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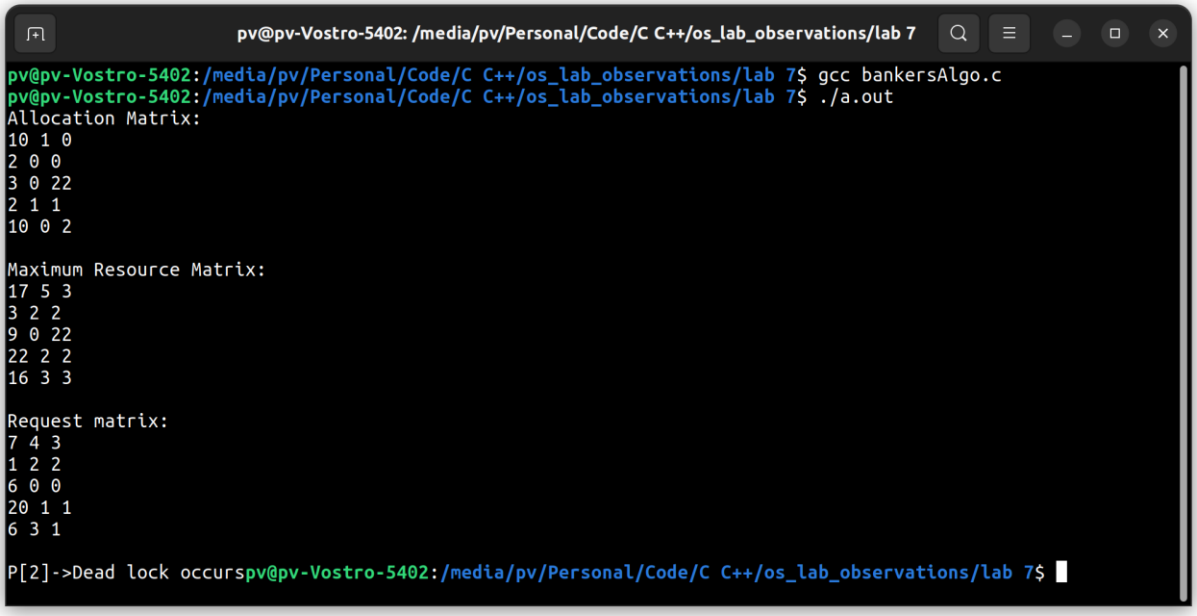
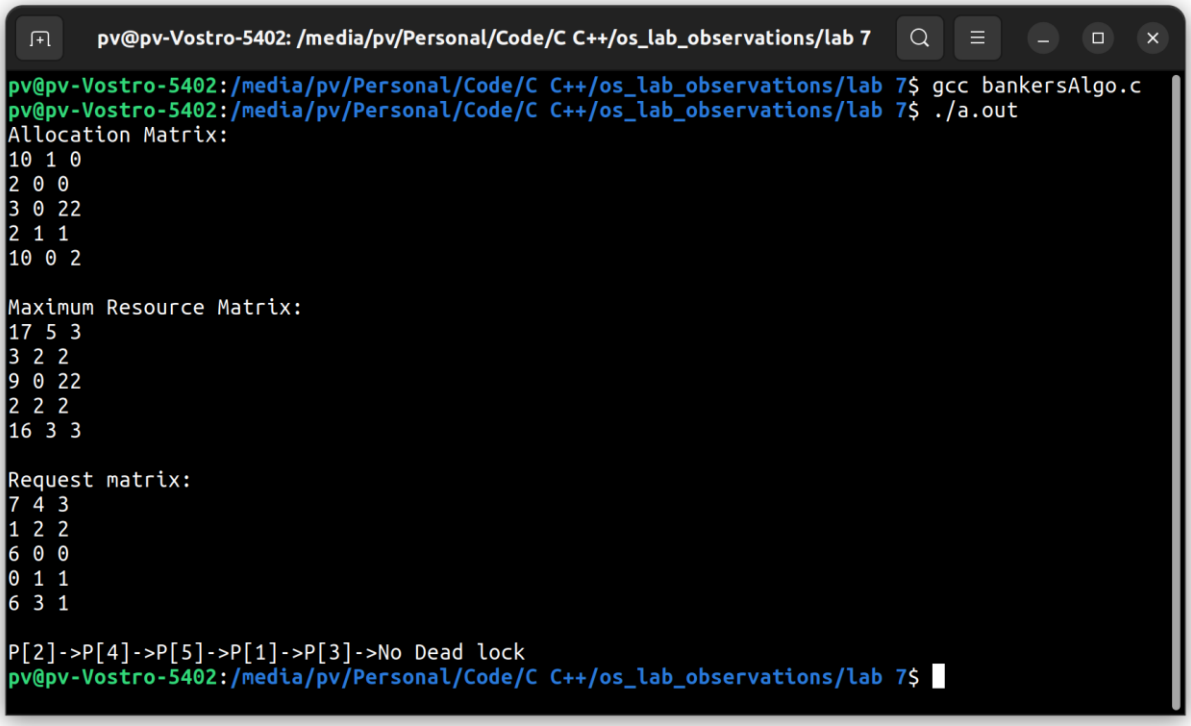
L21_L22_Lab7 Exercises

1) Implement the banker's algorithm