

PURBANCHAL UNIVERSITY

2021

B.E. (Computer)/Fourth Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG276CO: Database Management System (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.

$$8 \times 10 = 80$$

1 ✓ Define DBMS. Briefly explain the DBMS languages used for various operations. 1+4

(b) What are the different types of database users? Discuss the main responsibilities of DBA. 2+3

2(a) Differentiate between Network Data Model and Hierarchical Data Models. 5

(b) Construct ER diagram for the following database schema. 5
EMPLOYEES(E-ID, E_Name, E_Address, E_Contact, E_Age, Salary)

DEPARTMENT(D_ID, D_Name, D_Location)

PROJECT(P_ID, P_Name, P_Manager, P_Duration)

WORK(E_ID, P_ID, D_ID, WorkingHour)

3(a) Define relational algebra. Also list out the fundamental operators of relational algebra. 1+3

(b) Consider the following relational schema

SUPPLIER(S_ID, S_Name, Address)

PARTS(P_ID, P_Name, Color, Quantity)

CATALOG(S_ID, P_ID, Cost)

Write a relational algebraic query for followings:

(i) Find the names of suppliers who supply some red part.

(ii) Find the name of all parts that are supplied in quantity greater than 300.

(iii) Find the name of all parts supplied by "ABC Company".

4. Consider the following relational schema. 10
Contd. ...

(2)

SAILOR(S_ID, S_Name, Rating, Age)
RESERVES(S_ID, B_Id, Day)
BOAT(B_ID, B_Name, Color)

Write a SQL query to:

- ✓ (i) Create above mentioned tables.
- ✓ (ii) Insert one record in each of the relations.
- ✓ (iii) Display the name of sailors who have reserved red boat.
- ✓ (iv) Display the record of sailor reservation who have reserved green boat for 10 days.
- ✓ (v) Delete the sailor's records who had reserved the boat for one month

✓ 5(a) What is the need of Normalization? Differentiate between 3NF and BCNF with suitable example. 2+3

✓ (b) Compute the closure set of attributes for {A} and {BC} for the following relation: 5

$$R = \{A, B, C, D\}$$

$$FD's = \{A \rightarrow B, C \rightarrow D, C \rightarrow E\}$$

Also compute minimal super key for this relation.

✓ 6(a) What do you mean by database security? What is the importance of security in database system? 1+4

✓ (b) Explain the principles of database security. 5

✓ (b) What is a query-tree? Explain the concept of query optimization and query decomposition. 1+3

✓ 7(a) Explain the Query processing technique with a neat diagram. 5

✓ (b) Differentiate between Sequential and hashed file organization. 5

✓ 8(a) What is a database transaction? Explain the concept of serializability of schedules with example. 1+4

✓ (b) Discuss the deferred update and immediate update techniques of database recovery. 5

9. Write short note on any TWO: 5+5

✓ (a) Distributed Database System

✓ (b) Shadow Paging Recovery

(c) Triggers and views



PURBANCHAL UNIVERSITY

2019

B.E. (Computer) / Fourth Semester / Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG276CO: Database Management System (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

$$8 \times 10 = 80$$

Answer EIGHT questions.

1. Construct an ER diagram for the Gorkhali Automobile Corporation which operates number of vehicles. The relevant information is given below. 10

Every vehicle has a registration number and each vehicle is of specific model. The company accommodates a number of vehicle models and each model is identified by a model number and has a capacity and weight. In addition, the model also has a range associated with it. A number of technicians work for the company. They have unique name, SIN, address, phone number and salary. The company has controllers who control the incoming and outgoing vehicle traffic in the vehicle areas. As they are exposed to a lot of smoke emissions and also because their job is important they need to have an annual medical examination. The date of most recent exam must be stored for each controller. All company employees including technicians belong to union. Each employee has a union membership number which must be stored. The company performs a number of checks periodically to ensure that the vehicles are in good condition. These tests are standardized by the Beaureau of Motor Vehicles and are identified by BMV test number. Test has a name and maximum possible score. The BMV requires the company to keep track of each time a given vehicle is tested by a given technician using a given test. The information for each testing event is the date the number of hours spent in testing and score received on the test.

- 2(a) What do you mean by data independence? Explain how three-schema architecture ensures data independence? 2+5

Differentiate between DDL and DML language. 3

Contd. ...

