



**K. J. Somaiya College of Engineering, Mumbai-77**  
(Autonomous College Affiliated to University of Mumbai)

**Batch: A1      Roll No.: 1611011**

**Experiment No. 02**

**Grade: AA / AB / BB / BC / CC / CD / DD**

**Title:** Database Design and Implementation Process

**Objective:**

- Implement Database System Life Cycle.

**Expected Outcome of Experiment:**

**CO1:** Design and tune database.

**Books/ Journals/ Websites referred:**

1. Elmasri&Navathe“ fundamentals of Database Systems” V edition. PEARSON Education.
2. Korth, Silberschatzsudarshan “Database systems, concepts” 5<sup>th</sup> edition McGraw Hill.
3. Raghu Ramkrishnan& Johannes Gehrke “Database Management System” Tata McGraw Hill. III edition.

**Pre Lab/ Prior Concepts:**

Database System, ER diagram and Relation mapping, SQL



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**Case Study of large database system**

**Virtual Classroom:**

Online learning tool for Students.

Functionality:

1. A faculty creates course and uploads course contents to be available for enrolled students
2. A student can enroll in a course, view course details, access content
3. Faculty can create assignments and quiz based on the course
4. Student can answer quiz and upload answers to assignments
5. Student can interact and ask doubts to other students or faculty through discussion forum
6. System generates grade based on quiz answers and assignments graded by Faculty
7. Certificate is generated for successful completion of course



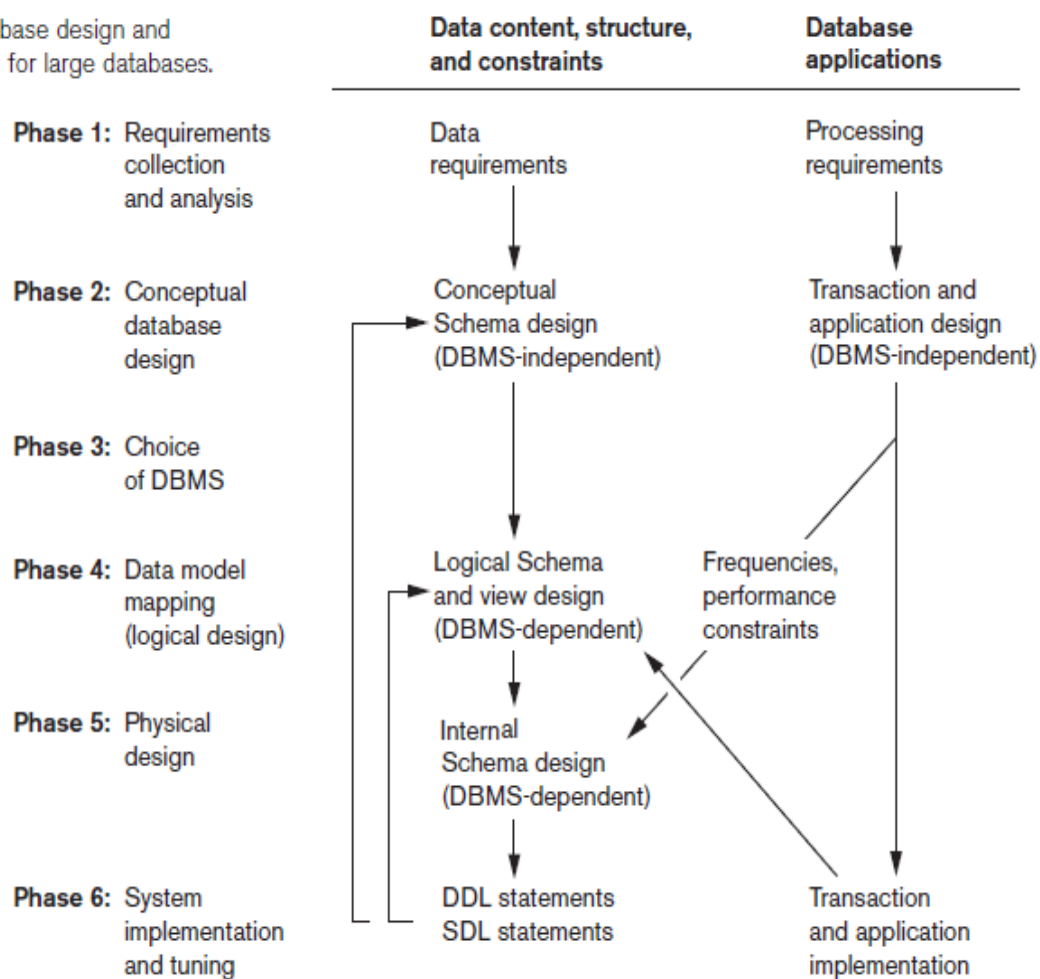
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## Database Design and Implementation System Life Cycle

### Phases w.r.t to case study

**Figure 10.1**

Phases of database design and implementation for large databases.