for n processes with m resources. Show the execution of your C program using suitable data set

   a. with deadlock and



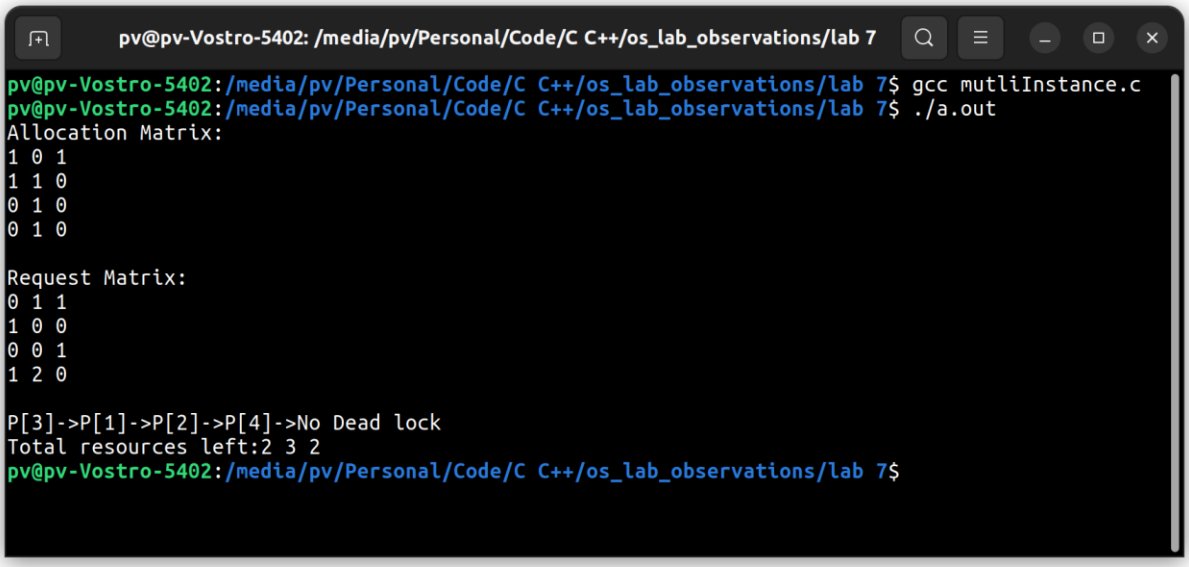
   b. without dead lock.