Consider given schema and write SQL statements for following queries. $2 \times 5 = 10$

Student (Stud#, Sname, Saddr, Sphone)
Assignment (Ass#, Aname, Adesc, Amgr#)
Department (Dept#, Dname, Daddr, Dmgr#)
Works_assign (Stud#, Ass#, totalhrs)
Works_dept (Stud#, Dept#, totalhrs)

- (a) Write DDL statements for creating relation student, assignment & works_assign.
(b) Count the number of students who work in assignment with ASS# A18 & whose total hours worked in department with Dept D10 is more than 40.
(c) Retrieve those departments with at least five students who work more than 20 hours on assignment with Ass# A 18.
(d) Change manager # of department 5 with manager no # 6.
(e) Add a field DOB in Student relation.

4(a) What are different types of integrity constraints? Explain with Example.5
4(b) Compute closure set of attributes for {A} & {BC} for following relation. Also compute minimal superkey for this relation. $\textcircled{3}+2$

R(A,B,C,D,E), FDs: $\{A \rightarrow B, C \rightarrow D, C \rightarrow E\}$
5. What is hashing? Explain how collision occurs in hashing.

Explain collision prevention techniques. $2+3+5$

6(a) Explain the process involved in query processing in brief. $\textcircled{6}$

6(b) What is a query-tree? Explain the concept of query optimization and query decomposition. $1+3$

7(a) Explain the methods of executing transaction? Explain with example the concept of conflict serializability of schedules. $\textcircled{3+2} \times$

7(b) Explain how two phase locking protocol ensures serializability but not deadlock cases. 5

8(a) What are the types of failures? Differentiate deferred update and immediate update based recovery techniques. $2+4$

8(b) What is write-ahead logging protocol? What are the advantages of shadow paging? $2+2$

$5+5$

9. Write short note on any TWO:

- (a) Mandatory security mechanism.
(b) Relational algebra Vs Relational calculus
(c) Distributed database system.

**PURBANCHAL UNIVERSITY
2018**

I.E. (Computer)/Fourth Semester/Final
Time: 03:00 hrs.
SEG276CO: Database Management System (New Course)

Full Marks: 80 /Pass Marks: 32

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.

$8 \times 10 = 80$

1. Explain E-R model, design E-R schema for bus ticket reservation system and also convert it into relational model [note: mention the assumption made for this design]. 4+4+2
2. What is Database Management System? Explain the system architecture of Database management system with appropriate block diagram. 2+8
- 3(a) Explain briefly about Physical and Logical Data Independence: /4
(b) Discuss advantages of DBMS over conventional Data processing file system. 6
4. Consider the schema given below and write the relational algebra for the given scenarios. $2 \times 5 = 10$
 - (i) Employee(employee_id,first_name,last_name,email,phone_number, job_id,salary,department_id)
 - (ii) Departments(department_id,department_name,,location_id)
 - (iii) Locations(location_id,street_address,postal_code, city, state, country_id)

Write Relational algebra to:

- (i) Display name, address and their department_id whose salary is greater than 6000.
- (ii) Find location id which has all the department name.
- (iii) Increase the salary of 'Ram' by 15 percent.
- (iv) List employees email, phone number whose department's postal_code is 'KTM44604'.
- (v) Find the largest salary without using aggregation function.

(2)

- a) With relevant example explain 1NF, 2NF, 3NF and BCNF. 6
- b) What is functional dependency? What are the two set of functional dependencies? How can we determine their equivalence? 4
- Discuss about query processing and query optimization with suitable diagram and examples. 5+5
- Why concurrency control is needed in Transaction Management? Describe Two Phase Locking Protocol (2PL) over single phase locking mechanism with necessary example explaining its advantages and disadvantages 3+7
- 8(a) Discuss about different types of failures. 2
- (b) Define schedule, serializability and also check whether the schedules s1 and s2 are conflict serializable or not: 8
- S1: R2(A); R3(C); W3(A); W2(A); W2(B); W3(C); R1(A); R1(B); W1(A); W1(B)
- S2: R1(A); R2(A); R3(A); W(A); R2(C); R2(B); W2(B); W1(C)
- 9(a) Explain about collision resolution technique used in hashing. 6
- (b) Explain memory hierarchy with diagram 4
- 10(a) What is distributed model? Explain lag based recovery with example. 1+4
- (b) What is ORDBMS? Explain different levels of security in database. 1+4

PURBANCHAL UNIVERSITY
2017

B.E. (Computer) / Fourth Semester / Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG276CO: Database Management System (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.

$$8 \times 10 = 80$$

1(a) Define data, database, database system and DBMS. Explain how 3 schema architecture ensures data independence and data abstraction. 2+5

