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17.Illustrate the deadlock avoidance concept by simulating Banker's algorithm with C.

Aim

The goal of the Banker's Algorithm is to prevent deadlock by allocating system resources to processes in a safe manner, ensuring that no set of processes gets stuck indefinitely waiting for resources.

Banker's Algorithm

1. **Input**:
   - `Available[]`: Number of available instances for each resource.
   - `Maximum[][]`: Maximum resource demand for each process.
   - `Allocation[][]`: Currently allocated resources for each process.
   - `Need[][]`: Remaining resource needs (`Need[i][j] = Maximum[i][j] - Allocation[i][j]`).
2. **Steps**:
   - Compute the `Need` matrix.
   - Check if a safe sequence exists:
     - For each process, verify if its resource `Need` can be satisfied using `Available`.
     - If yes, simulate allocation and proceed to the next process.
   - If all processes can execute in some sequence without running out of resources, the state is **safe**; otherwise, it's unsafe.

Procedure

1. Input the number of processes and resources.
2. Enter the `Available`, `Maximum`, and `Allocation` matrices.
3. Calculate the `Need` matrix.
4. Run the safety algorithm to find a safe sequence.
5. If a safe sequence is found, display it; otherwise, declare the state unsafe.

Code:

```
#include <stdio.h>

#include <stdbool.h>
```

```
int main() {
    int n, m, i, j, k;
    printf("Enter number of processes: ");
    scanf("%d", &n);
    printf("Enter number of resources: ");
    scanf("%d", &m);

    int Allocation[n][m], Maximum[n][m], Need[n][m], Available[m];
    printf("Enter Allocation matrix:\n");
    for (i = 0; i < n; i++)
        for (j = 0; j < m; j++)
            scanf("%d", &Allocation[i][j]);

    printf("Enter Maximum matrix:\n");
    for (i = 0; i < n; i++)
        for (j = 0; j < m; j++)
            scanf("%d", &Maximum[i][j]);

    printf("Enter Available resources:\n");
    for (j = 0; j < m; j++)
        scanf("%d", &Available[j]);

    for (i = 0; i < n; i++)
```