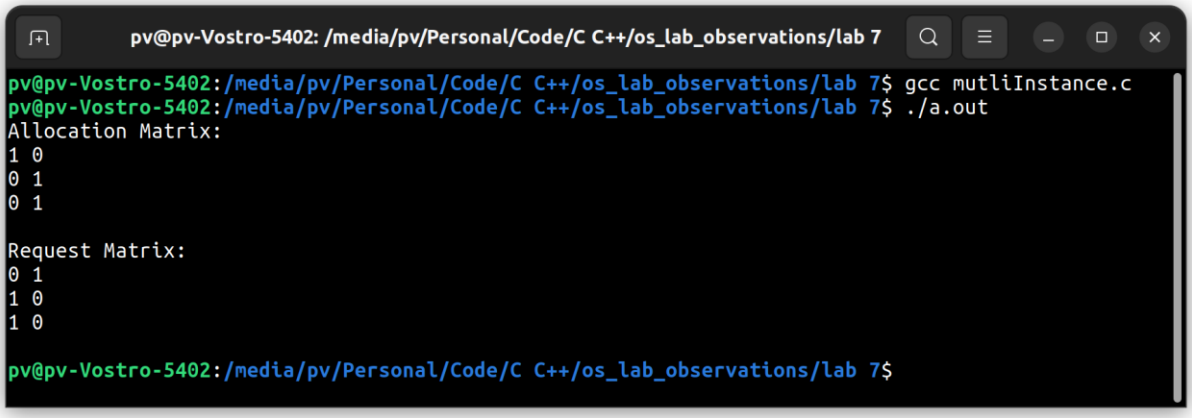


```
#include<stdio.h>
#include<stdbool.h>
#define row 5
#define col 3
bool final[row];
void initailFinal()
{
for(int i=0;i<row;i++)
final[i]=false;
}
void pout(int a[row][col])
{
for(int i=0;i<row;i++)
{
for(int j=0;j<col;j++)
printf("%d ",a[i][j]);
printf("\n");
}
printf("\n");
}

void pr(int a[col])
{

for(int i=0;i<col;i++)
{
printf("%d ",a[i]);

}
}

int main()
{
int allocation[row][col]={{10,1,0},{2,0,0},{3,0,22},{2,1,1},{10,0,2}};
printf("Allocation Matrix:\n");
pout(allocation);
int max[row][col]={{17,5,3},{3,2,2},{9,0,22},{2,2,2},{16,3,3}};
printf("Maximum Resource Matrix:\n");
pout(max);
int request[row][col];
int available[col]={3,3,2};
int cavailable[col];
int x=row;

for(int i=0;i<row;i++)
for(int j=0;j<col;j++)
request[i][j]=max[i][j]-allocation[i][j];
printf("Request matrix:\n");
pout(request);

initailFinal();

for(int i=0;i<col;i++)
```

```
{
cavailable[i]=available[i];

}
int j=0,count=0;
for(int k=0;k<row;k++)
//while(x!=0)
{
for(int i=0;i<row;i++)
{
if(final[i]==false)
{
        count=0;
        for(int j=0;j<col;j++)
        {
                if(cavailable[j]>=request[i][j])
                {
                        count++;
                }
        }
        if(count==col)
        {
                //printf("P[%d]->",i+1);
                for(int j=0;j<col;j++)
                {
                cavailable[j]+=allocation[i][j];
                }
                final[i]=true;
                x--;
        }
}

}
}

for(int i=0;i<row;i++)
{
if(final[i]==0)
x=1;
}
if(x!=1)
{
printf("No Dead lock\nTotal resources left:");
//pr(cavailable);
}

else
printf("Dead lock occurs");
//pout(request);
return 0;
}
```