(b) Differentiate between procedural and non-procedural database language. 3

2. Draw an ER diagram for keeping track of information for an art museum, the requirements of which are as follows (Make reasonable assumptions if required). 10

- The museum has a collection of art objects. Each art object has a unique Id, an Artist, a Year when it was created, a Title, and a Description.
- Art objects are categorized based on their type as painting, sculpture, and statue, plus another type called other to accommodate objects that do not fall into one of the three main types.
- A painting has a paint type, material on which it was drawn on, and style.
- A sculpture or statue has a material from which it was created, height, weight, and style.
- An art object in the other category has a type and style.
- Art objects are also categorized as permanent collection, which are owned by the museum (these have information on the date acquired, whether it is on display or stored, and cost) and borrowed, which has information on the collection (from which it was borrowed), date borrowed, and date returned.

(2)

- The museum keeps track of artist's information like name, date of birth, death date, country of origin, epoch, main style and description. The name is assumed to be unique.
- Different exhibitions occur, each having a name, start date and end date. Exhibitions are related to all the art objects that were on display during the exhibition.
- Information is kept on other collections with which the museum interacts, including name, which is considered to be unique, type, description, address, phone and contact person.

6(a)

(b)

7(a)

8

Write SQL for following queries on schemas as: 1+1+1+1+1

Employee(ssn, name, address, salary, age, mgrssn, dno)

Department(dno, dname, location)

Project(pno, pname, plocation, manager_name)

Works(ssn, pno, work hours)

(i) Write DDL statements to create Employee and Works relation

(ii) List all the employees who live in Bhaktapur and work in Construction department.

(iii) Count the number of employees working in 'Ring road project';

(iv) Insert new employee in Civil department.

(v) Increase 20% salary for all employees who work for 1-IRM department

Explain the importance of DBA. 5

Discuss inference rules for functional dependency. 5

Compute closure set of attributes for {A} & {BC} for following relation. Also compute minimal superkey for this relation. 3+2

R(A,B,C,D,E)

FDs: {A→B, C→D, C→E}

What are the purposes of normalization? Describe join dependency. 2+3

Normalize following schema of course registration by student into 3NF. 5

Student(sno,sname,saddress,pno,pname, pduration,
(cno,cname,credit))

FDs: (sno \rightarrow sname, saddress, pno)

pno \rightarrow pname, pduration)

cno \rightarrow cname, credit)

6(a) Describe the need of query optimization.

(b) What is buffer replacement strategy? How to detect and resolve hash collision in file organization. 2+4

7(a) What are the properties of Transaction? Why do we need concurrency control techniques? 2+3

(b) Explain how Two phase locking protocols ensures serializability but not deadlock cases. 5

8. Test serializability for given schedule. Also write equivalent serial schedule. 10

T1	T2	T3
Read (X) Write (X)		Read (Y) Read (Z)
Read (Y) Write (Y)	Read (Z)	Write (Y) Write (Z)

9(a) What are the types of failures? Differentiate deferred update and immediate update based recovery techniques. 2+4

(b) What is write-ahead logging protocol? What are the advantages shadow paging? 2+2

**PURBANCHAL UNIVERSITY
2016**

B. (Computer)/Fourth Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

G276CO: Database Management System (New Course)

Indicates are required to give their answers in their own words as far as practicable.

1 questions carry equal marks. The marks allotted for each sub-question specified along its side.

Answer EIGHT questions.

$8 \times 10 = 80$

Explain the importance and needs of DBMS. Describe few characteristics of modern database approach that differentiate it from traditional database systems.

Write down the importance of CREATE, ALTER and DROP statements in SQL. Explain using examples the following operators.

(i) IN-NOT IN

(ii) BETWEEN – NOT BETWEEN

(iii) LIKE – NOT LIKE

What is the significance of ER diagram during conceptual database design? Construct an ER diagram for a car insurance company with a set of customers each of which owns a number of cars. Each car has a number of recorded accidents associated with it. Make any additional assumptions if required. .

Why normalizing a relation is necessary? Explain with example the process of normalizing a table to second and third normal forms. How does 3NF differ from BCNF?

What do you mean by concurrent execution of transactions? How does two phase locking protocol handles concurrent execution? Explain conflict serializability of schedules.

Explain how integrity constraints help in securing a database. Discuss referential integrity constraints. Differentiate between mandatory and discretionary database access control mechanisms.

Contd. ...

Consider the following EMPLOYEE table given below.

