Reg No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (COMPUTER SCIENCE AND ENGINEERING / COMPUTER SCIENC AND INFORMATION SECURITY)
END SEMESTER EXAMINATIONS (ON-LINE), AUGUST 2021

SUBJECT: ADVANCED DATABASE SYSTEMS [CSE 5153]

REVISED CREDIT SYSTEM

(06/08/2021)

TIME : 2 HOUR **MAX.MARKS : 40 M**

Instructions to the Candidates

- Answer any **FOUR** full Questions.
- Missing data can be suitably assumed

1.A Consider the following Schema of the University database.

***classroom*(*building*, *room number*, *capacity*)**
***department*(*dept name*, *building*, *budget*)**
***course*(*course id*, *title*, *dept name*, *credits*)**
***instructor*(*ID*, *name*, *dept name*, *salary*)**
***section*(*course id*, *sec id*, *semester*, *year*, *building*, *room number*, *time slot id*)**
***teaches*(*ID*, *course id*, *sec id*, *semester*, *year*)**
***student*(*ID*, *name*, *dept name*, *tot cred*)**
***takes*(*ID*, *course id*, *sec id*, *semester*, *year*, *grade*)**
***advisor*(*s ID*, *i ID*)**
***time slot*(*time slot id*, *day*, *start time*, *end time*)**
***prereq*(*course id*, *prereq id*)**

i)Define a function dept_count that, given the name of a department, returns the count of the number of instructors in that department. Show the usage of function dept_count is used, to find the department names and budget of all departments with more than 12 instructors.

ii)Write a procedure dept_count_proc that, given the name of a department, output the number of instructors in that department. Show, how to invoke the procedure dept_count_proc. 5M

1.B Given relation PAY as in Figure 1, let p1: SAL < 30000 and p2: SAL ≥ 3000 be two simple predicates. Perform a horizontal fragmentation of PAY with respect to these predicates to obtain PAY1, and PAY2. Using the fragmentation of PAY, perform further derived horizontal fragmentation for EMP. Show completeness, reconstruction, and disjointness of the fragmentation of EMP. 5M

2.A Briefly explain the Multilevel Access Control and Distributed Access Control. 5M

2.B Consider the following query

$$\Pi_{ENAME}\ (EMP \bowtie_{ENO} (\sigma_{RESP="Manager"}\ (ASG)))$$

Write the importance of site selection and communication for a previously mentioned relational algebra query against a fragmented database. 5M

EMP

ENO	ENAME	TITLE
E1	J. Doe	Elect. Eng
E2	M. Smith	Syst. Anal.
E3	A. Lee	Mech. Eng.
E4	J. Miller	Programmer
E5	B. Casey	Syst. Anal.
E6	L. Chu	Elect. Eng.
E7	R. Davis	Mech. Eng.
E8	J. Jones	Syst. Anal.

ASG

ENO	PNO	RESP	DUR
E1	P1	Manager	12
E2	P1	Analyst	24
E2	P2	Analyst	6
E3	P3	Consultant	10
E3	P4	Engineer	48
E4	P2	Programmer	18
E5	P2	Manager	24
E6	P4	Manager	48
E7	P3	Engineer	36
E8	P3	Manager	40

PROJ

PNO	PNAME	BUDGET
P1	Instrumentation	150000
P2	Database Develop.	135000
P3	CAD/CAM	250000
P4	Maintenance	310000

PAY

TITLE	SAL
Elect. Eng.	40000
Syst. Anal.	34000
Mech. Eng.	27000
Programmer	24000

Figure 1

3.A Transform the operator tree of Figure 2 back to the tree using the restructuring algorithm. Describe each intermediate tree and show which rule the transformation is based on. 5M

3.B Consider the join graph of Figure 3, and give a program (possibly not optimal) that reduces each relation fully by semi-joins. 5M