2) Develop the C program to check whether there is a deadlock or not from Multiple Instance Resource Allocation Graph.

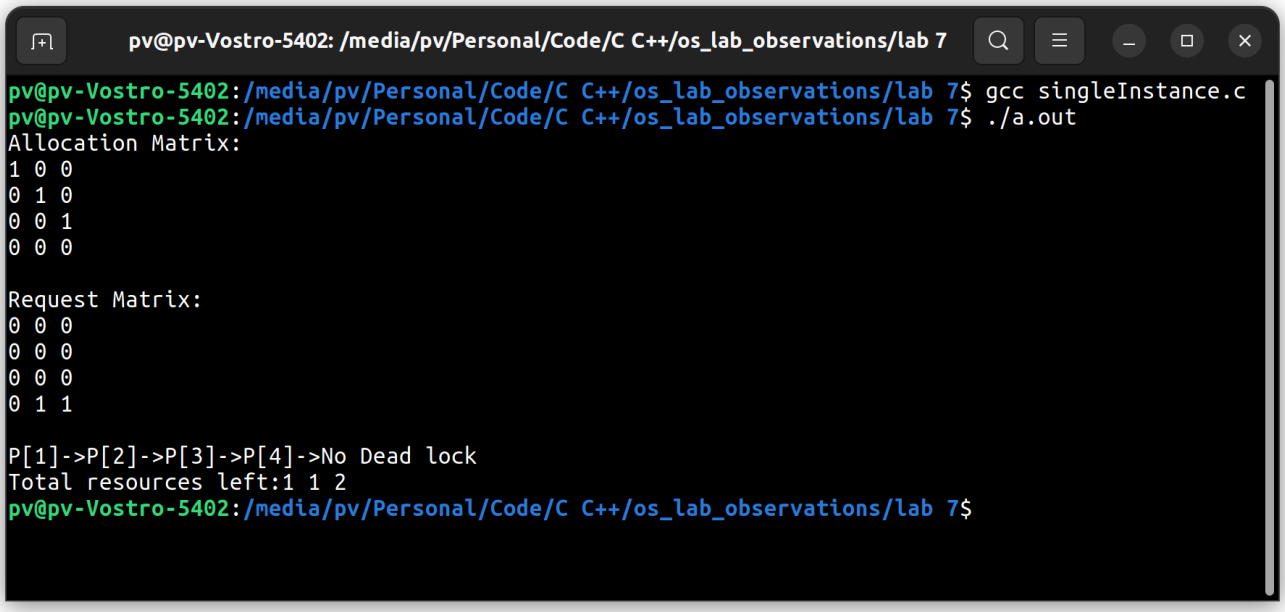


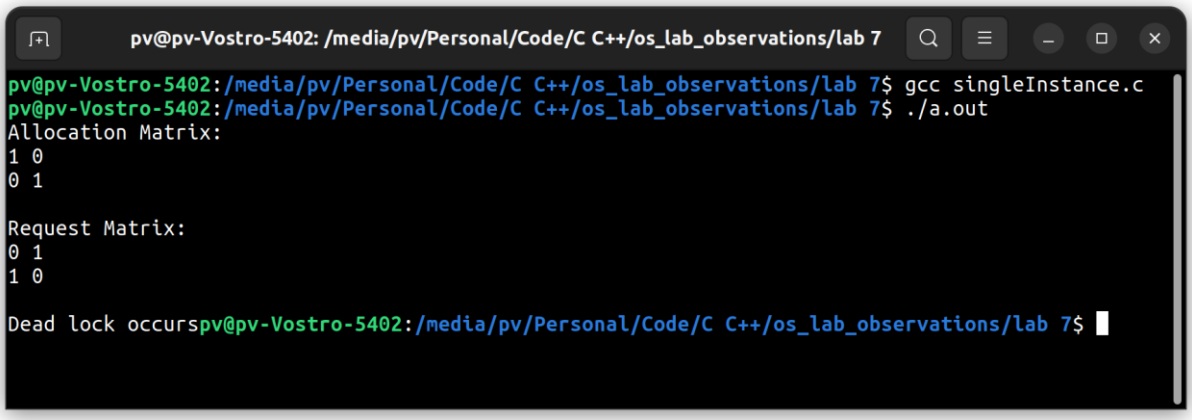


```c
#include<stdio.h>
#include<stdbool.h>
#define row 3
#define col 2
bool final[row];
void initailFinal()
{
for(int i=0;i<row;i++)
final[i]=false;
}
void pout(int a[row][col])
{
for(int i=0;i<row;i++)
{
for(int j=0;j<col;j++)
printf("%d ",a[i][j]);
printf("\n");
}
printf("\n");
}

void pr(int a[col])
{

for(int i=0;i<col;i++)
{
printf("%d ",a[i]);
}
printf("\n");
}

int main()
{
int allocation[row][col]={{1,0},{0,1},{0,1}};
printf("Allocation Matrix:\n");
pout(allocation);
int request[row][col]={{0,1},{1,0},{1,0}};
printf("Request Matrix:\n");
pout(request);
int available[col]={0,0};
int cavailable[col];
int x=row;
initailFinal();

for(int i=0;i<col;i++)
{
cavailable[i]=available[i];
}

int count=0;
for(int k=0;k<row;k++)
//while(x!=0)
{
```

```
for(int i=0;i<row;i++)
{
if(final[i]==false)
{
        count=0;
        for(int j=0;j<col;j++)
        {
                if(cavailable[j]>=request[i][j])
                {
                        count++;
                }
        }
        if(count==col)
        {
                printf("P[%d]->",i+1);
                for(int j=0;j<col;j++)
                {
                cavailable[j]+=allocation[i][j];
                }
                final[i]=true;
                x--;
        }
}

}
}

for(int i=0;i<row;i++)
{
if(final[i]==0)
x=1;
}
if(x!=1)
{
printf("No Dead lock\nTotal resources left:");
pr(cavailable);
}

else
printf("Dead lock occurs");
//pout(request);
return 0;
}
```

3) Develop the C program to check whether there is a deadlock or not from Single Instance Resource Allocation Graph.





