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Assignment No. 05

Problem Statement : Write a program using pthreads to demonstrate the reader writer synchronization problem. Implement appropriate synchronization. Show the different results with and without synchronization.

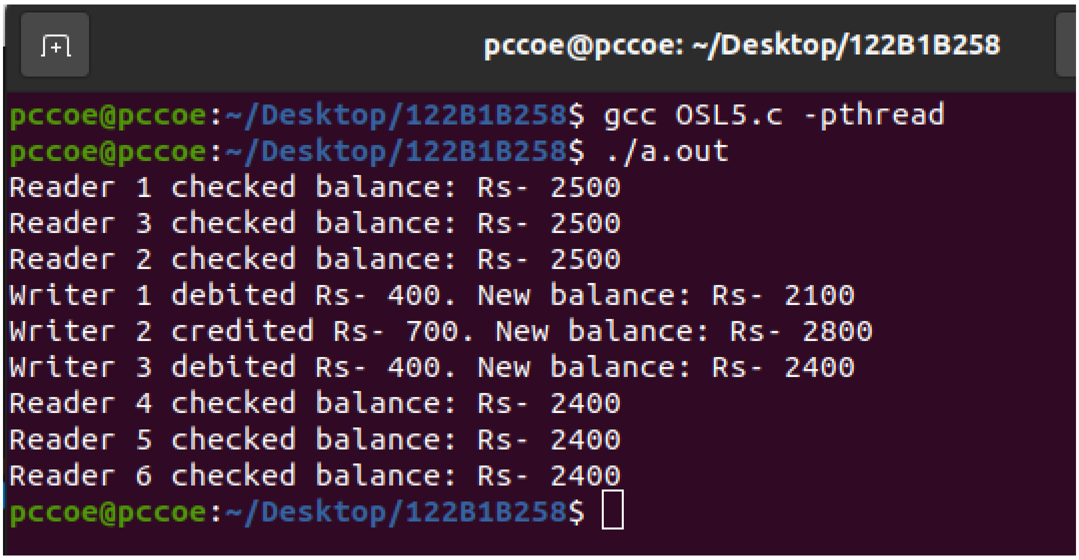
1. **Without Synchronization…**

Code :

```
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
int total_amount = 2500;
void *add_money(void *x) {
   int cash = 700;
   total_amount += cash;
   printf("Writer %d credited Rs- %d. New balance: Rs- %d\n", *((int *)x), cash,
total_amount);
}

void *deduct_money(void *x) {
   int cash = 400;
   total_amount -= cash;
   printf("Writer %d debited Rs- %d. New balance: Rs- %d\n", *((int *)x), cash,
total_amount);
}

void *show_balance(void *x) {
   printf("Reader %d checked balance: Rs- %d\n", *((int *)x), total_amount);
}
```

```
int main() {
    pthread_t readers[6], writers[3];
    char actions[] = {'D', 'C', 'D'};
    int ids[6] = {1, 2, 3, 4, 5, 6};
    for(int i = 0; i < 3; i++) {
        pthread_create(&readers[i], NULL, show_balance, &ids[i]);
    }
    for(int i = 0; i < 3; i++) {
        if(actions[i] == 'C')
            pthread_create(&writers[i], NULL, add_money, &ids[i]);
        else
            pthread_create(&writers[i], NULL, deduct_money, &ids[i]);
    }
    for(int i = 3; i < 6; i++) {
        pthread_create(&readers[i], NULL, show_balance, &ids[i]);
    }
    for(int i = 0; i < 3; i++) {
        pthread_join(readers[i], NULL);
    }
    for(int i = 0; i < 3; i++) {
        pthread_join(writers[i], NULL);
    }
    for(int i = 3; i < 6; i++) {
        pthread_join(readers[i], NULL);
    }
    return 0;
}
```

Output :



```
pccoe@pccoe:~/Desktop/122B1B258$ gcc OSL5.c -pthread
pccoe@pccoe:~/Desktop/122B1B258$ ./a.out
Reader 1 checked balance: Rs- 2500
Reader 3 checked balance: Rs- 2500
Reader 2 checked balance: Rs- 2500
Writer 1 debited Rs- 400. New balance: Rs- 2100
Writer 2 credited Rs- 700. New balance: Rs- 2800
Writer 3 debited Rs- 400. New balance: Rs- 2400
Reader 4 checked balance: Rs- 2400
Reader 5 checked balance: Rs- 2400
Reader 6 checked balance: Rs- 2400
pccoe@pccoe:~/Desktop/122B1B258$
```

2. **With Synchronization…**

Code :