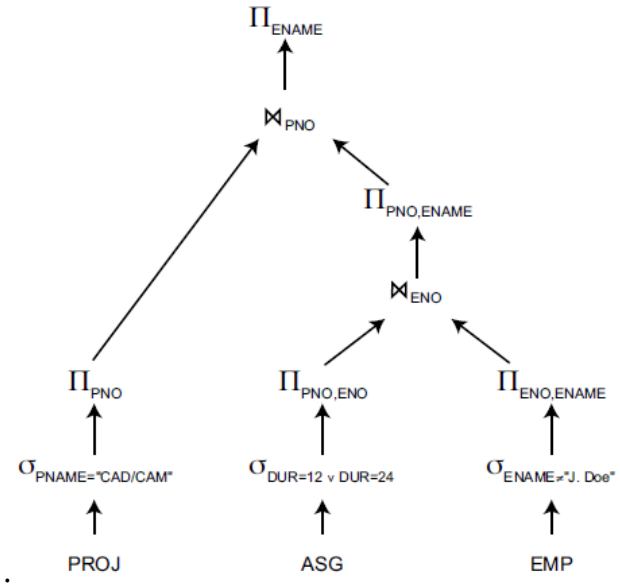


Figure 2

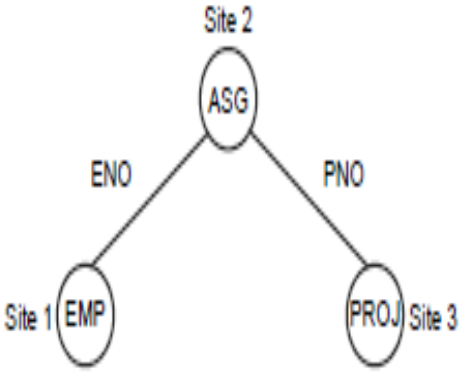


Figure 3

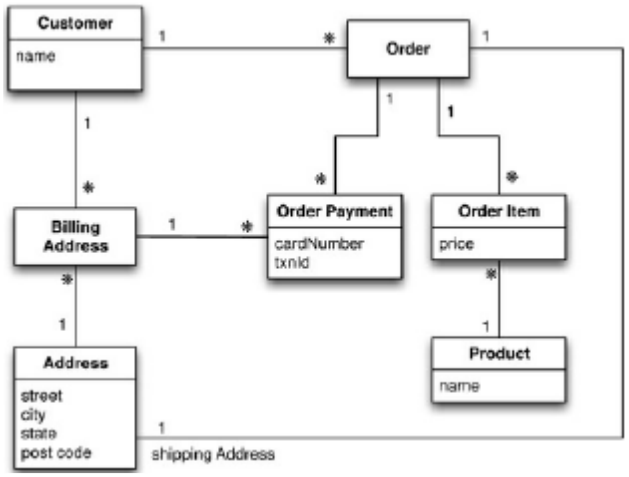
4.A i. What is Transaction? "*A single query can also be thought of as a program that can be posed as a transaction*. " Justify your answer.
ii. Write a short on Centralized Transaction Execution and Distributed Transaction Execution. 4M

4.B a) Consider the following two transactions:

*T*13: read(*A*);
read(*B*);
if *A* = 0 **then** *B* := *B* + 1;
write(*B*).
*T*14: read(*B*);
read(*A*);
if *B* = 0 **then** *A* := *A* + 1;
write(*A*).

Let the consistency requirement be $A = 0 \vee B = 0$, with $A = B = 0$ the initial values.
i. Show that every serial execution involving these two transactions preserves the consistency of the database.
ii. Show a concurrent execution of $T13$ and $T14$ that produces a non-serializable schedule.
iii. Is there a concurrent execution of $T13$ and $T14$ that produces a serializable schedule?
b) Discuss the site failure termination protocol for 2PC using a distributed communication topology. 6M

5.A a) We claimed that a scheduler, which implements a strict concurrency control algorithm, will always be ready to commit a transaction when it receives the coordinator's "prepare" message. Prove this claim.
b) What are Aggregates? Consider the following Data model oriented around a relational database (Figure 4) convert to an aggregate data model. 3M



6M

Figure 4.

5.B List the advantages and disadvantages of Update Management Strategies. 4M

6.A a) Discuss the modeling for data access with an example.
b) Write a short note on Master-Slave Replication and peer-to-peer replication. 6M

6.B Imagine you are starting a new social networking site designed for NoSQL database developers. The goal is to support the NoSQL development community by providing a platform for sharing tips, asking questions, and keeping in touch with others working on similar problems. You make the suitable assumptions and design a Social Network Graph Database. 4M

-ALL THE BEST-