LAB ASSIGNMENT – 7

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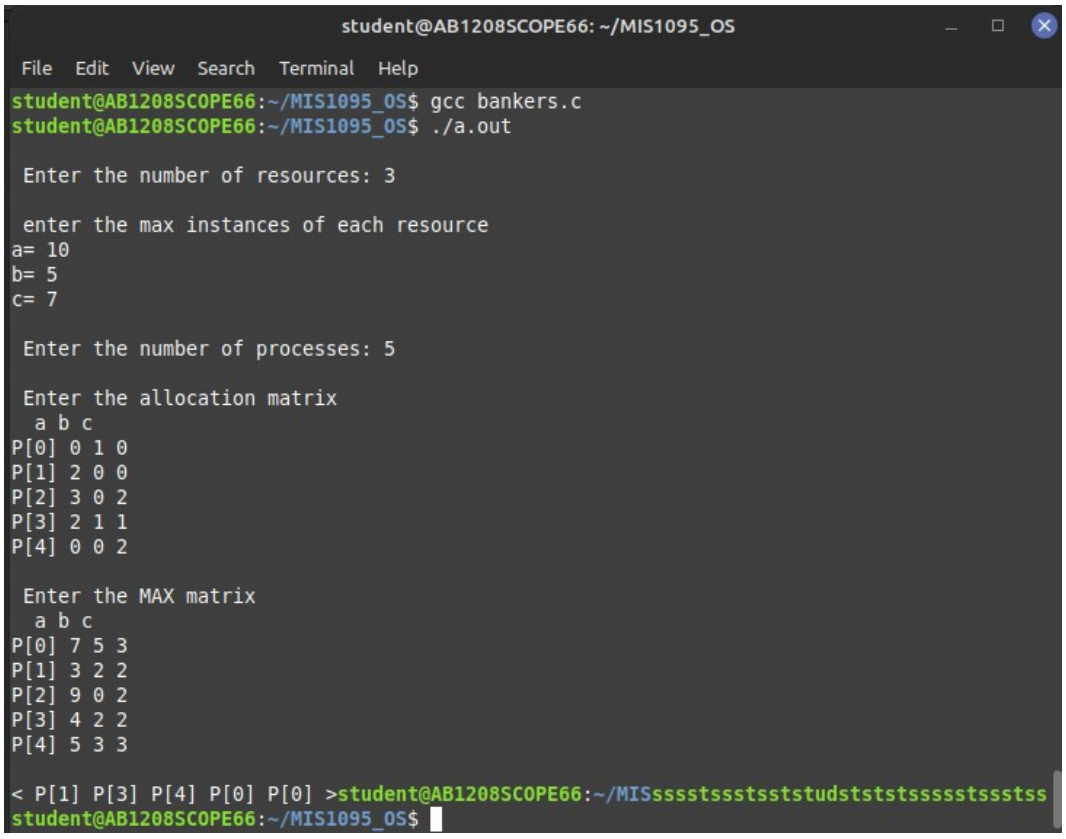
Bankers Algorithm:-

CODE:-

```
#include <stdio.h>

int main() {
int k = 0, a = 0, b = 0, instance[5], availability[5], allocated[10][5], need[10][5], MAX[10][5], process, P[10],
no_of_resources, cnt = 0, i, j;

printf("\n Enter the number of resources: ");
scanf("%d", &no_of_resources);

printf("\n enter the max instances of each resource\n");
for (i = 0; i < no_of_resources; i++) {
availability[i] = 0;
printf("%c= ", (i + 97));
scanf("%d", &instance[i]);
}

printf("\n Enter the number of processes: ");
scanf("%d", &process);

printf("\n Enter the allocation matrix\n ");
for (i = 0; i < no_of_resources; i++)
printf(" %c", (i + 97));
printf("\n");

for (i = 0; i < process; i++) {
P[i] = i;
printf("P[%d] ", P[i]);
for (j = 0; j < no_of_resources; j++) {
scanf("%d", &allocated[i][j]);
availability[j] += allocated[i][j];
}
}

printf("\n Enter the MAX matrix\n ");
for (i = 0; i < no_of_resources; i++) {
printf(" %c", (i + 97));
availability[i] = instance[i] - availability[i];
}
printf("\n");

for (i = 0; i < process; i++) {
printf("P[%d] ", i);
for (j = 0; j < no_of_resources; j++)
scanf("%d", &MAX[i][j]);
}
printf("\n");
```

```
int op[10];
a = -1;
for (i = 0; i < process; i++) {
cnt = 0;
b = P[i];
for (j = 0; j < no_of_resources; j++) {
need[b][j] = MAX[b][j] - allocated[b][j];
if (need[b][j] <= availability[j])
cnt++;
}

if (cnt == no_of_resources) {
op[k++] = P[i];
for (j = 0; j < no_of_resources; j++)
availability[j] += allocated[b][j];
} else
P[++a] = P[i];
}

printf("< ");
for (i = 0; i < process; i++) {
printf("P[%d] ", op[i]);
}
printf(">");

return 0;
}
```