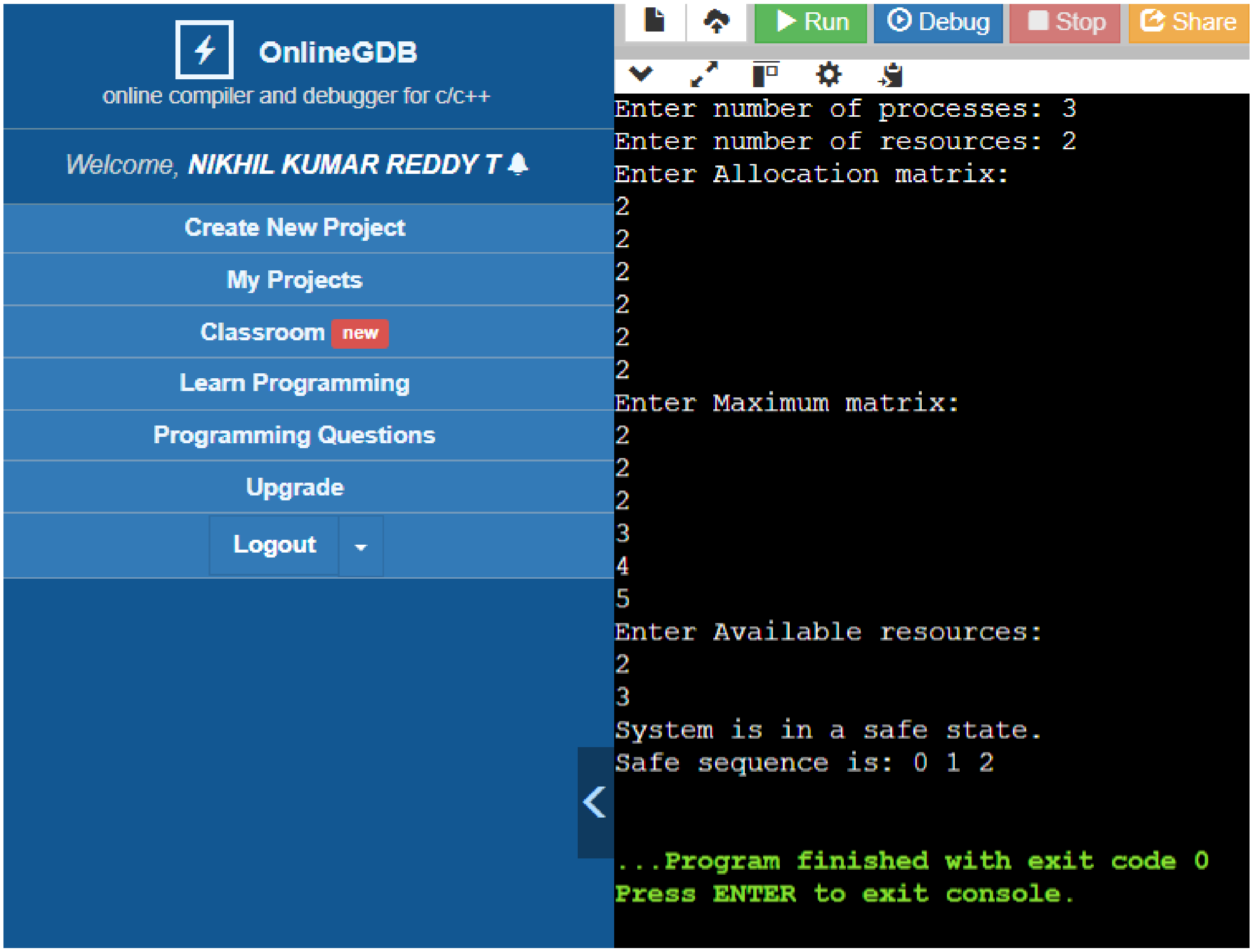
```
    for (j = 0; j < m; j++)
        Need[i][j] = Maximum[i][j] - Allocation[i][j];

bool Finish[n];
for (i = 0; i < n; i++)
    Finish[i] = false;

int SafeSequence[n], work[m];
for (j = 0; j < m; j++)
    work[j] = Available[j];

int count = 0;
while (count < n) {
    bool found = false;
    for (i = 0; i < n; i++) {
        if (!Finish[i]) {
            for (j = 0; j < m; j++)
                if (Need[i][j] > work[j])
                    break;

            if (j == m) {
                for (k = 0; k < m; k++)
                    work[k] += Allocation[i][k];
```

```
                SafeSequence[count++] = i;

                Finish[i] = true;

                found = true;

            }

        }

    }

    if (!found) {

        printf("System is in an unsafe state.\n");

        return 0;

    }

}


printf("System is in a safe state.\nSafe sequence is: ");

for (i = 0; i < n; i++)

    printf("%d ", SafeSequence[i]);

printf("\n");


return 0;

}
```

Result

1. The system checks if a safe sequence exists.
2. If found, it displays the safe sequence (e.g., `0 2 1 3`).
3. If not, it reports that the system is in an unsafe state.

Output:


OnlineGDB
online compiler and debugger for c/c++
Welcome, NIKHIL KUMAR REDDY T
Create New Project
My Projects
Classroom new
Learn Programming
Programming Questions
Upgrade
Logout
Run
Debug
Stop
Share
Enter number of processes: 3
Enter number of resources: 2
Enter Allocation matrix:
2
2
2
2
2
2
Enter Maximum matrix:
2
2
2
3
4
5
Enter Available resources:
2
3
System is in a safe state.
Safe sequence is: 0 1 2
...Program finished with exit code 0
Press ENTER to exit console.