```c
#include<stdio.h>
#include<stdbool.h>
#define row 2
#define col 2
bool final[row];
void initailFinal()
{
	for(int i=0;i<row;i++)
	final[i]=false;
}
void pout(int a[row][col])
{
	for(int i=0;i<row;i++)
	{
		for(int j=0;j<col;j++)
		printf("%d ",a[i][j]);
		printf("\n");
	}
	printf("\n");
}

void pr(int a[col])
{
	for(int i=0;i<col;i++)
	{
		printf("%d ",a[i]);
	}
	printf("\n");
}

int main()
{
int allocation[row][col]={{1,0},{0,1}};
printf("Allocation Matrix:\n");
pout(allocation);
int request[row][col]={{0,1},{1,0}};
printf("Request Matrix:\n");
pout(request);
int available[col]={0,0};
int cavailable[col];
int x=row;
initailFinal();

for(int i=0;i<col;i++)
{
cavailable[i]=available[i];
}

int count=0;
for(int k=0;k<row;k++)
//while(x!=0)
{
for(int i=0;i<row;i++)
```

```
{
if(final[i]==false)
{
        count=0;
        for(int j=0;j<col;j++)
        {
                if(cavailable[j]>=request[i][j])
                {
                        count++;
                }
        }
        if(count==col)
        {
                printf("P[%d]->",i+1);
                for(int j=0;j<col;j++)
                {
                cavailable[j]+=allocation[i][j];
                }
                final[i]=true;
                x--;
        }
}

}
}

for(int i=0;i<row;i++)
{
if(final[i]==0)
x=1;
}
if(x!=1)
{
printf("No Dead lock\nTotal resources left:");
pr(cavailable);
}

else
printf("Dead lock occurs");
//pout(request);
return 0;
}
```

4) Modify the question to read the data from the file "a.txt" and implement the banker's algorithm for the same.

```
pv@pv-Vostro-5402: /media/pv/Personal/Code/C C++/...
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$ cat a.txt
AllocationMatrix:
10 1 0
2 0 0
3 0 22
2 1 1
10 0 2
MaximumResourceMatrix:
17 5 3
3 2 2
9 0 22
2 2 2
16 3 3
AvailableMatrix:
3 3 2
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$ gcc fileBankers.c
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$ ./a.out
AllocationMatrix:
10 1 0
2 0 0
3 0 22
2 1 1
10 0 2

MaximumResourceMatrix:
17 5 3
3 2 2
9 0 22
2 2 2
16 3 3

AvailableMatrix:
3 3 2
Request matrix:
7 4 3
1 2 2
6 0 0
0 1 1
6 3 1

P[2]->P[4]->P[5]->P[1]->P[3]->No Dead lock
Total resources left:30 5 27
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$
```

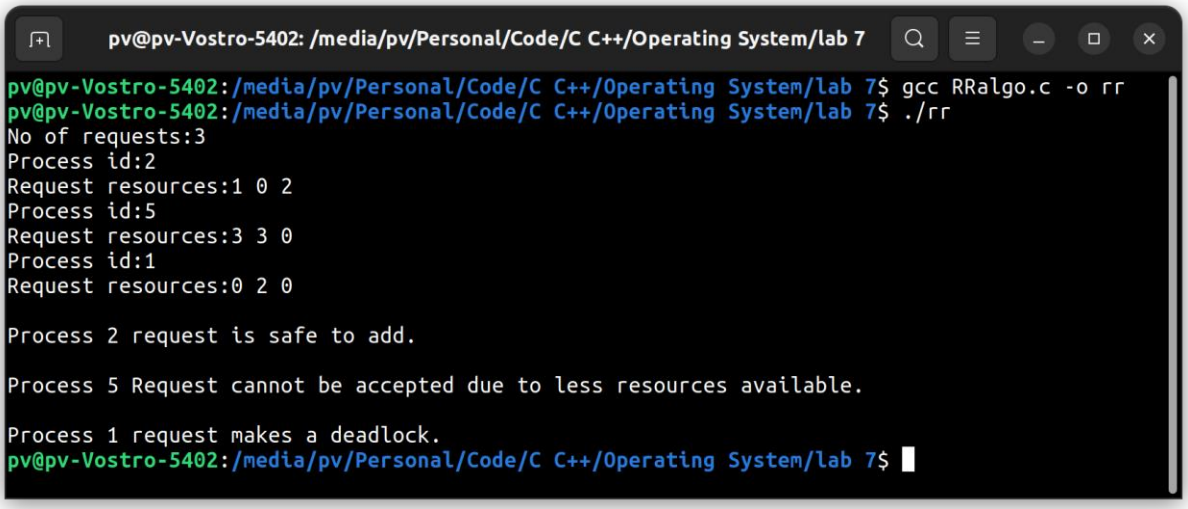
```
pv@pv-Vostro-5402: /media/pv/Personal/Code/C C++/os_lab_observations/lab 7
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$ gcc fileBankers.c
pv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$ ./a.out
AllocationMatrix:
10 1 0
2 0 0
3 0 22
2 1 1
10 0 2

MaximumResourceMatrix:
17 5 3
3 2 2
9 0 22
25 2 2
16 3 3

AvailableMatrix:
3 3 2
Request matrix:
7 4 3
1 2 2
6 0 0
23 1 1
6 3 1

P[2]->Dead lock occurspv@pv-Vostro-5402:/media/pv/Personal/Code/C C++/os_lab_observations/lab 7$
```

```
#include<stdio.h>
#include<stdbool.h>
#define row 5
#define col 3
bool final[row];
void initailFinal()
{
for(int i=0;i<row;i++)
final[i]=false;
}
