VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

School of Computer Science and Engineering

Fall Semester 2024-25

Continuous Assessment Test – I

SLOT: A2+TA2

Programme Name & Branch: B.Tech CSE

Course Name & Code: Database Systems, BCSE302L

Class Number (s): VL2024250101691, 1603, 1736, 1554, 1683, 1560, 1549, 1649, 1539, 1716, 1522, 1533, 1616, 1704, 1511, 1727, 1569, 1666, 1545, 1528, 1581

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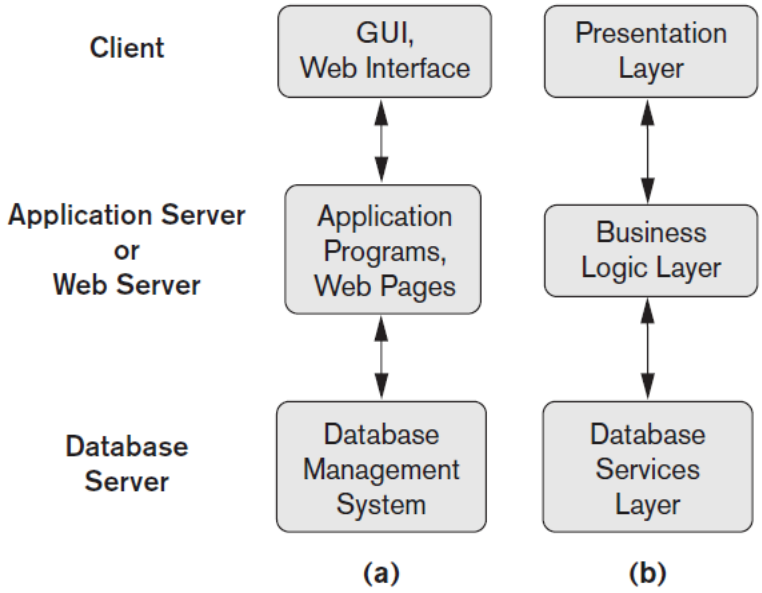
Exam Duration: 90 Min. **Maximum Marks: 50**

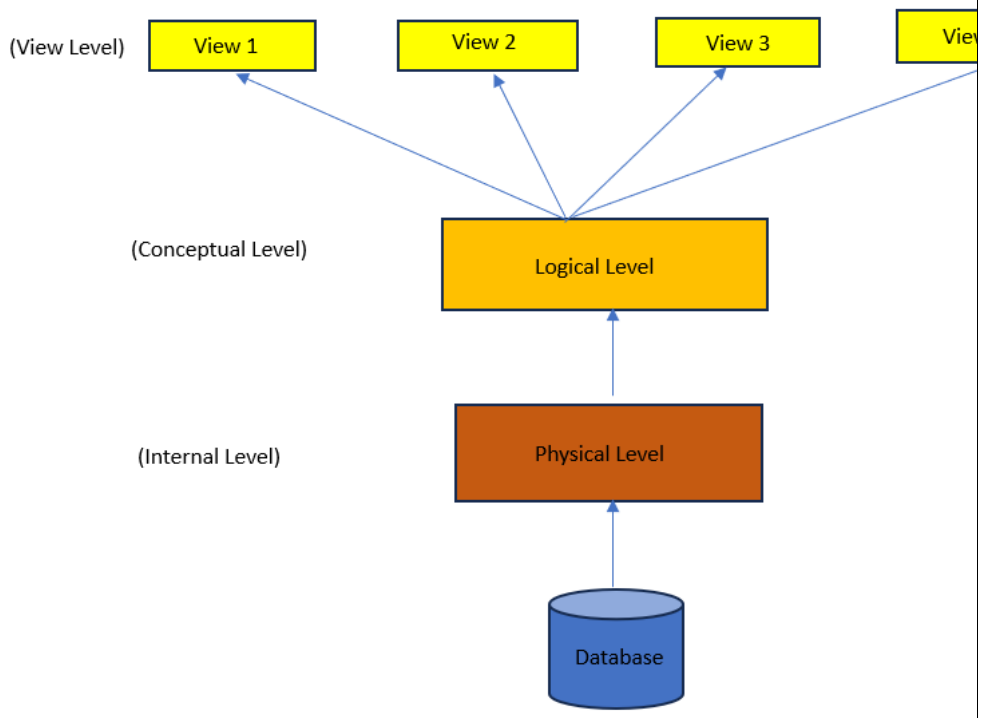
General instruction(s):

