functional system which includes interface and output designs, data validations and data normalization.

1. Data validations and data normalization.

1.1. Data validations.

The library is home to many books and can be borrowed by anyone. The librarian is responsible for managing all bookkeeping and loan / repayment management. So, the data we need are: Staff,

student (or teacher) information, borrow / return information and books information. This information must be specific and accurate 100%.

1.2. Data normalization.

Database normalization is the process of eliminating redundant data in tables to improve storage efficiency, data integrity, and scalability. It usually involves splitting the existing tables into multiple table the table rejoin or link every time a query is given.

- First normal form: the given table is converted into 1NF as follows.
  - ✓ *Step 1: Remove the duplicate columns from table 1.*
  - ✓ *Step 2: Create separate tables for each group of related data and identify each row group with a unique column (primary key).*
- Second normal form: A table is in first normal form and each non-key field is functionally dependent upon primary key.
- Third normal form (3NF) requires that there are no functional dependencies of non-key attributes on something other than a candidate key. A table is in 3NF if all of the non-primary-key attributes- mutually independent. There should not be transitive depeinces.

Normalization of database tables in library system: (Some examples)

Before 1st data normalization:

borrowID	bookID	studentID
1122	110, 120, 320, 303	bitE183

=> In the Borrowed Table there is repeating books. A student has borrowed 4 books.

After 1st data normalization:

borrowID	bookID	studentID
1122	110	bitE183
1122	120	bitE183
1122	320	bitE183
1122	303	bitE183

Before 2nd data normalized:

In the following Student relation, all attributes are dependent on the primary key StudentID.

StudentID	Name	DepartmentID	borrowDate	exparyDate
BITf13E18	Azhar	20	17-6-15	1-7-15

After 2nd data normalized:

Can create two other relations from Student Table.

Table1

departmentID	departmentName
11	CS & IT Department
22	Education Department

Table2

StudentID	Name	borrowDate	exparyDate
BITf13E18	Azhar	17-6-15	1-7-15

Before 3rd data normalized:

studentID	Name	Gender	departmentID	Address	Phone	City

After 3rd data normalized:

Table1

studentID	departmentID	departmant
IT-113	C-26	Cs & IT
Lm-456	L-11	Law

Table2: Student contact table.

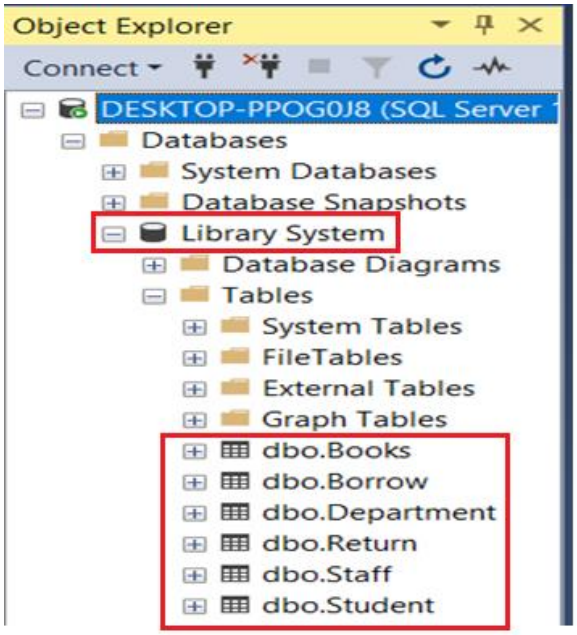
studentID	City	Phone	Address
IT-111	Sargodha	0331236547	Statlite Twon
Cs-786	Sargodha	0327162226	Statlite Twon

Table3: Student

sdtID	Name	Gender	sdtDepartment
IT-111	Mino	Female	CS & IT
Cs-786	Yoon	Female	Education

2. Interface and output designs.

ARCHITECTURE AND RECORD OF TABLES FOR LIBRARY SYSTEM IN SQL SERVER 2020



2.1. Table Book

Design view

	Column Name	Data Type	Allow Nulls
🔑	bookID	smallint	☐
	ISBN	smallint	☐
	bookName	nvarchar(MAX)	☐
	authorName	nvarchar(50)	☐
	bookEdition	nvarchar(50)	☐
			☐