ENO	ENAME	DESIGNATION	SALARY	COMMISSION	DEPTNO
A1	Prakash	Manager	10000	1000	101
A2	Gopal	Clerk	4500		110
A3	Hari	Salesman	8000	800	101
A4	Ram	Peon	4000		101
A5	Prasanna	Clerk	4500		110
A6	Dipak	Salesman	8000	800	101

Now answer the following questions:

- (a) Write SQL syntax to create the given table and insert few records in it.
- (b) Write SQL syntax to update the salary of all the employees by 10% who works in department number 101.
- (c) Write SQL query to retrieve all information of all Employees who does not have any commission.
- (d) Write SQL query to find the deptno and employee name of all Employees who work in the same department in which employee 'A2' works.(Assume that you do not know the department number of 'A2')
- (e) Write SQL query to count the distinct number of departments in the table

Why relational algebra is known as Procedural Query Language?
Explain with example SELECT, PROJECT, JOIN and CARTESIAN PRODUCT operators used in relational algebra.

What do you mean by Database Recovery? What information is stored in log for recovery? Explain deferred update and immediate update recovery techniques.

Write short notes on any TWO:

5+5

- (a) Three schema Architecture
- (b) Functional dependency Vs Multivalued dependency
- (c) Query optimization



Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer EIGHT questions.

1. What is the difference between a database and database management system? For what reasons do organizations choose to invest in database management system? $8 \times 1 = 8$
2. Explain the concept of data model. What data models are used in DBMS? Discuss the distinguished features of each. $5 + 5$
3. Construct an ER diagram for a car insurance company with a set of customers each of which owns a number of cars. Each car has a number of recorded accidents associated with it. Also convert the ER diagram into relations showing primary key and foreign key. 10
- 4(a) What are the benefits of normalization in relational database design? Why functional dependency is important during normalization? $2 + 3$
- (b) Consider the following relational schema:
 Explain how fd2 and fd3 violates the definition of second normal form. Convert the given schema into 2NF. 5

<u>RollNo</u>	<u>BookNo</u>	<u>IssuedDate</u>	<u>StdName</u>	<u>StdFee</u>	<u>BookName</u>
fd1					
fd2					
fd3					

Contd. ...

(2)

Consider the following two tables:

EMPLOYEE

empno	ename	commission	salary	deptno
101	Smith	400	20000	10
102	King	200	10000	10
103	Martin	0	5000	20
104	Kayes	-	3000	20
105	Staten	0	5000	20

DEPARTMENT

Deptno	Deptname	DeptLocation
10	Human Resource	Kathmandu
20	Quality Control	Biratnagar
30	Production	Janakpur

Now answer the following questions:

4+2+2+2

- Write SQL syntax to create the above two tables with primary key and foreign key specified.
- Write SQL query to find empno, employee name and department name for all employees who work in department 20.
- Write SQL query to display information of all employees, whose name starts with letter 'S' or who have no commission.
- Write SQL query to display the department wise total salary of department 10 and 20 in descending order of department number.

Define database security. Why security of database is more important in multiuser DBMS? Explain the actions that we perform in discretionary access control to protect database. 2+3+5

3

- Explain query processing in brief.

- Explain the process of buffer management. Explain the significance of 'PIN COUNT' and 'DIRTY BIT' during buffer management.

3+4

- What is two-phase locking protocol? Explain how it ensures serializability during concurrent execution of transactions.

1+5

(3)

- (b) What is deadlock? Differentiate between wait-die and ~~wait~~ and ~~wait~~ schemes.
9. Write short notes on any TWO:
- (a) Shadow paging
 - (b) Join operation
 - (c) ORDBMS

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Lab: 03

RACE CONDITION AND THREAD SYNCHRONIZATION

OBJECTIVE: To implement the Race condition and Thread Synchronization.

THEORY

A **race condition** is a situation that may occur inside a critical section. This happens when the result of multiple thread execution in critical section differs according to the order in which the threads execute. Race conditions in critical sections can be avoided if the critical section is treated as an atomic instruction. Also, proper thread synchronization using locks or atomic variables can prevent race conditions.

Thread synchronization is the concurrent execution of two or more threads that share critical resources. Threads should be synchronized to avoid critical resource use conflicts. Otherwise, conflicts may arise when parallel-running threads attempt to modify a common variable at the same time.

Semaphore: A semaphore is a signaling mechanism and a thread that is waiting on a semaphore can be signaled by another thread. This is different than a mutex as the mutex can be signaled only by the thread that called the wait function. A semaphore uses two atomic operations, wait and signal for process synchronization. The wait operation decrements the value of its argument S, if it is positive. If S is negative or zero, then no operation is performed.