Specify if any printed material may be permitted

Any other specific instruction

Q. No.	Question	Max Marks	CO	BL
1a.	Discuss the main characteristics of the database approach and how it differs from traditional file systems. Ans: In traditional **file processing**, each user defines and implements the files needed for a specific software application as part of programming the application. This redundancy in defining and storing data results in wasted storage space and in redundant efforts to maintain common up-to-date data. In the database approach, a single repository maintains data that is defined once and then accessed by various users repeatedly through queries, transactions, and application programs. The main characteristics of the database approach versus the file-processing approach are the following: ■ Self-describing nature of a database system ■ Insulation between programs and data, and data abstraction ■ Support of multiple views of the data ■ Sharing of data and multiuser transaction processing	5	CO1	BL2

b.	If you were designing a Web-based system to make railway reservations and sell railway tickets, which DBMS architecture would you choose? Why? Why would the other architectures not be a good choice? Ans: Three-Tier Client/Server Architecture for Web Application is the best choice. The Client consists of Web User Interface. The Web Server contains the application logic which includes all the rules and regulations related to the reservation process and the issue of tickets; the Database Server contains the DBMS.  Centralized DBMS Architecture would not work since the user interface and database server are on different machines for a web-based system. Basic Client/Server Architecture and Two-Tier Client/Server Architecture would work if the Business Logic can reside on server other than the DBMS Server. In general, if the business logic was on the DBMS Server, it will put an excessive burden on the server. If the business logic were to reside on the web client, it will burden the communication network as well a possibly thin client.	5	CO1	BL2
2.a.	What is Data Abstraction? Explain about different views of data. Ans. Data Abstraction is one of the most important concepts in DBMS. Data abstraction is the process of hiding unwanted and irrelevant details from the end user. It helps to store information in such a way that the end user can access data which is necessary, the user will not be able to see what data is stored or how it is stored in a database. Data abstraction helps to keep data secure from unauthorized access and it hides all the implementation details. **Levels of Abstraction in DBMS** There are three levels of data abstraction in DBMS that are mentioned below.	5	CO1	BL2



Data Abstraction levels in DBMS

- Physical or internal level
- logical or conceptual level
- view or external level

So lets see about each level in detail, first we will physical level.

Physical or Internal Level

It is the lowest level of data abstraction which defines how data is stored in database . It defines data structures used to store data and methods to access data in database. It is very complex to understand and hence kept hidden from user. Database administrator decides how and where to store the data in database.

Physical level deals with actual storage details like data organization, disk space allocation and data access methods.

