

**Bachelor Of Engineering In Information Technology**  
**2<sup>nd</sup> Year 1<sup>st</sup> Semester, Supplementary Examination, 2023**

Time : Three hours

Database Management Systems

Full Marks=100

CO1 [10]	<p><b>Q1.</b></p> <p>(a) Differentiate relation schema and relational instance?</p> <p>(b) Describe the logical data independence and physical data independence.</p> <p>(c) What is the advantage of DBMS over file processing system?</p> <p style="text-align: right;">[3+3+4=10]</p>																																			
CO2 [20]	<p><b>Q2. (a)</b></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th colspan="5" style="text-align: left;">Pet_Store</th> </tr> <tr> <th>Pet_ID</th> <th>Pet_Name</th> <th>Category</th> <th>Price</th> <th>Breed</th> </tr> </thead> <tbody> <tr> <td>1281</td> <td>Tom</td> <td>Dog</td> <td>10,000</td> <td>Beagle</td> </tr> <tr> <td>1282</td> <td>Jenny</td> <td>Cat</td> <td>5,000</td> <td>Persian</td> </tr> <tr> <td>1281</td> <td>Tom</td> <td>Dog</td> <td>20,000</td> <td>X</td> </tr> <tr> <td>1282</td> <td>Tom</td> <td>Dog</td> <td>15,000</td> <td>Labrador</td> </tr> <tr> <td>1281</td> <td>Lucy</td> <td>Bird</td> <td>8,000</td> <td>Macaw</td> </tr> </tbody> </table> <p>Identify that the following two functional dependencies do hold or not on <b>Pet_Store</b>.</p> <p>i) Pet_ID → Pet_Name</p> <p>ii) Category → Pet_Name</p> <p>(b) Consider the following relational schema: Airway(Flno, Flname, Source, Destination).  The following functional dependencies hold:  FD1: Flname → Source  FD2: Source → Flno  FD3: Source → Destination</p> <p>Identify all candidate key(s) for the above relation.  What is the highest normal form of R?</p> <p>(c) Define decomposition and how does it address redundancy? Discuss the problems that may be caused by the use of decompositions?</p> <p style="text-align: right;">[4+(4+4)+(4+4)=20]</p>	Pet_Store					Pet_ID	Pet_Name	Category	Price	Breed	1281	Tom	Dog	10,000	Beagle	1282	Jenny	Cat	5,000	Persian	1281	Tom	Dog	20,000	X	1282	Tom	Dog	15,000	Labrador	1281	Lucy	Bird	8,000	Macaw
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CO3 [20]	<p><b>Q3. (a) Consider the following schema given below:</b></p> <p><b>Suppliers(sID, sName, address)</b></p> <p><b>Parts(pID, pName, colour)</b></p> <p><b>Catalog(sID, pID, price)</b></p> <p>Write down the relational algebra expression equivalent to the following statement given below.</p> <p>i) Find the sIDs of all suppliers who supply a part that is red or green.</p> <p>ii) Find the names of all red parts.</p> <p>(b) <b>Write SQL query</b> for following table <b>stud(rollno,name,sub1,sub2,sub3)</b></p> <p>i) Display name of student who got <b>minimum marks in sub1</b>.</p> <p>ii) Find <b>total marks of sub1</b> of all student.</p> <p>(c) Illustrate different set of operations in relational algebra with an example.</p> <p style="text-align: right;">[(3+3)+(3+3)+8=20]</p>																																			
CO4 [20]	<p><b>Q4.</b></p> <p>(a) Write in detail about the <b>Hash based Indexing and Tree based Indexing?</b></p> <p>(b) Explain about <b>B+ tree index file?</b></p> <p>(c) Let us consider the following statistics for searching for a condition in a given relation.  Number of blocks containing record of the relation (b) = 500  Time to transfer one block (t<sub>b</sub>) = 0.5 milliseconds  Time for one seek (t<sub>s</sub>) = 4 milliseconds</p>																																			

