#include<stdio.h>

#define N 100

#define M 100

int max[M][N];

int allocated[M][N];

int need[M][N];

int available[N];

int work[N];

int finish[M];//boolean 0 or 1

int safestate[M];

int request[N];

int flag=0;

//m=no of processes

//n=no of resources

void init(int m){

int i=0;

for(i=0;i<m;i++){

finish[i]=0;safestate[i]=0;

}

}

void resourcerequest(int pno,int m,int n){

int i,j;

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

if(request[i]>need[pno][i]){

flag=1;

break;

}

}

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

if(request[i]>available[i]){

flag=1;

break;

}

}

if(flag==1){

printf("It can not be granted\n");

return;

}

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

allocated[pno][i]+=request[i];

available[i]-=request[i];

need[pno][i]-=request[i];

}

init(m);

if(safestatealgo(m,n)==1){

printf("The safe state is as follows:\n");

for(j=0;j<m;j++){

printf("%d ",safestate[j]);

}

printf("Request has been granted\n");

}

else{

printf("Request has not been granted because not in safe state\n");

}

}

void fillneed(int m,int n){

int i,j;

for(i=0;i<m;i++){

for(j=0;j<n;j++){

need[i][j]=max[i][j]-allocated[i][j];

}

}

}

int safestatealgo(int m,int n){

int i,j,k,t;

k=0;

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

work[i]=available[i];

}

for(t=0;t<m;t++){

for(j=0;j<m;j++){

flag=0;

if(finish[j]==1){

//printf("t:%d\n",t);

continue;

}

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

if(need[j][i]>work[i]){

flag=1;

break;

}

}

if(flag==0){

finish[j]=1;

//printf("j:%d\n",j);

safestate[k]=j;

k++;

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

work[i]+=allocated[j][i];

}

}

}

}

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

if(finish[i]==0)

return 0;

}

return 1;

}

int main(){

int m,n,i,j,procno;

printf("Enter the no of processes and no of resources");

scanf("%d %d",&m,&n);

printf("Enter the max array\n");

for(i=0;i<m;i++){

for(j=0;j<n;j++){

scanf("%d",&max[i][j]);

}

}

printf("Enter the allocated array\n");

for(i=0;i<m;i++){

for(j=0;j<n;j++){

scanf("%d",&allocated[i][j]);

}

}

printf("Enter the available array\n");

for(j=0;j<n;j++){

scanf("%d",&available[j]);

}

fillneed(m,n);

if(safestatealgo(m,n)==1){

printf("The safe state is as follows:\n");

for(j=0;j<m;j++){

printf("%d ",safestate[j]);

}

printf("\nEnter the process no:");

scanf("%d",&procno);

printf("\nEnter the request array...\n");

for(j=0;j<n;j++){

scanf("%d",&request[j]);

}

resourcerequest(procno,m,n);

}

else{

printf("Not in safe state\n");

}

return 0;

}