Ex. No.: 9
Date: 22/2/25

DEADLOCK AVOIDANCE

AIM:

To find out a safe sequence using Banker's algorithm for deadlock avoidance.

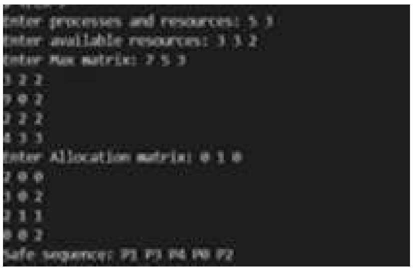
ALGORITHM:

```
1. Initialize work=available and finish[i]=false for all values of i
2. Find an i such that both:
finish[i]=false and Needi<= work
3. If no such i exists go to step 6
4. Compute work=work+allocationi
5. Assign finish[i] to true and go to step 2
6. If finish[i]==true for all i, then print safe sequence
7. Else print there is no safe sequence.
```

PROGRAM:

```
#include <stdio.h>
#include <stdbool.h>

#define MAX 10

void findSafeSequence(int n, int m, int available[], int max[][MAX], int allocation[][MAX]) {
    int work[MAX], finish[MAX] = {0}, safeSeq[MAX], need[MAX][MAX];
    for (int i = 0; i < m; i++) work[i] = available[i];
    for (int i = 0; i < n; i++)
        for (int j = 0; j < m; j++)
            need[i][j] = max[i][j] - allocation[i][j];

    int count = 0;
    while (count < n)
    {
        bool found = false;
        for (int i = 0; i < n; i++) {
            if (!finish[i]) {
                bool canAllocate = true;
                for (int j = 0; j < m; j++)
                    if (need[i][j] > work[j]) { canAllocate = false; break; }
                if (canAllocate) {
                    for (int j = 0; j < m; j++) work[j] += allocation[i][j];
                    safeSeq[count++] = i;
                    finish[i] = 1;
                    found = true;
                }
            }
        }
        if (!found) { printf("No safe sequence.\n"); return; }
    }
    printf("Safe sequence: ");
    for (int i = 0; i < n; i++) printf("P%d ", safeSeq[i]);
    printf("\n");
}

int main() {
    int n, m, available[MAX], max[MAX][MAX], allocation[MAX][MAX];

    printf("Enter processes and resources: ");
    scanf("%d %d", &n, &m);
    while (getchar() != '\n');

    printf("Enter available resources: ");
    for (int i = 0; i < m; i++) scanf("%d", &available[i]);
    while (getchar() != '\n');

    printf("Enter Max matrix: \n");
    for (int i = 0; i < n; i++)
        for (int j = 0; j < m; j++) scanf("%d", &max[i][j]);
    while (getchar() != '\n');

    printf("Enter Allocation matrix: \n");
    for (int i = 0; i < n; i++)
        for (int j = 0; j < m; j++) scanf("%d", &allocation[i][j]);
    while (getchar() != '\n');

    findSafeSequence(n, m, available, max, allocation);
    return 0;
}
```

OUTPUT:



```
Enter processes and resources: 5 3
Enter available resources: 3 3 2
Enter Max matrix: 7 5 3
3 2 2
9 0 2
2 2 2
4 3 3
Enter Allocation matrix: 0 1 0
2 0 0
3 0 2
2 1 1
0 0 2
Safe sequence: P1 P3 P4 P0 P2
```