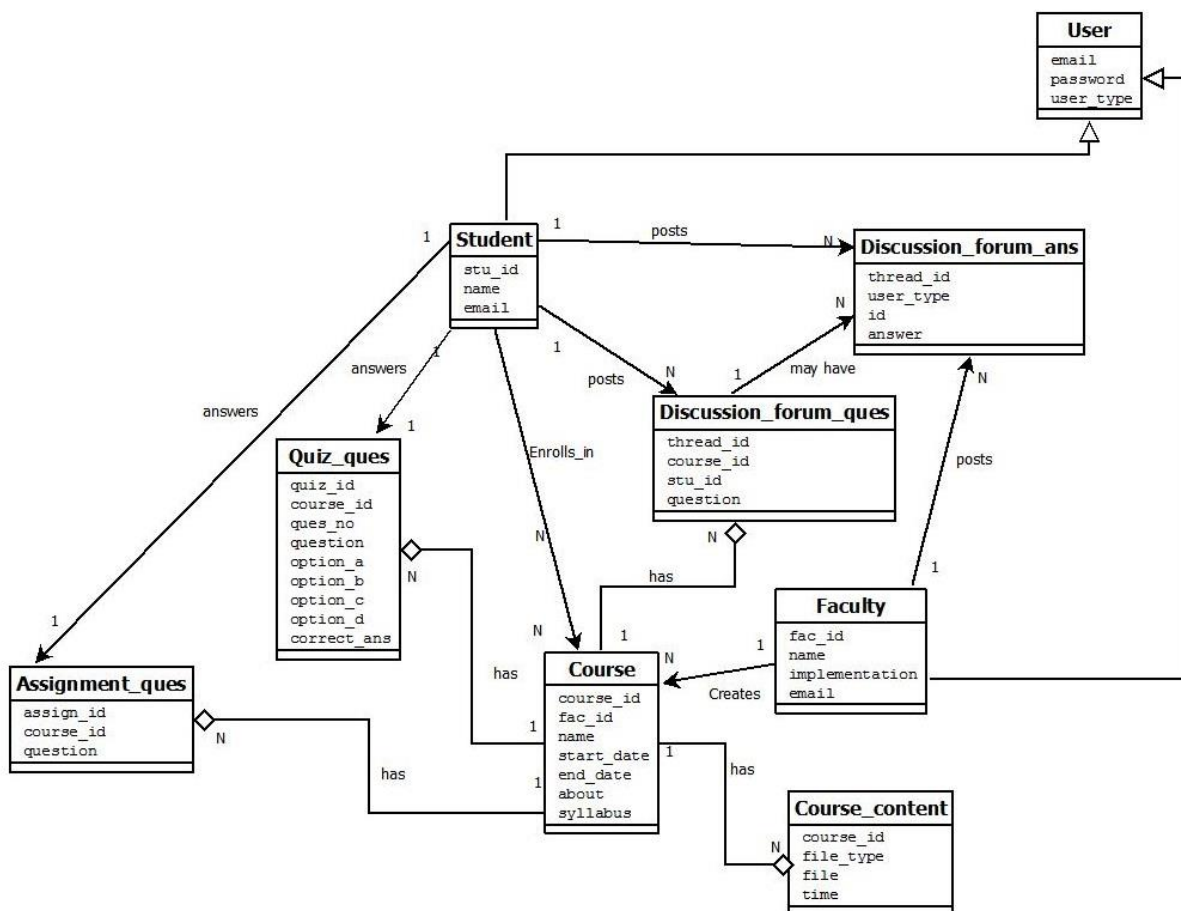


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**Implementation details**

1. Requirement Collection (Screenshots of UML Diagram)

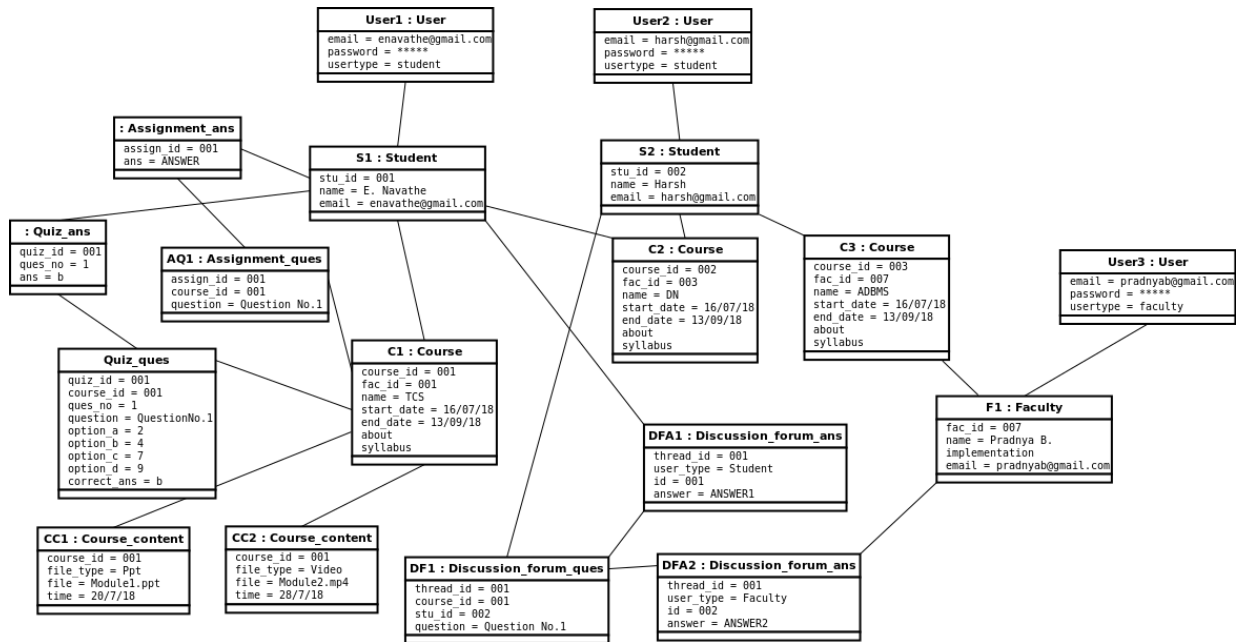
Class diagram:





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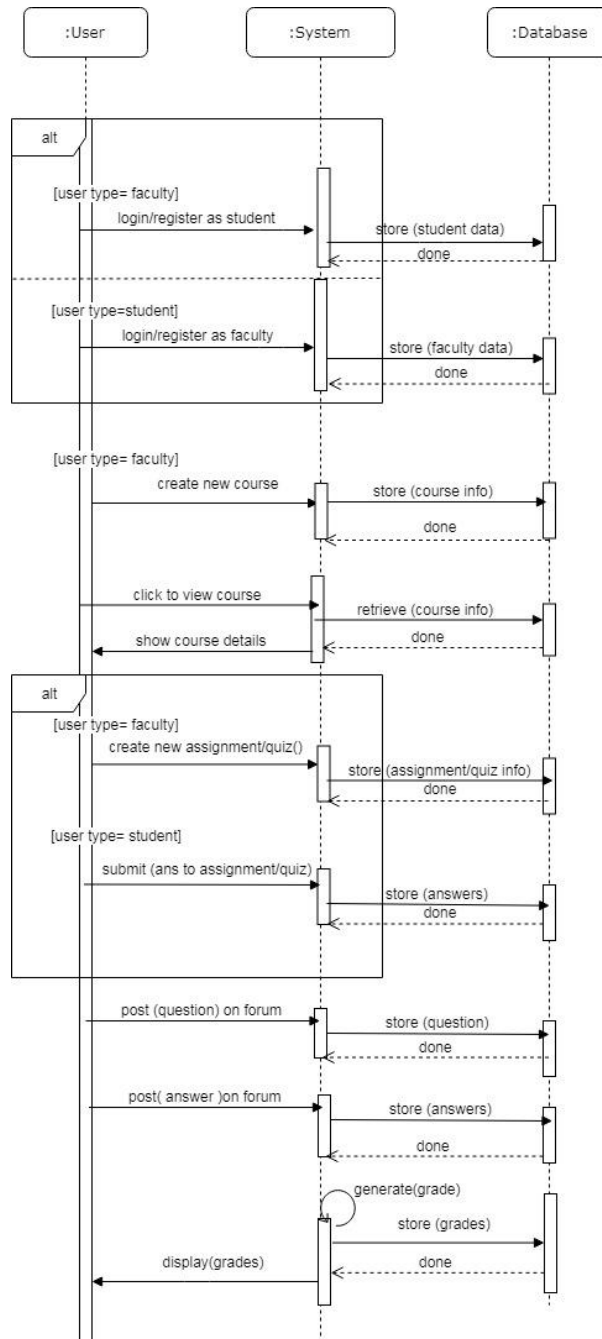
Object diagram:





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Sequence diagram:

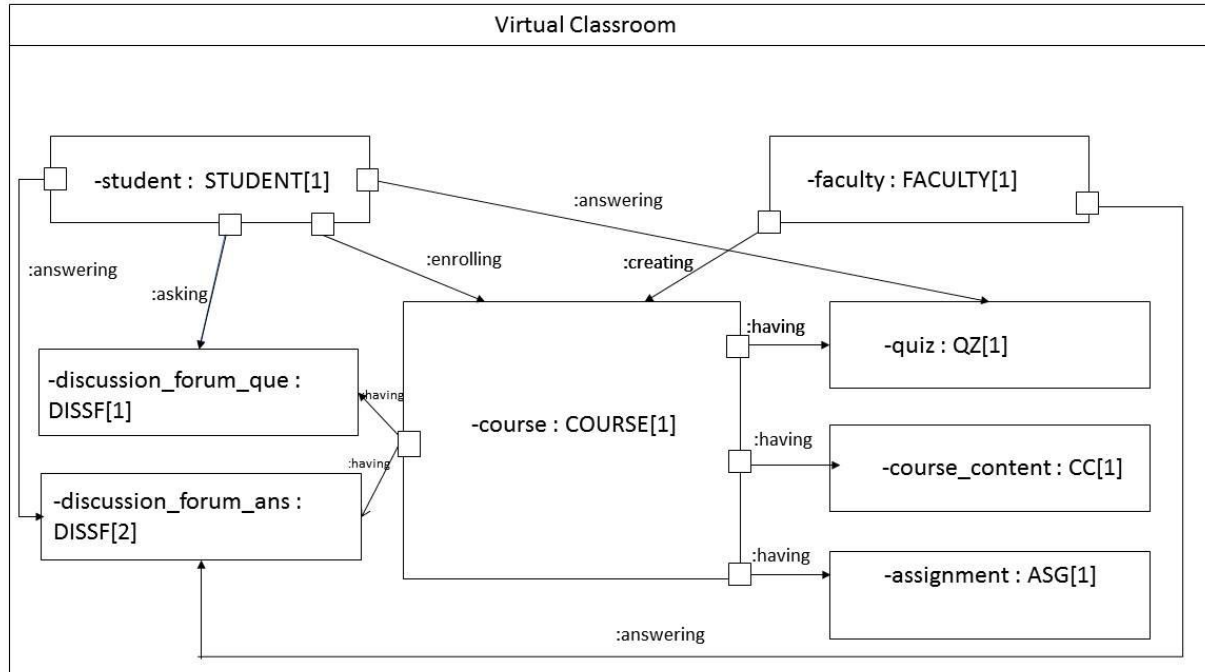




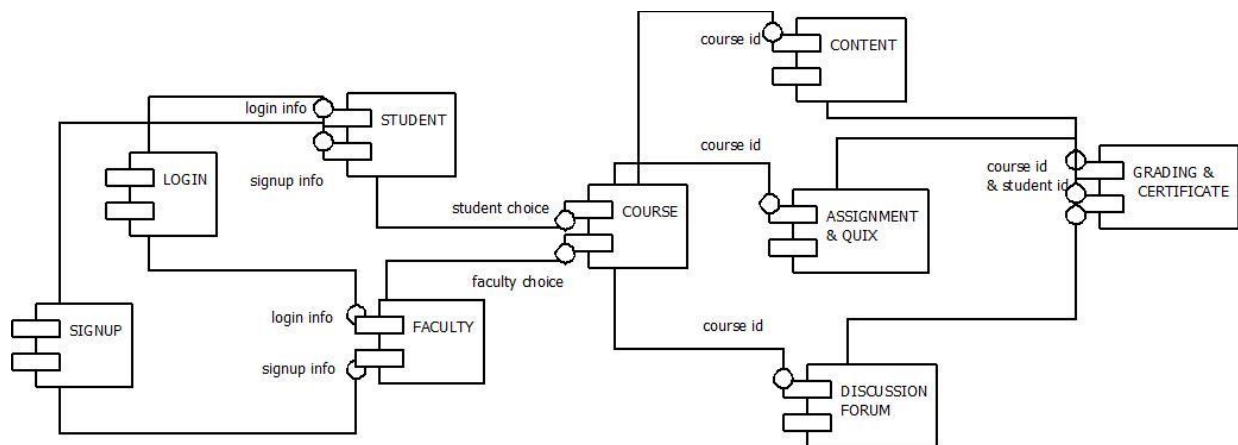
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Composite diagram:

Composite diagram:



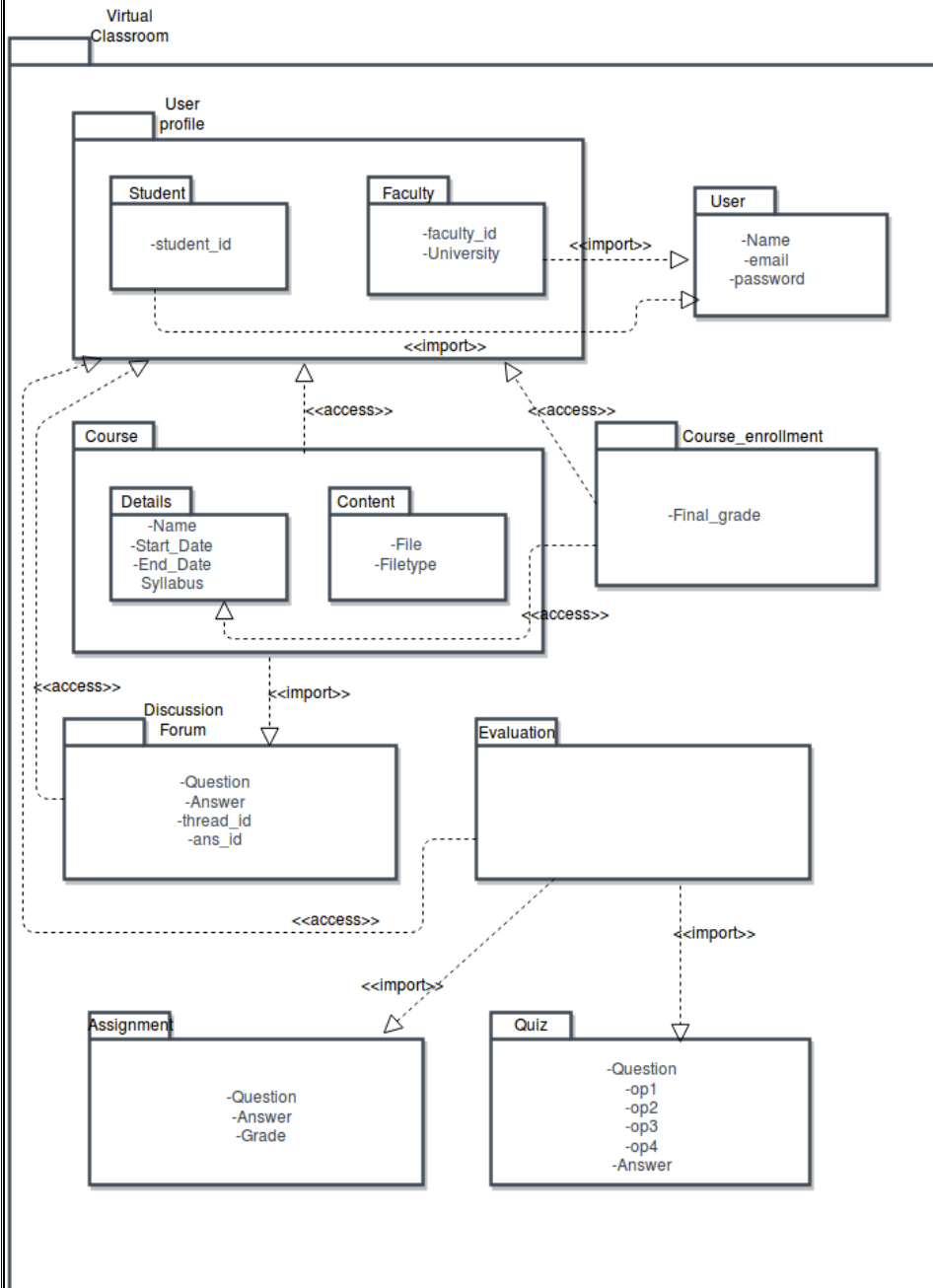
Component diagram:





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Package diagram:

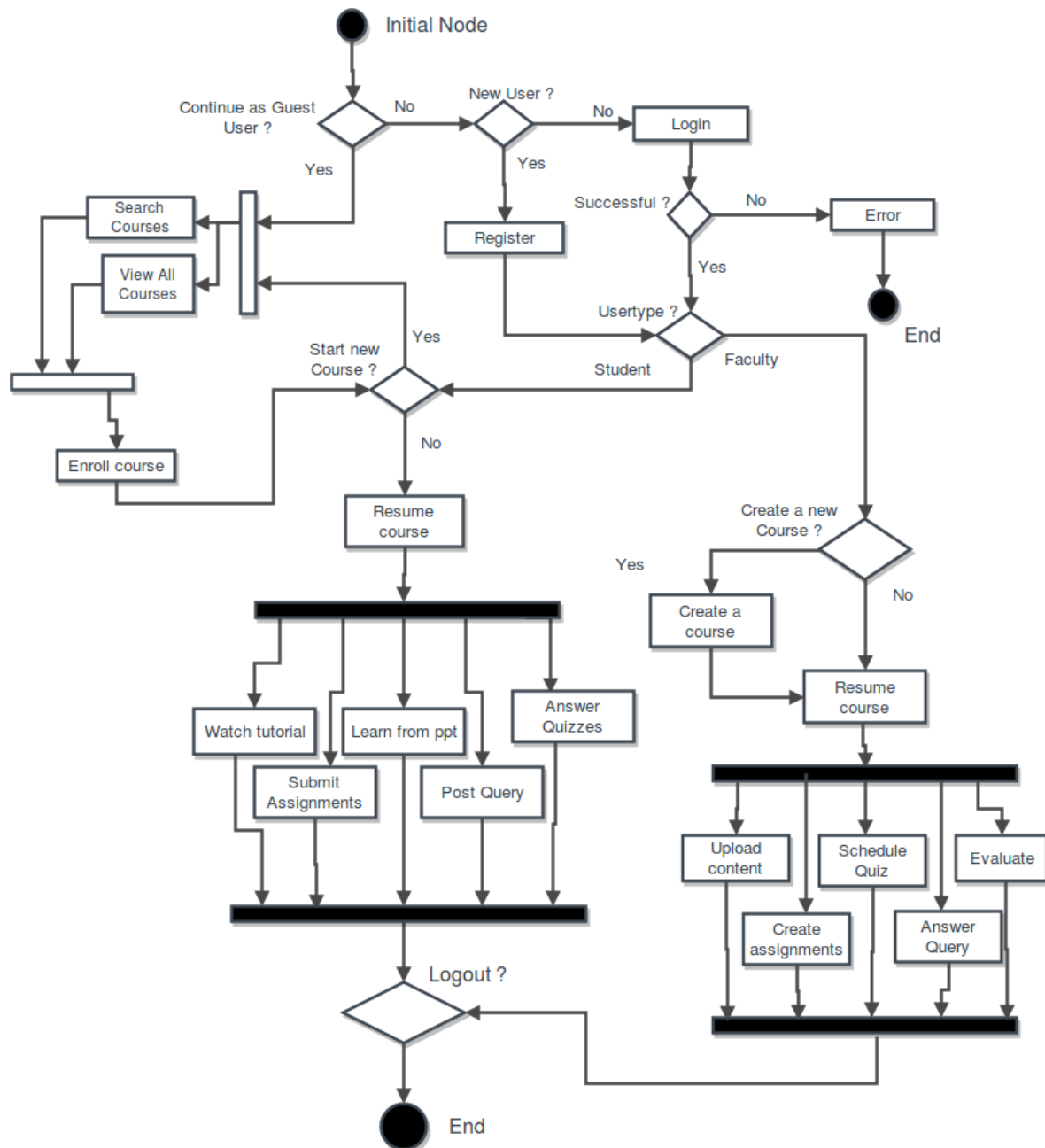






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Activity diagram:

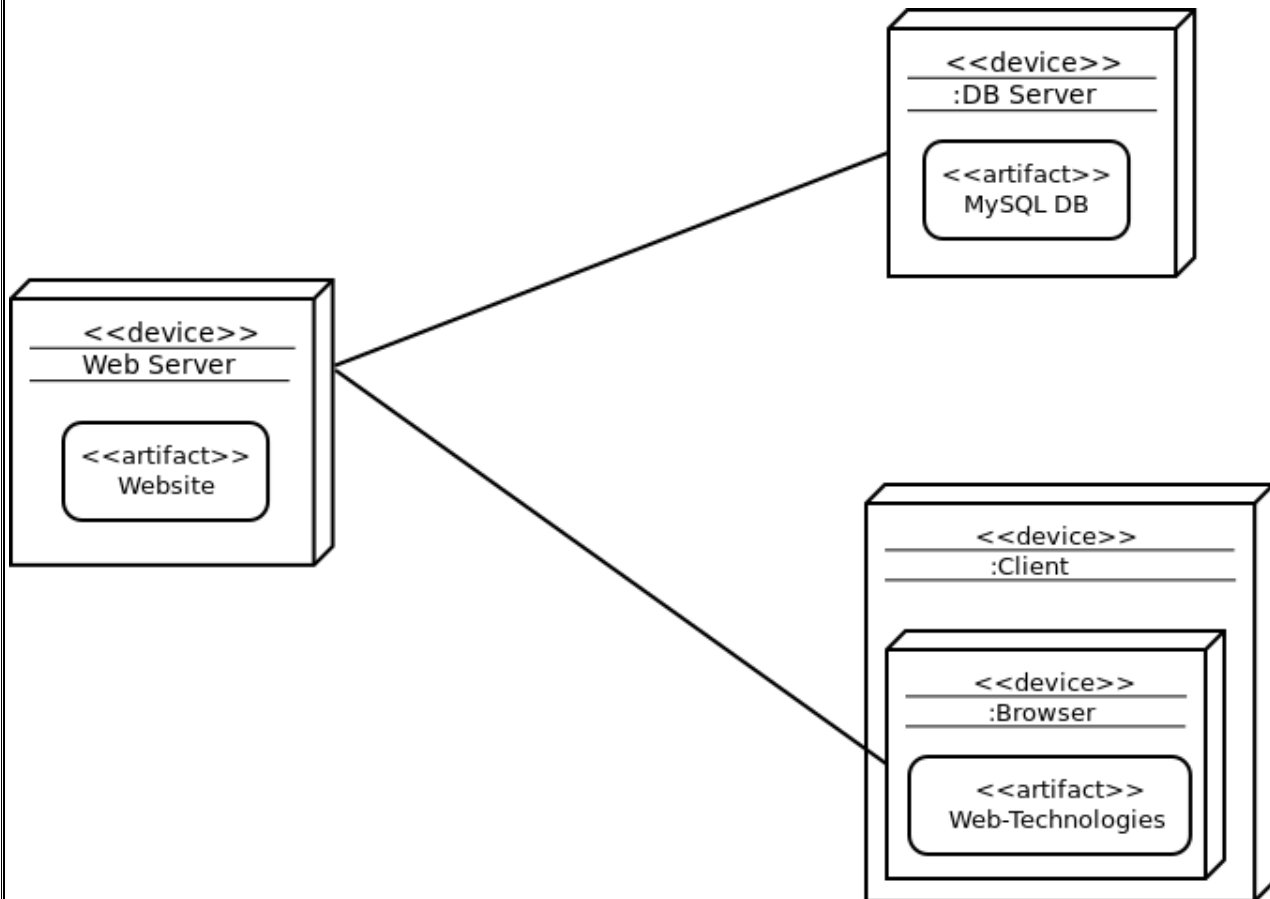




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Deployment diagram;