void pout(int a[row][col])
{
for(int i=0;i<row;i++)
{
for(int j=0;j<col;j++)
printf("%d ",a[i][j]);
printf("\n");
}
printf("\n");
}

void pr(int a[col])
{

for(int i=0;i<col;i++)
{
printf("%d ",a[i]);
}
printf("\n");
}

int main()
{
char  name[30];
FILE *fp=fopen("a.txt","r");
int allocation[row][col];
fscanf(fp,"%s",name);
printf("%s\n",name);
for(int i=0;i<row;i++)
for(int j=0;j<col;j++)
fscanf(fp,"%d",&allocation[i][j]);
pout(allocation);


fscanf(fp,"%s",name);
int max[row][col];
for(int i=0;i<row;i++)
for(int j=0;j<col;j++)
fscanf(fp,"%d",&max[i][j]);
printf("%s\n",name);
pout(max);

int request[row][col];
```

```
fscanf(fp,"%s",name);
printf("%s\n",name);
int available[col];
for(int i=0;i<col;i++)
fscanf(fp,"%d",&available[i]);
pr(available);
fclose(fp);
int cavailable[col];
int x=row;

for(int i=0;i<row;i++)
for(int j=0;j<col;j++)
request[i][j]=max[i][j]-allocation[i][j];
printf("Request matrix:\n");
pout(request);

initailFinal();

for(int i=0;i<col;i++)
{
cavailable[i]=available[i];

}
int j=0,count=0;
for(int k=0;k<row;k++)
//while(x!=0)
{
for(int i=0;i<row;i++)
{
if(final[i]==false)
{
        count=0;
        for(int j=0;j<col;j++)
        {
                if(cavailable[j]>=request[i][j])
                {
                        count++;
                }
        }
        if(count==col)
        {
                printf("P[%d]->",i+1);
                for(int j=0;j<col;j++)
                {
                cavailable[j]+=allocation[i][j];
                }
                final[i]=true;
                x--;
        }
}

}
}
```

```
for(int i=0;i<row;i++)
{
if(final[i]==0)
x=1;
}
if(x!=1)
{
printf("No Dead lock\nTotal resources left:");
pr(cavailable);
}

else
printf("Dead lock occurs");
//pout(request);
return 0;
}
```

5) Resource Request Algorithm:




```c
#include<stdio.h>
#include<stdbool.h>
#define row 5
#define col 3
void initailFinal(bool final[])
{
for(int i=0;i<row;i++)
	final[i]=false;
}
void print_2d(int a[row][col])
{
	for(int i=0;i<row;i++)
	{
		for(int j=0;j<col;j++)
			printf("%d ",a[i][j]);
		printf("\n");
	}
	printf("\n");
}
void print_1d(int a[col])
{
for(int i=0;i<col;i++)
	printf("%d ",a[i]);
}
int compare(int a[col],int b[col])
{
	int x=0;
		for(int i=0;i<col;i++)
		{

		if(a[i]<=b[i])
		    x++;
		}
		if(x==col)
		return 1;
```

```
            else
            return 0;
}

int bankers(int allocation[row][col],int request[row][col],int available[col])
{
        int cavailable[col];
        int x=row;
        bool final[row];
            initailFinal(final);
            for(int i=0;i<col;i++)
                cavailable[i]=available[i];
        int j=0,count=0;
            for(int k=0;k<row;k++)
            {
                for(int i=0;i<row;i++)
                {
                    if(final[i]==false)
                    {
                        count=0;
                        for(int j=0;j<col;j++)
                        {
                            if(cavailable[j]>=request[i][j])