Records

	bookID	ISBN	bookName	authorName	bookEdition
▶	1141	4151	Web Pentrat...	Azhar	First
	2567	5678	Linux Com...	Javed	Second
	4352	5652	Ethical Hack...	Ramzan	First
	5632	9875	Hack The N...	Mazhar	Third
*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*

2.2. Table borrows

Design view

	Column Name	Data Type	Allow Nulls
🔑	borrowID	smallint	☐
	borrowDate	nvarchar(50)	☐
	expiryDate	nvarchar(50)	☐
	bookID	smallint	☐
	studentID	smallint	☐
			☐

=> studentID is foreign key in borrow table.

Records

	borrowID	borrowDate	expiryDate	bookID	studentID
▶	1151	15-6-15	1-7-15	5689	183
*	NULL	NULL	NULL	NULL	NULL

2.3. Table student

Design view

DESKTOP-PPOG0J8.L...tem - dbo.Student | DESKTOP-PPOG0J8.L...tem - dbo.Student

	Column Name	Data Type	Allow Nulls
🔑	studentID	smallint	☐
	studentName	nvarchar(50)	☐
	departmentID	smallint	☐
	studentGender	nvarchar(50)	☐
	studentAddress	nvarchar(50)	☐
	studentPhone	nvarchar(50)	☐
			☐

=> departmentID is foreign key in student table

Records

	studentID	studentNa...	departmen...	studentGen...	studentAd...	studentPho...
	126	Ramzan	12	Male	Chack 18	3008136255
	154	Abdusamad	12	Male	Raza Town	3075408811
	183	Azhar Javaid	12	Male	Behria Town	3127400558
	1097	Tabish	16	Male	Block 12	3331234567
▶*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*

2.4. Table department table.

Design view

	Column Name	Data Type	Allow Nulls
▶🔑	lepartmentID	smallint	☐
	departmentName	nvarchar(MAX)	☐
			☐

Records

	departmen...	departmen...
▶	12	IT Departm...
	13	Physics
	14	Chemistry
	16	Commerce
	18	Business
	19	Economics
	21	Food Science
	22	English
	23	Math
	24	Islamic
	25	Urdu
	26	Education
*	*NULL*	*NULL*

2.5. Table return table

Design view

	Column Name	Data Type	Allow Nulls
🔑	returnID	smallint	☐
	bookID	smallint	☐
	returnDate	date	☐
	borrowID	smallint	☐
	staffID	nvarchar(50)	☐
	studentID	smallint	☐
			☐

=> Here bookID, borrowID, staffID, studentID are foreign keys

Records

	returnID	bookID	returnDate	borrowID	staffID	studentID
▶	5444	2589	2015-04-04	404	sf14	303
	5645	456	2015-09-03	2156	sf12	115
	5699	1122	2015-07-04	526	sf15	556
	5756	2654	2015-01-15	556	sf13	556
*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*