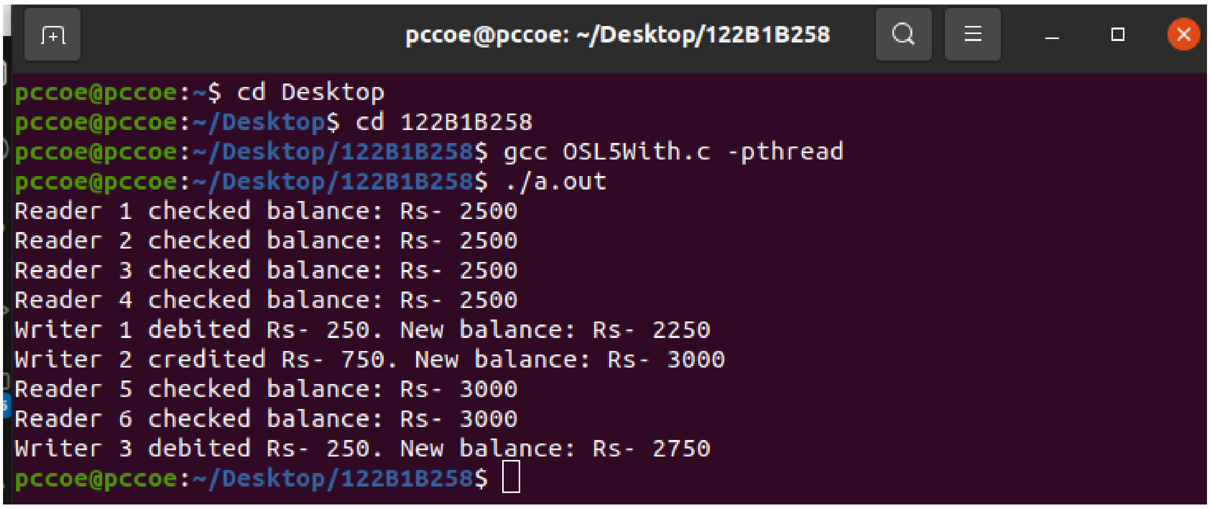
```
#include <pthread.h>

#include <semaphore.h>

#include <stdio.h>

sem_t resource;

pthread_mutex_t lock;

int total_amount = 2500;

int active_readers = 0;

void *add_money(void *x) {

  int cash = 750;

  sem_wait(&resource);

  total_amount += cash;

  printf("Writer %d credited Rs- %d. New balance: Rs- %d\n", *((int *)x), cash,
total_amount);

  sem_post(&resource);
```

```
}

void *deduct_money(void *x) {
    int cash = 250;
    sem_wait(&resource);
    total_amount -= cash;
    printf("Writer %d debited Rs- %d. New balance: Rs- %d\n", *((int *)x), cash, total_amount);
    sem_post(&resource);
}

void *show_balance(void *x) {
    pthread_mutex_lock(&lock);
    active_readers++;
    if (active_readers == 1) {
        sem_wait(&resource);
    }
    pthread_mutex_unlock(&lock);
    printf("Reader %d checked balance: Rs- %d\n", *((int *)x), total_amount);
    pthread_mutex_lock(&lock);
    active_readers--;
    if (active_readers == 0) {
        sem_post(&resource);
    }
    pthread_mutex_unlock(&lock);
}

int main() {
```

```
pthread_t readers[6], writers[3];
char actions[] = {'D', 'C', 'D'};
pthread_mutex_init(&lock, NULL);
sem_init(&resource, 0, 1);
int ids[6] = {1, 2, 3, 4, 5, 6};
for (int i = 0; i < 3; i++) {
    pthread_create(&readers[i], NULL, show_balance, &ids[i]);
}
for (int i = 0; i < 3; i++) {
    if (actions[i] == 'C')
        pthread_create(&writers[i], NULL, add_money, &ids[i]);
    else
        pthread_create(&writers[i], NULL, deduct_money, &ids[i]);
}
for (int i = 3; i < 6; i++) {
    pthread_create(&readers[i], NULL, show_balance, &ids[i]);
}
for (int i = 0; i < 3; i++) {
    pthread_join(readers[i], NULL);
}
for (int i = 0; i < 3; i++) {
    pthread_join(writers[i], NULL);
}
for (int i = 3; i < 6; i++) {
    pthread_join(readers[i], NULL);
}
pthread_mutex_destroy(&lock);
sem_destroy(&resource);
```

```
    return 0;
}
```

Output :



```
pccoe@pccoe:~$ cd Desktop
pccoe@pccoe:~/Desktop$ cd 122B1B258
pccoe@pccoe:~/Desktop/122B1B258$ gcc OSL5With.c -pthread
pccoe@pccoe:~/Desktop/122B1B258$ ./a.out
Reader 1 checked balance: Rs- 2500
Reader 2 checked balance: Rs- 2500
Reader 3 checked balance: Rs- 2500
Reader 4 checked balance: Rs- 2500
Writer 1 debited Rs- 250. New balance: Rs- 2250
Writer 2 credited Rs- 750. New balance: Rs- 3000
Reader 5 checked balance: Rs- 3000
Reader 6 checked balance: Rs- 3000
Writer 3 debited Rs- 250. New balance: Rs- 2750
pccoe@pccoe:~/Desktop/122B1B258$ 
```