Logical or Conceptual Level

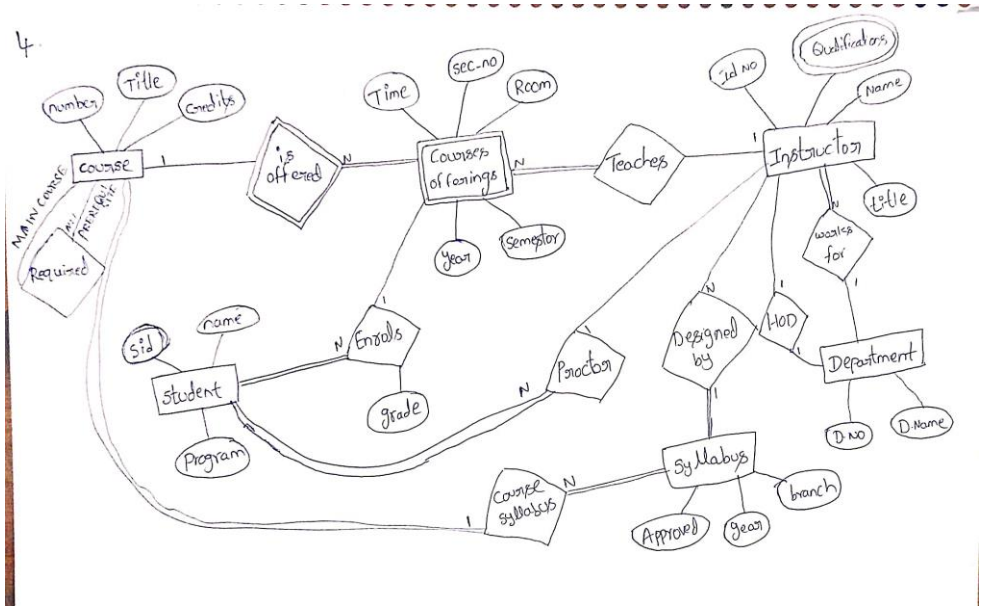
It is intermediate level present next to physical level. It defines what data is present in database and their relationships between them . It is less complex as compared to physical level. Programmers generally work at this level and depending on data, structure of tables, relationships and their constraints is decided at this level.

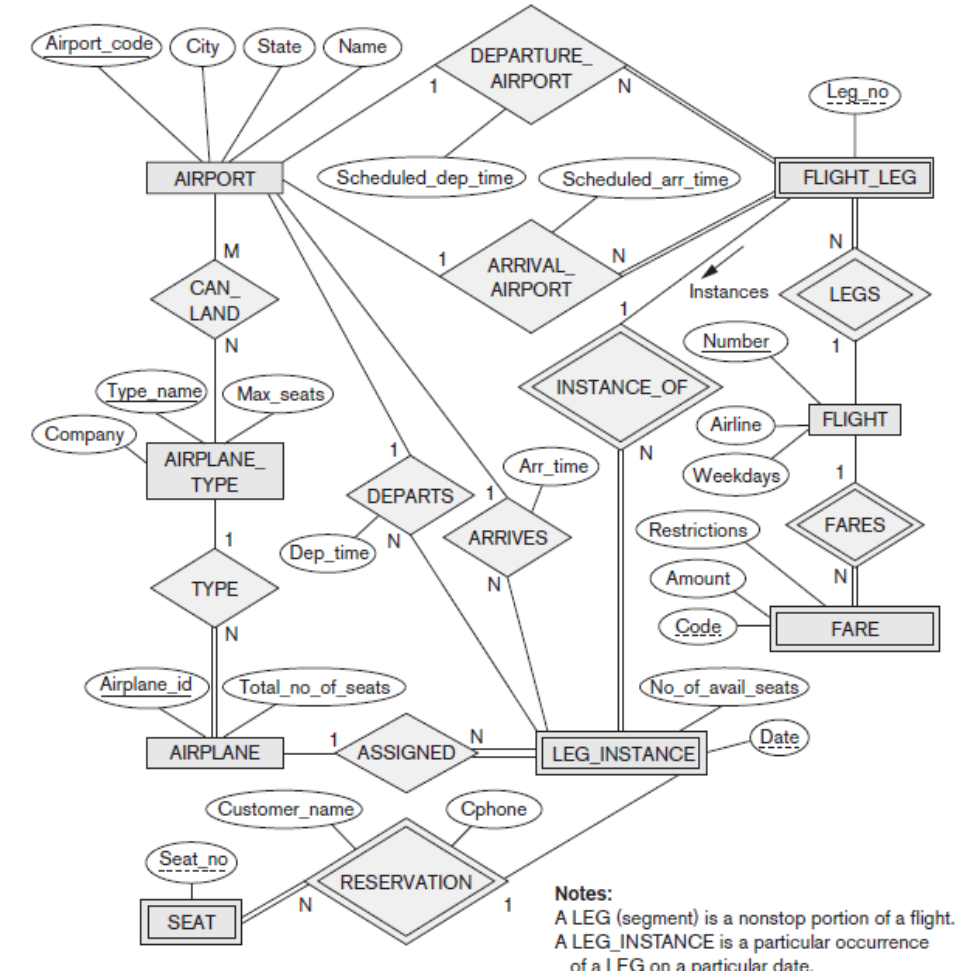
View or External Level

	It is the highest level in abstraction. There are different levels of views and each view defines only a part of whole data required to user. This level defines many views of same database for sim0lication of view to user. This is the highest level and easiest to understand for user.			