2.6. Table staff table.

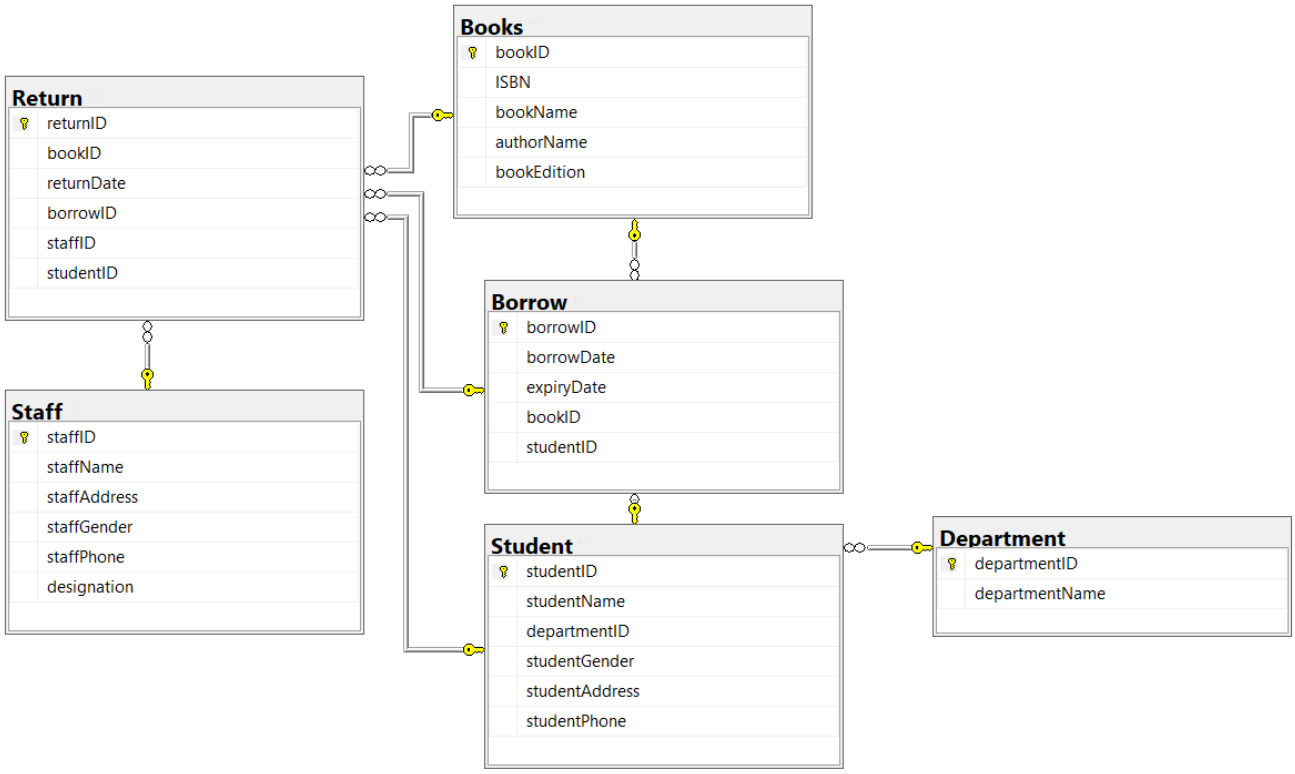
Design view

	Column Name	Data Type	Allow Nulls
🔑	staffID	nvarchar(50)	☐
	staffName	nchar(10)	☐
	staffAddress	nvarchar(50)	☐
	staffGender	nchar(10)	☐
	staffPhone	nvarchar(50)	☐
	designation	nchar(10)	☐
			☐

Records

	staffID	staffName	staffAddress	staffGender	staffPhone	designation
▶	sf12	Arshad	Block 4	Male	3001234567	Naibqasid
	sf15	Latif	Main City	Male	3121234567	Sweeper
	sf16	Irfan	Green Town	Male	3331234567	Bookkeeper
	sf17	Roqia	Raza Town	Femal	3461234567	Librairan
*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*	*NULL*

2.7. Entity relationship model in Microsoft SQL Server 2020



D1 Assess the effectiveness of the design in relation to user and system requirements.

- The library system help eliminates paperwork in the library. Instead, to record all transactions, the computer system will be used so issues like lost records are unlikely.

- Background of the project: Library management system is an application that references other library systems with normal (online) and it is suitable for use in small and medium libraries. The library system is used by librarians and staff to manage books and library transactions using a computer. The system is designed to help record everything.

- The design of the system is simple, easy to use and meets the requirements set out such as presenting and storing information clearly understandable, find information and data faster, etc.

- However, during the long-term operation, some new errors or needs may occur, so it is necessary to check, maintain and upgrade regularly.