PROGARM FOR RACE CONDITION

```
#include<stdio.h>
#include<pthread.h>
#include<unistd.h>
void *fun1();
void *fun2();
int shared=1; //shared variable
int main(){
    pthread_t thread1,thread2;
    pthread_create(&thread1,NULL,fun1,NULL);
    pthread_create(&thread2,NULL,fun2,NULL);
    pthread_join(thread1,NULL);
    pthread_join(thread2,NULL);
    printf("Final value of shared is %d\n",shared);
}

void *fun1(){
    int x; x=shared; //thread one read value of shared variable
    printf("Thread1 reads the value of shared variable as %d\n",x);
    x++;
    printf("Local updation by thread1: %d\n",x);
    sleep(1); shared=x;
    printf("Value of shared variable updated by Thread1 is %d\n",shared);
}

void *fun2(){
    int y;
```

```

y=shared;
printf("Thread2 reads the value of shared variable as %d\n",y);
y--;
printf("Local updation by Thread2: %d\n",y);
sleep(1);                                //thread 1 is preempted by thread 2
shared=y;
printf("Value of shared variable updated by Thread is %d\n",shared);
}

```

OUTPUT:

```

Thread1 reads the value of shared variable as 1
Local updation by thread1: 2
Thread2 reads the value of shared variable as 1
Local updation by thread2: 0
Value of shared variable updated by Thread1 is 2
Value of shared variable updated by Thread is 0
Final value of shared is 0

```

PROCESS SYNCHRONIZATION:

```

#include<stdio.h>
#include<pthread.h>
#include<unistd.h>
#include<semaphore.h>
void *fun1();
void *fun2();
int shared=5;           //shared variable
sem_t s;                //semaphore variable
int main(){
    sem_init(&s,0,1);
    pthread_t thread1,thread2;
    pthread_create(&thread1,NULL,fun1,NULL);
    pthread_create(&thread2,NULL,fun2,NULL);
    pthread_join(thread1,NULL);
    pthread_join(thread2,NULL);
    printf("Final value of shared is %d\n",shared);
}

void *fun1(){
    int x;
    sem_wait(&s);
    x=shared;
    printf("Thread1 reads the value of shared variable as %d\n",x);
    x++;
    printf("Local updation by thread1: %d\n",x);
    sleep(1);
    shared=x;
    printf("Value of shared variable updated by Thread1 is %d\n",shared);
    sem_post(&s);
}

```

```

}

void *fun2(){
    int y;
    sem_wait(&s);
    y=shared;
    printf("Thread2 reads the value of shared variable as %d\n",y);
    y--;
    printf("Local updation by Thread2: %d\n",y);
    sleep(1);
    shared=y;
    printf("Value of shared variable updated by Thread2 is %d\n",shared);
    sem_post(&s);
}

```

OUTPUT:

```

Thread1 reads the value of shared variable as 5
Local updation by thread1: 6
Value of shared variable updated by Thread1 is 6
Thread2 reads the value of shared variable as 6
Local updation by thread2: 5
Value of shared variable updated by Thread2 is 5
Final value of shared is 5

```

PROCESS SYNCHRONIZATION WITH MUTEX

```

#include<stdio.h>
#include<pthread.h>
#include<unistd.h>
#include<semaphore.h>
void *fun1();
void *fun2();
int shared=1;           //shared variable
pthread_mutex_t l;      //mutex lock
int main(){
    pthread_mutex_init(&l,NULL);
    pthread_t thread1,thread2;
    pthread_create(&thread1,NULL,fun1,NULL);
    pthread_create(&thread2,NULL,fun2,NULL);
    pthread_join(thread1,NULL);
    pthread_join(thread2,NULL);
    printf("Final value of shared is %d\n",shared);
}

void *fun1(){
    int x;
    printf("Thread1 trying to acquire lock\n");
    pthread_mutex_lock(&l);
    printf("Thread1 acquire lock\n");