b.	List the types of Database users and discuss the roles of DBA.
	Ans.
	
	Database users can be divided into the following types −
	• End Users
	  ○ Naive users / Parametric users
	  ○ Sophisticated users
	• Application Programmer or Specialized users or Back-End Developer
	• System Analyst
	• Database Administrator (DBA)
	• Temporary Users or Casual Users
	1. Database Administrator (DBA)
	A Database Administrator (DBA) is a person/team who defines the schema and also controls the 3 levels of the database. The DBA will then create a new account ID and password for the user if he/she needs to access the database. DBA is also responsible for providing security to the database and he allows only authorized users to access/modify the database. DBA is responsible for problems such as security breaches and poor system response time.
	• DBA also monitors the recovery and backup and provides technical support.
	• The DBA has a DBA account in the DBMS which is called a system or superuser account.
	• DBA repairs damage caused due to hardware and/or software failures.
	• DBA is the one having privileges to perform DCL (Data Control Language) operations such as GRANT and REVOKE, to allow/restrict a particular user from accessing the database.
	2. Naive / Parametric End Users
	Parametric End Users are the unsophisticated who don't have any DBMS knowledge but they frequently use the database applications in their daily life to get the desired results. For example, Railway's ticket booking users are naive users. Clerks in any bank is a naive user because they don't have any DBMS knowledge but they still use the database and perform their given task.
	3. A System Analyst
		5	CO1	BL2

	A system Analyst is a user who analyzes the requirements of parametric end users. They check whether all the requirements of end users are satisfied. **4. Sophisticated Users** Sophisticated users can be engineers, scientists, business analyst, who are familiar with the database. They can develop their own database applications according to their requirement. They don't write the program code but they interact the database by writing SQL queries directly through the query processor. **5. Database Designers** Data Base Designers are the users who design the structure of database which includes tables, indexes, views, triggers, stored procedures and constraints which are usually enforced before the database is created or populated with data. He/she controls what data must be stored and how the data items to be related. It is the responsibility of Database Designers to understand the requirements of different user groups and then create a design which satisfies the need of all the user groups. **6. Application Programmers** Application Programmers also referred as System Analysts or simply Software Engineers, are the back-end programmers who writes the code for the application programs. They are the computer professionals. These programs could be written in Programming languages such as Visual Basic, Developer, C, FORTRAN, COBOL etc. Application programmers design, debug, test, and maintain set of programs called "canned transactions" for the Naive (parametric) users in order to interact with database. **7. Casual Users / Temporary Users** Casual Users are the users who occasionally use/access the database but each time when they access the database they require the new information, for example, Middle or higher level manager. **8. Specialized users** Specialized users are sophisticated users who write specialized database application that does not fit into the traditional data-processing framework. Among these applications are computer aided-design systems, knowledge-base and expert systems etc.			
3.	A university registrar's office maintains data about the following entities: (a) courses, with attributes including number, title, credits, syllabus, and prerequisites; (b) course offerings, is to model year, semester, section number, timings, and classroom; (c) students, with attributes student-id, name, and program; (d) instructors, with attributes identification number, name, department, qualifications and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled in must be appropriately modelled. Each student has exactly one instructor as a proctor. A proctor is a professor/instructor who proctors zero or more	10	CO2	BL3

	students. One or more courses are offered by an instructor and one or more students register for a course offered by an instructor. A course can have zero or more prerequisites. The qualifications of an instructor can be many. One of the instructors is a HOD for a department. Also, the syllabus for each course is designed by one or more faculty members who are instructors. Construct an E-R diagram for the registrar's office as per the specifications. Document all other assumptions that you make about the mapping constraints (cardinality ratios). Ans.  			
4.	Map the given ER model to a relational schema. Identify and represent all the Constraints.	10	CO2	BL4