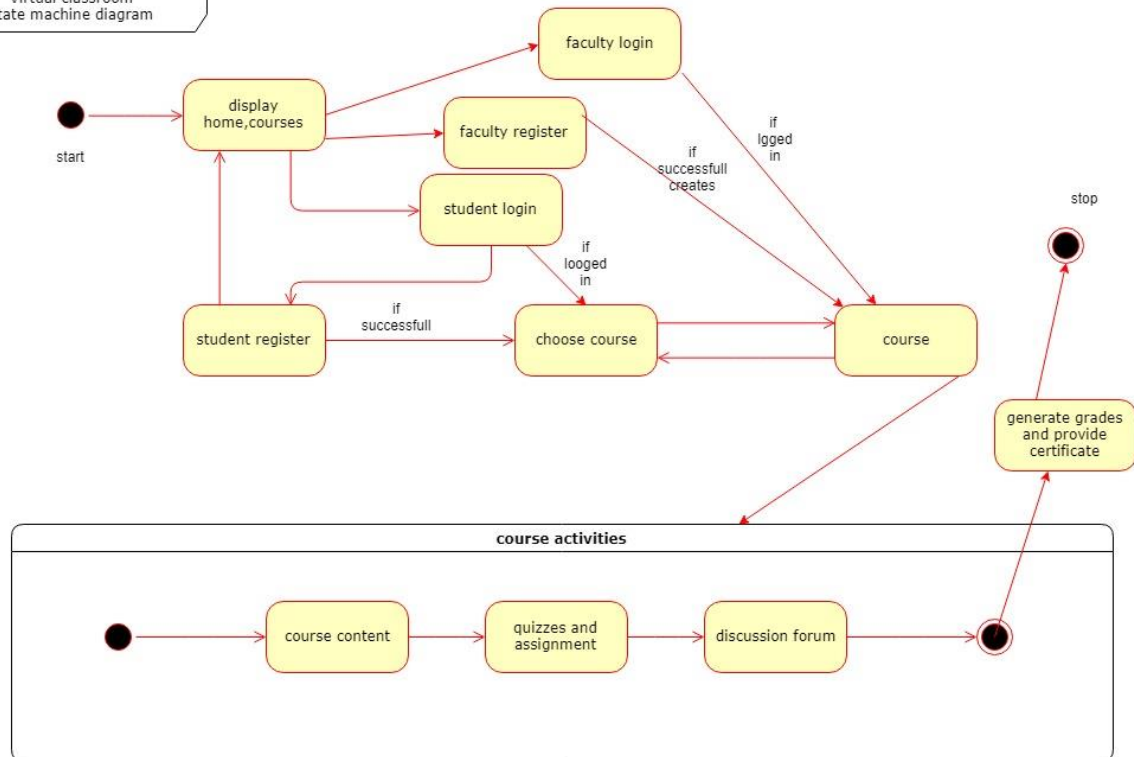


State machine diagram:



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Virtual classroom  
state machine diagram

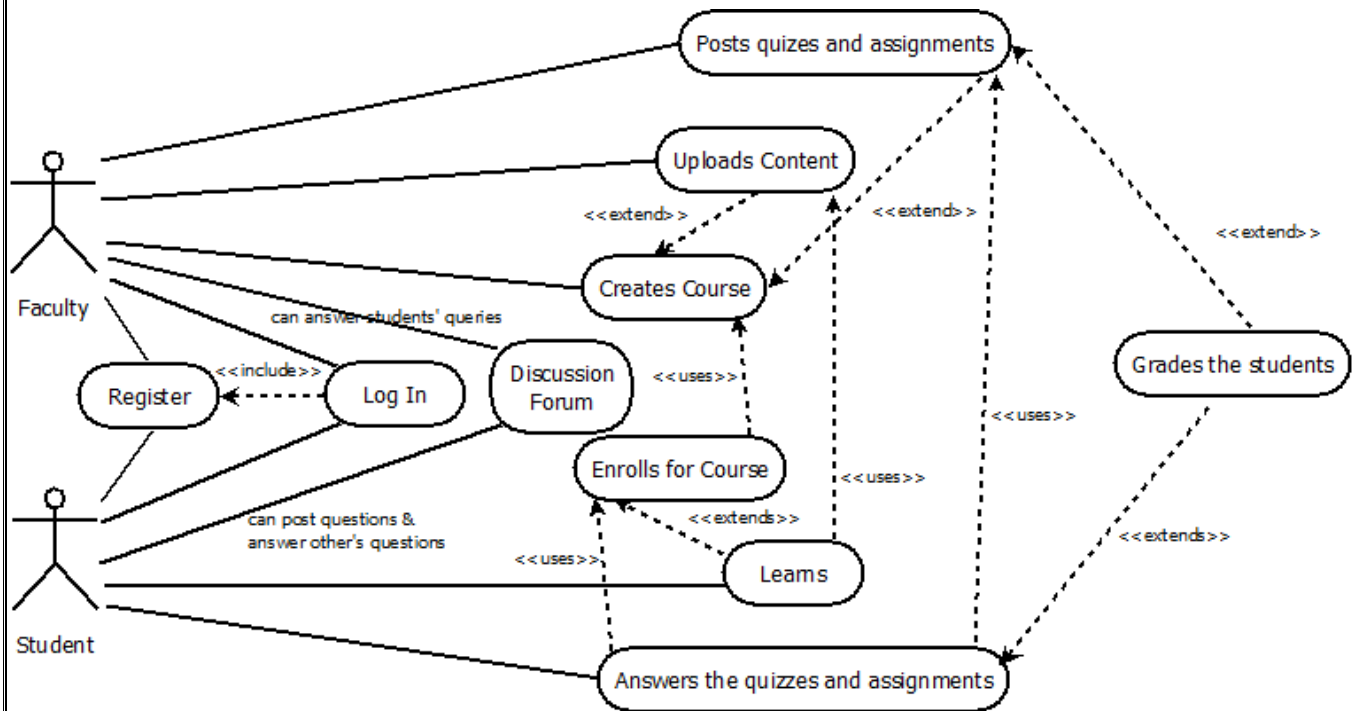


Text

Use case diagram:



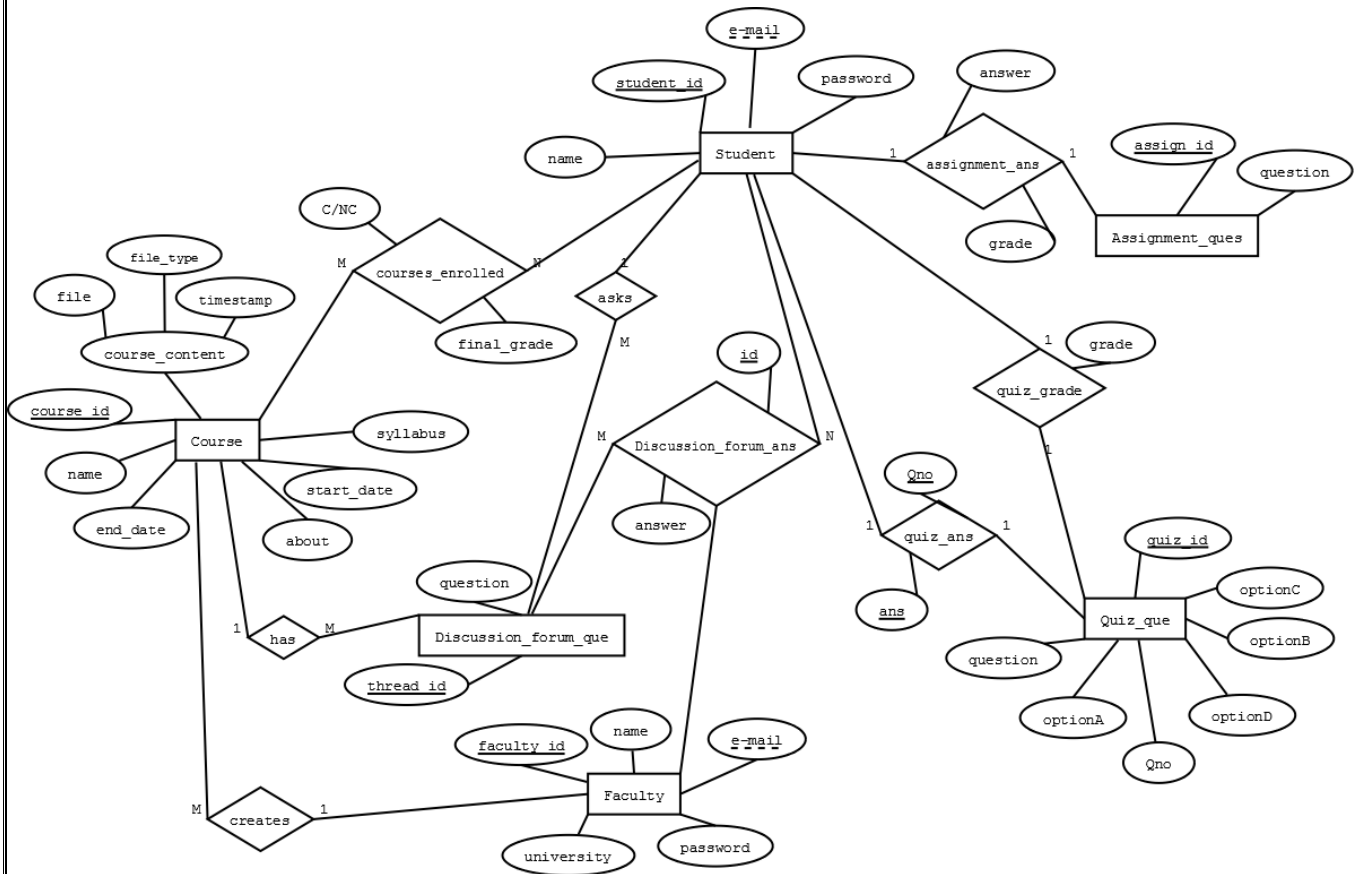
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2. Conceptual Database(Screenshots of EER)





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### 3. Relational Database(Screenshots)

#### **Relational Model (Virtual Classroom):**

Student :

<u>Student_id</u>	First_Name	Last_Name	email	password
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Faculty :

<u>Faculty_id</u>	First_Name	Last_Name	University	email	password
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Course :

<u>Course_id</u>	<u>Faculty_id</u>	Name	Start_Date	End_Date
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Course\_enrolled :

<u>Student_id</u>	<u>Course_id</u>	Completion_Status	Final_Grade
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Course\_Content :

<u>Course_id</u>	File	<u>TimeStamp</u>	File_Type
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Discussion\_Forum\_Question :

<u>Course_id</u>	<u>Student_id</u>	<u>Thread_id</u>	Question
------------------	-------------------	------------------	----------



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Discussion\_Forum\_Answer :

Course_id	Id	<u>Thread_id</u>	Answer	User_Type
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Assignment\_Question :

Course_id	<u>Assignment_id</u>	Question
-----------	----------------------	----------

Assignment\_Answer:

<u>Assignment_id</u>	Student_id	Answer	Grade
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Quiz\_Question :

<u>Course_id</u>	<u>Quiz_id</u>	<u>Question_no</u>	Question	Option_A	Option_B	Option_C	Option_D	Correct_Answer
------------------	----------------	--------------------	----------	----------	----------	----------	----------	----------------

Quiz\_Answer :

<u>Quiz_id</u>	<u>Course_id</u>	<u>Student_id</u>	<u>Question_no</u>	Answer
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Quiz\_Grade :

<u>Quiz_id</u>	<u>Student_id</u>	<u>Course_id</u>	Grade
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**Primary Keys :**



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Table	Foreign Key
Course	Faculty → Faculty_id
Course_enrolled	Student → Student_id, Course → Course_id
Course_Content	Course → Course_id
Discussion_forum_question	Course → Course_id, Student → Student_id
Discussion_forum_ans	Course → Course_id, Depending on value of attribute 'UserType' , 'id' becomes foreign key of Student or Faculty. Student → Student_id, Faculty → Faculty_id
Assignment_Question	Course → Course_id
Assignment_Answer	Assignment → Assignment_id, Student → Student_id
Quiz_Question	Course → Course_id
Quiz_Answer	Student → Student_id, Quiz → Quiz_id, Course → Course_id
Quiz_Grade	Student → Student_id, Quiz → Quiz_id, Course → Course_id

### 4. Physical Database(Screenshots of database tables)

Physical Tables Implementation:





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← Server: 127.0.0.1 » Database: brainfirst » Table: student										
Browse Structure SQL Search Insert Export Import Privileges Operations Tr										
Table structure Relation view										
#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action	
<input type="checkbox"/>	1 student_id	int(11)			No	None		AUTO_INCREMENT	Change	Drop  More
<input type="checkbox"/>	2 student_fname	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	3 student_lname	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	4 email	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More