```

```

x=shared;
printf("Thread1 reads the value of shared variable as %d\n",x);
x++;
printf("Local updation by thread1: %d\n",x);
sleep(1);
shared=x;
printf("Value of shared variable updated by Thread1 is %d\n",shared);
pthread_mutex_unlock(&l);
printf("Thread1 released the lock\n");
}

void *fun2(){
    int y;
    printf("Thread2 trying to acquire lock\n");
    pthread_mutex_lock(&l);
    printf("Thread2 acquire lock\n");
    y=shared;
    printf("Thread2 reads the value of shared variable as %d\n",y);
    y--;
    printf("Local updation by Thread2: %d\n",y);
    sleep(1);
    shared=y;
    printf("Value of shared variable updated by Thread2 is %d\n",shared);
    pthread_mutex_unlock(&l);
    printf("Thread2 released the lock\n");
}

```

OUTPUT:

Thread1 trying to acquire lock
 Thread1 acquire lock
 Thread1 reads the value of shared variable as 1
 Local updation by thread1: 2
 Thread2 trying to acquire lock
 Value of shared variable updated by Thread1 is 2
 Thread1 released the lock
 Thread2 acquire lock
 Thread2 reads the value of shared variable as 2
 Local updation by thread2: 1
 Value of shared variable updated by Thread2 is 1
 Thread2 released the lock
 Final value of shared is 1

PROCESS SYNCHRONIZATION WITH MUTEX FOR THREE VAIRABLES

```
#include<stdio.h>
#include<pthread.h>
#include<unistd.h>
#include<semaphore.h>
void *fun1();
void *fun2();
void *fun3();
int shared=1;           //shared variable
pthread_mutex_t l;      //mutex lock
int main(){
    pthread_mutex_init(&l,NULL);
    pthread_t thread1,thread2;
    pthread_create(&thread1,NULL,fun1,NULL);
    pthread_create(&thread2,NULL,fun2,NULL);
    pthread_join(thread1,NULL);
    pthread_join(thread2,NULL);
    printf("Final value of shared is %d\n",shared);
}

void *fun1(){
    int x;
    printf("Thread1 trying to acquire lock\n");
    pthread_mutex_lock(&l);
    printf("Thread1 acquire lock\n");
    x=shared;
    printf("Thread1 reads the value of shared variable as %d\n",x);
    x++;
    printf("Local updation by thread1: %d\n",x);
    sleep(1);
    shared=x;
    printf("Value of shared variable updated by Thread1 is %d\n",shared);
    pthread_mutex_unlock(&l);
    printf("Thread1 released the lock\n");
}

void *fun2(){
    int y;
    printf("Thread2 trying to acquire lock\n");
    pthread_mutex_lock(&l);
    printf("Thread2 acquire lock\n");
    y=shared;
    printf("Thread2 reads the value of shared variable as %d\n",y);
    y--;
    printf("Local updation by Thread2: %d\n",y);
    sleep(1);
    shared=y;
    printf("Value of shared variable updated by Thread2 is %d\n",shared);
}
```

```

pthread_mutex_unlock(&l);
printf("Thread2 released the lock\n");
}

void *fun3(){
    int z;
    printf("Thread3 trying to acquire lock\n");
    pthread_mutex_lock(&l);
    printf("Thread3 acquire lock\n");
    z=shared;
    printf("Thread3 reads the value of shared variable as %d\n",z);
    z++;
    printf("Local updation by Thread3: %d\n",z);
    sleep(1);
    shared=z;
    printf("Value of shared variable updated by Thread3 is %d\n",shared);
    pthread_mutex_unlock(&l);
    printf("Thread3 released the lock\n");
}

```

OUTPUT:

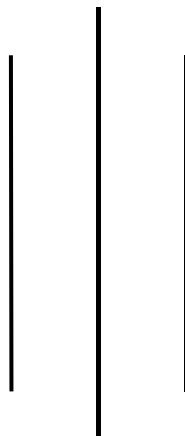
Thread1 trying to acquire lock
 Thread1 acquire lock
 Thread2 trying to acquire lock
 Thread3 trying to acquire lock
 Thread1 reads the value of shared variable as 1
 Local updation by thread1: 2
 Value of shared variable updated by Thread1 is 2
 Thread1 released the lock
 Thread2 acquire lock
 Thread2 reads the value of shared variable as 2
 Local updation by thread2: 1
 Value of shared variable updated by Thread2 is 1
 Thread2 released the lock
 Thread3 acquire lock
 Thread3 reads the value of shared variable as 1
 Local updation by thread3: 2
 Value of shared variable updated by Thread3 is 2
 Thread3 released the lock
 Final value of shared is 2

PURBANCHAL UNIVERSITY



KHWOPA ENGINEERING COLLEGE

LIBALI-08, BHAKTAPUR



LAB REPORT ON OPERATING SYSTEM

LAB NO. 3

SUBMITTED BY:

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