Airport_code
City
State
Name
DEPARTURE_ AIRPORT
1
N
Leg_no
AIRPORT
Scheduled_dep_time
Scheduled_arr_time
FLIGHT_LEG
1
ARRIVAL_ AIRPORT
N
N
M
CAN_ LAND
Instances
LEGS
1
N
1
Number
INSTANCE_OF
Type_name
Max_seats
Company
AIRPLANE_ TYPE
Airline
FLIGHT
N
Weekdays
1
1
DEPARTS
Arr_time
1
Restrictions
FARES
Dep_time
N
ARRIVES
1
TYPE
Amount
N
N
Code
FARE
N
Airplane_id
Total_no_of_seats
No_of_avail_seats
AIRPLANE
1
ASSIGNED
N
LEG_INSTANCE
Date
Customer_name
Cphone
Seat_no
RESERVATION
SEAT
N
1
Notes:
A LEG (segment) is a nonstop portion of a flight.
A LEG_INSTANCE is a particular occurrence
of a LEG on a particular date.

Ans:

AIRPORT

Airport_code	Name	City	State

FLIGHT

Flight_number	Airline	Weekdays

FLIGHT_LEG

Flight_number	Leg_number	Departure_airport_code	Scheduled_departure_time
		Arrival_airport_code	Scheduled_arrival_time

LEG_INSTANCE

Flight_number	Leg_number	Date	Number_of_available_seats	Airplane_id
		Departure_airport_code	Departure_time	Arrival_airport_code	Arrival_time

FARE

Flight_number	Fare_code	Amount	Restrictions

AIRPLANE_TYPE

Airplane_type_name	Max_seats	Company

CAN_LAND

Airplane_type_name	Airport_code

AIRPLANE

Airplane_id	Total_number_of_seats	Airplane_type

SEAT_RESERVATION

Flight_number	Leg_number	Date	Seat_number	Customer_name	Customer_phone

Each FLIGHT is identified by a Flight_number, and consists of one or more FLIGHT_LEGs with Leg_numbers 1, 2, 3, and so on.
Each FLIGHT_LEG has scheduled arrival and departure times, airports, and one or more LEG_INSTANCEs—one for each Date on which the flight travels.
FAREs are kept for each FLIGHT. For each FLIGHT_LEG instance, SEAT_RESERVATIONs are kept, as are the AIRPLANE used on the leg and the actual arrival and departure times and airports.
An AIRPLANE is identified by an Airplane_id and is of a particular AIRPLANE_TYPE. CAN_LAND relates AIRPLANE_TYPEs to the AIRPORTs at which they can land.
An AIRPORT is identified by an Airport_code.

5. Examine the table shown below. — 7

staffNo	*branchNo*	*branchAddress*	*name*	*position*	*hoursPerWeek*
S4555	B002	City Center Plaza, Seattle, WA 98122	Ellen Layman	Assistant	16
S4555	B004	16 – 14th Avenue, Seattle, WA 98128	Ellen Layman	Assistant	9
S4612	B002	City Center Plaza, Seattle, WA 98122	Dave Sinclair	Assistant	14
S4612	B004	16 – 14th Avenue, Seattle, WA 98128	Dave Sinclair	Assistant	10