                                count++;
                        }
                        if(count==col)
                        {
                            for(int j=0;j<col;j++)
                            {
                            cavailable[j]+=allocation[i][j];
                            }
                            final[i]=true;
                            x--;
                        }
                    }
                }
            }

            for(int i=0;i<row;i++)
            {
            if(final[i]==0)
            x=1;
            }
            if(x!=1)
            {
            return 0;
            }
            else
            return 1;
}

void process(int x,int resources_request[][col],int allocation[row][col],int request[row][col],int
available[col],int k)
```

```
{
	int t;
	int new_allocation[row][col],new_request[row][col],new_available[col];
		for(int i=0;i<row;i++)
		{
			for(int j=0;j<col;j++)
			{
			new_allocation[i][j]=allocation[i][j];
			new_request[i][j]=request[i][j];
			new_available[j]=available[j];
			}
		}
	if(compare(resources_request[k],new_available))
		{
		for(int i=0;i<col;i++)
		{
		t=resources_request[k][i];
		new_allocation[x][i]=new_allocation[x][i]+t;
		new_available[i]=new_available[i]-t;
		new_request[x][i]=new_request[x][i]-t;
		}

	if(bankers(new_allocation,new_request,new_available)==0)
	{
		printf("\nProcess %d request is safe to add.\n",x+1);

		for(int i=0;i<col;i++)
		{
		t=resources_request[k][i];
		allocation[x][i]=allocation[x][i]+t;
		available[i]=available[i]-t;
		request[x][i]=request[x][i]-t;
		}
	}

		else
		printf("\nProcess %d request makes a deadlock.\n",x+1);
		}
		else
		printf("\nProcess %d Request cannot be accepted due to less resources
available.\n",x+1);
}

void resourceRequest(int allocation[row][col],int request[row][col],int available[col])
{
	int n,x;
		printf("No of requests:");
		scanf("%d",&n);
	int process_request[n];
	int resources_request[n][col];
		for(int i=0;i<n;i++)
		{
		printf("Process id:");
```

```
            scanf("%d",&process_request[i]);
            printf("Request resources:");
            for(int j=0;j<col;j++)
            scanf("%d",&resources_request[i][j]);
            }
            for(int i=0;i<n;i++)
            {
            x=process_request[i]-1;
        process(x,resources_request,allocation,request,available,i);
            }
}

int main()
{
        int allocation[row][col]={{10,1,0},{2,0,0},{3,0,22},{2,1,1},{10,0,2}};
            //printf("Allocation Matrix:\n");
            //print_2d(allocation);
        int max[row][col]={{17,5,3},{3,2,2},{9,0,22},{2,2,2},{16,3,3}};
            //printf("Maximum Resource Matrix:\n");
            //print_2d(max);
        int request[row][col];
        int available[col]={3,3,2};
            for(int i=0;i<row;i++)
            for(int j=0;j<col;j++)
            request[i][j]=max[i][j]-allocation[i][j];
        resourceRequest(allocation,request,available);
return 0;
}
```