← Server: 127.0.0.1 » Database: brainfirst » Table: faculty										
Browse Structure SQL Search Insert Export Import Privileges Operations Tr										
Table structure Relation view										
#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action	
<input type="checkbox"/>	1 faculty_id	int(11)			No	None		AUTO_INCREMENT	Change	Drop  More
<input type="checkbox"/>	2 faculty_fname	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	3 faculty_lname	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	4 email	varchar(50)	latin1_swedish_ci		No	None			Change	Drop  More

← Server: 127.0.0.1 » Database: brainfirst » Table: course										
Browse Structure SQL Search Insert Export Import Privileges Operations Tracki										
Table structure Relation view										
#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action	
<input type="checkbox"/>	1 course_id	int(11)			No	None		AUTO_INCREMENT	Change	Drop  More
<input type="checkbox"/>	2 faculty_id	int(11)			No	None			Change	Drop  More
<input type="checkbox"/>	3 course_name	varchar(100)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	4 start_date	date			No	None			Change	Drop  More
<input type="checkbox"/>	5 end_date	date			No	None			Change	Drop  More
<input type="checkbox"/>	6 about	varchar(1000)	latin1_swedish_ci		No	None			Change	Drop  More
<input type="checkbox"/>	7 syllabus	blob			No	None			Change	Drop  More



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Server: 127.0.0.1 » Database: brainfirst » Table: course\_enrolled

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 student_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2 course_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3 whether_completed	varchar(4)	latin1_swedish_ci		Yes	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4 grade	varchar(5)	latin1_swedish_ci		Yes	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>

Server: 127.0.0.1 » Database: brainfirst » Table: course\_content

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 course_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2 file	longblob			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3 time	timestamp			No	CURRENT_TIMESTAMP			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4 file_type	varchar(10)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>

Server: 127.0.0.1 » Database: brainfirst » Table: discussion\_forum\_ques

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 course_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2 student_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3 thread_id	int(11)			No	None	AUTO_INCREMENT		<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4 question	varchar(500)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>



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Server: 127.0.0.1 » Database: brainfirst » Table: discussion\_forum\_ans

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1	course_id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2	thread_id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3	user_type	varchar(10)	latin1_swedish_ci	No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4	id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	5	answer	text	latin1_swedish_ci	No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>

Server: 127.0.0.1 » Database: brainfirst » Table: assignment\_ques

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1	course_id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2	assignment_id	int(11)		No	None		AUTO_INCREMENT	<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3	question	longblob		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>

Server: 127.0.0.1 » Database: brainfirst » Table: assignment\_ans

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1	student_id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2	assignment_id	int(11)		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3	answer	longblob		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4	grade	varchar(10)	latin1_swedish_ci	Yes	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>



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Server: 127.0.0.1 » Database: brainfirst » Table: quiz\_ques

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 course_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2 quiz_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3 ques_num	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4 question	varchar(200)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	5 option_a	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	6 option_b	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	7 option_c	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	8 option_d	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	9 correct_answer	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>

Server: 127.0.0.1 » Database: brainfirst » Table: quiz\_ans

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[Table structure](#) [Relation view](#)

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/>	1 student_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	2 course_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	3 quiz_id	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	4 ques_num	int(11)			No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>
<input type="checkbox"/>	5 answer	varchar(50)	latin1_swedish_ci		No	None			<a href="#">Change</a> <a href="#">Drop</a> <a href="#">More</a>



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Server: 127.0.0.1 » Database: brainfirst » Table: quiz\_grade

Browser Structure SQL Search Insert Export Import Privileges Operations

Table structure Relation view

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
<input type="checkbox"/> 1	course_id	int(11)			No	None			Change  Drop  More
<input type="checkbox"/> 2	student_id	int(11)			No	None			Change  Drop  More
<input type="checkbox"/> 3	quiz_id	int(11)			No	None			Change  Drop  More
<input type="checkbox"/> 4	grade	varchar(10)	latin1_swedish_ci		Yes	None			Change  Drop  More

### Conclusion:

Design and implementation of database was done successfully.

### Post Lab Descriptive Questions:

1. What are the strategies used schema design

Ans:

Following are strategies used in schema design:

- i) Naming conventions:

- a) Avoid using just ID as the PK of each table. It will lead to lots of aliasing when joining other tables and returning multiple IDs from several tables.



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- b) Beware of using SQL Server reserved words (User, Date, etc.) in table names, column names and elsewhere. Use of a reserved word will give a syntax error unless you specify [square brackets] around the value, making development slower and the statements longer.
- c) Don't use hyphens, spaces, quotes, etc. Because they will be invalid or require [square brackets]. e.g. SELECT [category-id] FROM [custom-category]
- d) Name the tables in the singular, not plural. For example, name the table Customer and Order rather than Customers and Orders. It is obvious that a table contains multiple customers and hopefully not a single row, so the plurality is somewhat redundant and may introduce inconsistency issues with some table names.

ii) Using proper constraints:

Constraints such as required fields, unique values, allowed values, etc., at the database level can perform additional validation to ensure the integrity of the data. These checks should not be the only place where validation occurs. Validation should be baked into the front end application as well. If the application catches a validation issue, a “pretty” error can be displayed to the end user.

2. What are the strategies used for View Integration explain w.r.t your case study

Ans:

View integration used in our table is N-ary integration for as multiple user schemas merge into one. Views are used in our case study to show only the required tables as per the user type. Like, assignment answer of students shouldn't be viewed by other students but only the faculty.



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3. Why it is important to design the schema and applications in Parallel w.r.t. database applications and data contents?

Ans:

Database design coordinates with the actual view of the database in the system and how it is going to look on the server side. Making factual views of database in the form of various diagrams mentioned above is a process of database design. This is an equally important step apart from implementation because it simplifies the efforts and confusions created while actual implementation. Database implementation is actual database creation on the physical level with the help of database querying languages like SQL or MongoDB. For implementing the database one needs to have a clear view of the system he/she is going to build thus database implementation and design should go hand in hand. When the system is live and we need to add some transactions or constraints onto the database, we again need to make the changes in the physical view.

**Date: 28/08/18**