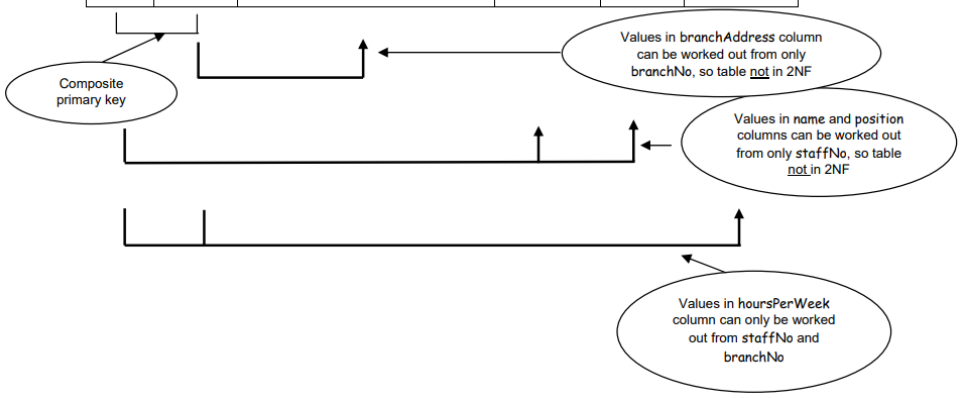
(a) Why is this table not in 2NF? (b) Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).

Ans.

Answer:

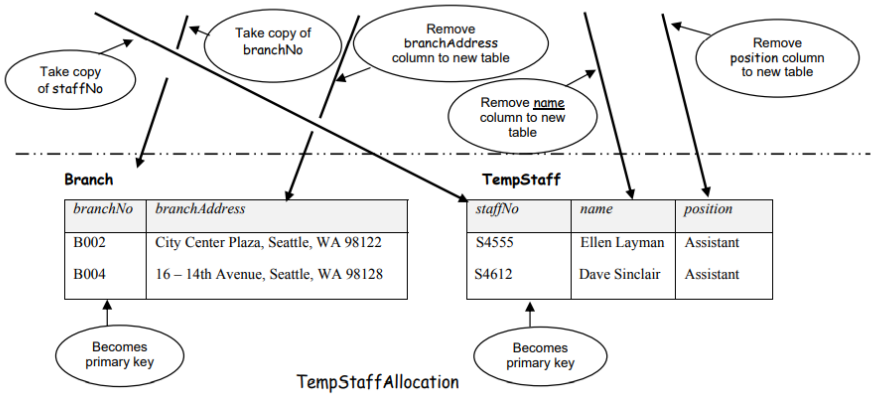
TempStaffAllocation

staffNo	*branchNo*	*branchAddress*	*name*	*position*	*hoursPerWeek*
S4555	B002	City Center Plaza, Seattle, WA 98122	Ellen Layman	Assistant	16
S4555	B004	16 – 14th Avenue, Seattle, WA 98128	Ellen Layman	Assistant	9
S4612	B002	City Center Plaza, Seattle, WA 98122	Dave Sinclair	Assistant	14
S4612	B004	16 – 14th Avenue, Seattle, WA 98128	Dave Sinclair	Assistant	10



TempStaffAllocation

staffNo	*branchNo*	*branchAddress*	*name*	*position*	*hoursPerWeek*
S4555	B002	City Center Plaza, Seattle, WA 98122	Ellen Layman	Assistant	16
S4555	B004	16 – 14th Avenue, Seattle, WA 98128	Ellen Layman	Assistant	9
S4612	B002	City Center Plaza, Seattle, WA 98122	Dave Sinclair	Assistant	14
S4612	B004	16 – 14th Avenue, Seattle, WA 98128	Dave Sinclair	Assistant	10



Branch

branchNo	*branchAddress*
B002	City Center Plaza, Seattle, WA 98122
B004	16 – 14th Avenue, Seattle, WA 98128

TempStaff

staffNo	*name*	*position*
S4555	Ellen Layman	Assistant
S4612	Dave Sinclair	Assistant

TempStaffAllocation

staffNo	*branchNo*	*hoursPerWeek*
S4555	B002	16
S4555	B004	9
S4612	B002	14
S4612	B004	10

b.	Given R(A,B,C,D,E) with the set of FDs, F{AB→CD, BC→ D, D→E, C → E}	3	CO2	BL3

	(i) Find candidate keys of R (ii)What is the normal form of R? Ans. i) AB ii) 2NF			