	<p>Find out the cost of selection query on a key attribute using linear search file scan.</p> <p style="text-align: center;">Or</p> <p>Suppose a file is organized using a B+ tree of order 4. The search-keys are inserted in the following order: 1, 5, 10, 25, 30, 3, 8, 13, 27, 35, 15, 17, 19.</p> <p>Draw the B+ tree and justify this statement "The Key 25 will be in root node". <span style="float: right;">[8+6+6=20]</span></p>																																															
<p>CO5 [20]</p>	<p><b>Q5. (a)</b> Consider the following schedule S of Transactions T1, T2, T3 and T4. R(X) denotes read operation on data item X by transaction Ti. W(Y) denotes write operation on data item Y by transaction Ti.</p> <table border="1" data-bbox="210 616 596 936" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>T1</th> <th>T2</th> <th>T3</th> </tr> </thead> <tbody> <tr> <td></td> <td>R(X)</td> <td></td> </tr> <tr> <td>R(Y)</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>R(Z)</td> </tr> <tr> <td></td> <td></td> <td>W(Z)</td> </tr> <tr> <td></td> <td>W(Y)</td> <td></td> </tr> <tr> <td>R(X)</td> <td></td> <td></td> </tr> </tbody> </table> <p>Justify the following for the above schedule S:</p> <p>i) Is S conflict serializable or not?</p> <p>ii) If the schedule is conflict serializable then how many conflict serializable schedule are possible for the above schedule.</p> <p>(b) Consider the following example of a log of four transactions, where an immediate database modification scheme is used. If a crash occurs just after step 12 and the recovery of the system is successfully completed, which of the following transactions need to do redo and undo operations?</p> <table border="1" data-bbox="204 1243 683 1803" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>steps</th> <th>Details of log</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>&lt;T0 start&gt;</td> </tr> <tr> <td>2</td> <td>&lt;T0, A, 100, 200&gt;</td> </tr> <tr> <td>3</td> <td>&lt;T0, A, 200, 300&gt;</td> </tr> <tr> <td>4</td> <td>&lt;T0 commit&gt;</td> </tr> <tr> <td>5</td> <td>&lt;T1 start&gt;</td> </tr> <tr> <td>6</td> <td>&lt;T1, B, 500, 400&gt;</td> </tr> <tr> <td>7</td> <td>&lt;checkpoint{ T1} &gt;</td> </tr> <tr> <td>8</td> <td>&lt;T2 start&gt;</td> </tr> <tr> <td>9</td> <td>&lt;T2, A, 300, 1500&gt;</td> </tr> <tr> <td>10</td> <td>&lt;T2 commit&gt;</td> </tr> <tr> <td>11</td> <td>&lt;T3 start&gt;</td> </tr> <tr> <td>12</td> <td>&lt;T3, C, 1000, 2000&gt;</td> </tr> </tbody> </table> <p>(c) Discuss about the recoverable schedules? <span style="float: right;">[(5+5)+5+5=20]</span></p>	T1	T2	T3		R(X)		R(Y)					R(Z)			W(Z)		W(Y)		R(X)			steps	Details of log	1	<T0 start>	2	<T0, A, 100, 200>	3	<T0, A, 200, 300>	4	<T0 commit>	5	<T1 start>	6	<T1, B, 500, 400>	7	<checkpoint{ T1} >	8	<T2 start>	9	<T2, A, 300, 1500>	10	<T2 commit>	11	<T3 start>	12	<T3, C, 1000, 2000>
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<p>CO6 [10]</p>	<p><b>Q6.</b></p> <p>(a) Define <b>Decentralized Database and Data Warehouse.</b></p> <p>(b) Write down the 5V's (characteristics) of big data. <span style="float: right;">[5+5=10]</span></p>																																															

After completing this course, the students should be able to:

**CO1:** Explain the basic Database concepts and different data models. (K2)

**CO2:** Find the available functional dependencies to apply normalization concepts in typical scenarios. (K3)

**CO3:** Design queries using relational algebra operations and SQL. (K3)

**CO4:** Explain principles of Physical Data Storage and Query Optimization. (K3)

**CO5:** Comprehend transaction processing and concurrency control techniques and apply them in various problems (K3)

**CO6:** Discuss different types of advanced databases. (K2)