OUTPUT:-

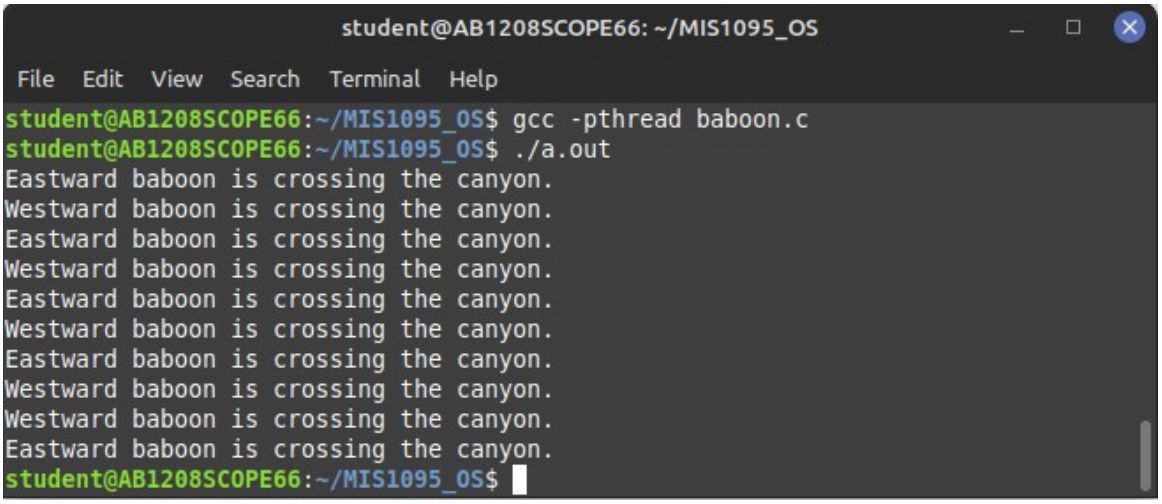


CHALLENGING QUESTION

A student majoring in anthropology and minoring in Computer Science has embarked on a research project to see if African Baboons can be taught about deadlocks. He locates a deep canyon and fastens a rope across it, so the baboons can cross hand-over-hand. Several baboons can cross at the same time, provided that they are all going in the same direction. If eastward-moving and westward-moving baboons ever get onto the rope at the same time, a deadlock will result (the baboons will be stuck in the middle) because it is impossible for one baboon to climb over another one while suspended over the canyon. If a baboon wants to cross the canyon, it must check to see that no other baboon is currently crossing in the opposite direction. Write a program using semaphores that avoid deadlock.

```
#include <stdio.h>
#include <unistd.h>
#include <pthread.h>
#include <semaphore.h>

// Define the semaphore variables
sem_t eastSem, westSem, mutex;
int eastCount = 0, westCount = 0;

void* baboonCross(void* direction) {
int dir = *(int*)direction;

if (dir == 0) { // Eastward baboon
sem_wait(&mutex);
eastCount++;
if (eastCount == 1) {
sem_wait(&westSem);
}
sem_post(&mutex);

printf("Eastward baboon is crossing the canyon.\n");
// Simulate crossing the canyon
sleep(1);

sem_wait(&mutex);
eastCount--;
if (eastCount == 0) {
sem_post(&westSem);
}
sem_post(&mutex);
} else if (dir == 1) { // Westward baboon
sem_wait(&mutex);
westCount++;
if (westCount == 1) {
```

```
sem_wait(&eastSem);
}
sem_post(&mutex);

printf("Westward baboon is crossing the canyon.\n");
// Simulate crossing the canyon
sleep(1);

sem_wait(&mutex);
westCount--;
if (westCount == 0) {
sem_post(&eastSem);
}
sem_post(&mutex);
}

pthread_exit(NULL);
}

int main() {
// Initialize the semaphores
sem_init(&eastSem, 0, 1);
sem_init(&westSem, 0, 1);
sem_init(&mutex, 0, 1);

// Create threads for baboons
pthread_t baboonThreads[10];
int directions[10] = {0, 1, 1, 0, 0, 1, 1, 0, 0, 1}; // Example directions: 0 - Eastward, 1 - Westward

for (int i = 0; i < 10; i++) {
pthread_create(&baboonThreads[i], NULL, baboonCross, (void*)&directions[i]);
}

// Wait for all baboon threads to finish
for (int i = 0; i < 10; i++) {
pthread_join(baboonThreads[i], NULL);
}

// Destroy the semaphores
sem_destroy(&eastSem);
sem_destroy(&westSem);
sem_destroy(&mutex);

return 0;
}
```


student@AB1208SCOPE66: ~/MIS1095_OS
File Edit View Search Terminal Help
student@AB1208SCOPE66:~/MIS1095_OS$ gcc -pthread baboon.c
student@AB1208SCOPE66:~/MIS1095_OS$ ./a.out
Eastward baboon is crossing the canyon.
Westward baboon is crossing the canyon.
Eastward baboon is crossing the canyon.
Westward baboon is crossing the canyon.
Eastward baboon is crossing the canyon.
Westward baboon is crossing the canyon.
Eastward baboon is crossing the canyon.
Westward baboon is crossing the canyon.
Westward baboon is crossing the canyon.
Eastward baboon is crossing the canyon.
student@AB1208SCOPE66:~/MIS1095_OS$