REFERENCES

- En.wikipedia.org. (2020). *Database*. [online] Available at: https://en.wikipedia.org/wiki/Database [Accessed 21 Jan. 2020].
- W3schools. (2020). *Introduction to Database*. [online] Available at: https://www.w3schools.in/dbms/database/ [Accessed 21 Jan. 2020].
- Bjsitsolutions.blogspot.com. (2020). *What Is Databases?*. [online] Available at: http://bjsitsolutions.blogspot.com/2017/03/what-is-databases.html [Accessed 21 Jan. 2020].
- Tutorialspoint.com. (2020). *Types of databases*. [online] Available at: https://www.tutorialspoint.com/Types-of-databases [Accessed 22 Jan. 2020].
- Oracle.com. (2020). *What is a relational database?*. [online] Available at: https://www.oracle.com/database/what-is-a-relational-database/ [Accessed 22 Jan. 2020].
- Techopedia.com. (2020). *What is a Database Management System (DBMS)? - Definition from Techopedia*. [online] Available at: https://www.techopedia.com/definition/24361/database-management-systems-dbms [Accessed 22 Jan. 2020].
- En.wikipedia.org. (2020). *Database*. [online] Available at: https://en.wikipedia.org/wiki/Database [Accessed 22 Jan. 2020].
- Lifewire. (2020). *Relationships Are the Basis for Relational Databases*. [online] Available at: https://www.lifewire.com/database-relationships-p2-1019758 [Accessed 23 Jan. 2020].
- Rjspm.com. (2020). [online] Available at: http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf [Accessed 23 Jan. 2020].
- En.wikipedia.org. (2020). *Oracle Database*. [online] Available at: https://en.wikipedia.org/wiki/Oracle_Database#See_also [Accessed 23 Jan. 2020].
- SearchOracle. (2020). *What is Oracle? - Definition from WhatIs.com*. [online] Available at: https://searchoracle.techtarget.com/definition/Oracle [Accessed 23 Jan. 2020].
- Anon, (2020). [online] Available at: https://www.techwalla.com/articles/the-advantages-of-oracle-databases [Accessed 23 Jan. 2020].
- Erpgreat.com. (2020). *Advantage of Oracle Database*. [online] Available at: https://www.erpgreat.com/oracle-database/advantage-of-oracle-database.htm [Accessed 23 Jan. 2020].

- Reference. (2020). *What Are Some Advantages and Disadvantages of Oracle Database?*. [online] Available at: https://www.reference.com/world-view/advantages-disadvantages-oracle-database-dbec0904f3b40425 [Accessed 25 Jan. 2020].
- Symantec.com. (2020). *Oracle Definition, Functions, Advantages and Disadvantages | Symantec Connect*. [online] Available at: https://www.symantec.com/connect/articles/oracle-definition-functions-advantages-and-disadvantages [Accessed 25 Jan. 2020].
- Anon, (2020). [online] Available at: https://www.techwalla.com/articles/advantages-disadvantages-of-oracle-sql [Accessed 25 Jan. 2020].
- Forums.databasejournal.com. (2020). *Weaknesses/Disadvantages of Oracle?*. [online] Available at: http://forums.databasejournal.com/showthread.php?35009-Weaknesses-Disadvantages-of-Oracle [Accessed 25 Jan. 2020].
- En.wikipedia.org. (2020). *Microsoft SQL Server*. [online] Available at: https://en.wikipedia.org/wiki/Microsoft_SQL_Server [Accessed 26 Jan. 2020].
- En.wikipedia.org. (2020). *MySQL*. [online] Available at: https://en.wikipedia.org/wiki/MySQL [Accessed 28 Jan. 2020].
- En.wikipedia.org. (2020). *PostgreSQL*. [online] Available at: https://en.wikipedia.org/wiki/PostgreSQL [Accessed 28 Jan. 2020].
- En.wikipedia.org. (2020). *Microsoft Access*. [online] Available at: https://en.wikipedia.org/wiki/Microsoft_Access [Accessed 28 Jan. 2020].
- Smartdraw.com. (2020). *Entity Relationship Diagram (ERD) - What is an ER Diagram?*. [online] Available at: https://www.smartdraw.com/entity-relationship-diagram/ [Accessed 18 Feb. 2020].
- ByteScout. (2020). *MS SQL Server History and Advantages*. [online] Available at: https://bytescout.com/blog/2014/09/ms-sql-server-history-and-advantages.html [Accessed 18 Feb. 2020].
- Postgresqltutorial.com. (2020). *What is PostgreSQL*. [online] Available at: https://www.postgresqltutorial.com/what-is-postgresql/ [Accessed 21 Feb. 2020].