4. Write a C program to simulate Real-Time CPU Scheduling algorithms:
a) Rate- Monotonic
b) Earliest-deadline First

Code:

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


int et[10], i, n, dl[10], p[10], ready[10], flag = 1;

int lcm(int a, int b) {
    int max = (a > b) ? a : b;
    while (1) {
        if (max % a == 0 && max % b == 0)
            return max;
        max++;
    }
}

int lcmArray(int arr[], int n) {
    int result = arr[0];
    for (int i = 1; i < n; i++) {
        result = lcm(result, arr[i]);
    }
    return result;
}

void mono() {
    int time = lcmArray(dl, n);
    int op = 0, pr = 0, pre = pr;



    while (op <= time) {
        for (i = 0; i < n; i++) {
            if (op % dl[i] == 0) {
                ready[i] = 1;
            }
        }

        flag = 0;
```

```
        for (i = 0; i < n; i++) {
            if (ready[i] == 1) {
                flag = 1;
                break;
            }
        }

        if (flag == 0) {
            pr = -1;
        } else {
            pr = -1;
            for (i = 0; i < n; i++) {
                if (ready[i] == 1) {
                    if (pr == -1 || dl[i] < dl[pr]) {
                        pr = i;
                    }
                }
            }
        }


            if (pr != pre) {
                if (pr == -1) {
                    printf("%d Idle ",op);
                } else {
                    printf("%d P%d ",op, pr + 1);
                }
            }

        op++;
        if (pr != -1) {
            p[pr] = p[pr] - 1;
            if (p[pr] == 0) {
                p[pr] = et[pr];
                ready[pr] = 0;
            }
        }

        pre = pr;
    }

    printf("\n");
}
```

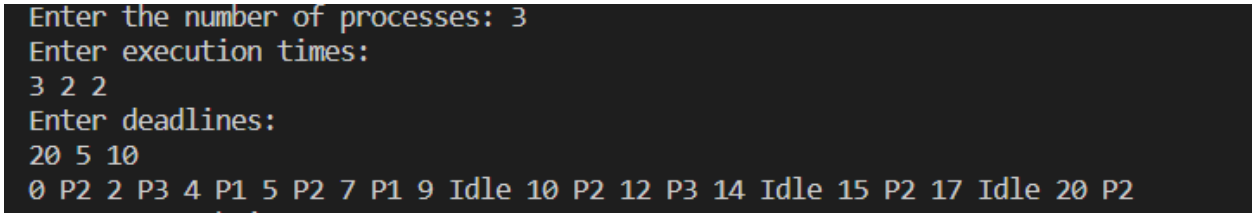
```
void edf() {
    int time = lcmArray(dl, n);
    int op = 0, pr = 0, pre = -1;
    int flag, i;

    while (op <= time) {
        for (i = 0; i < n; i++) {
            if (op % dl[i] == 0) {
                ready[i] = 1;
            }
        }

        flag = 0;
        for (i = 0; i < n; i++) {
            if (ready[i] == 1) {
                flag = 1;
                break;
            }
        }

        if (flag == 0) {
            pr = -1;
        } else {
            pr = -1;
            for (i = 0; i < n; i++) {
                if (ready[i] == 1) {
                    if (pr == -1 || p[i] < p[pr]) {
                        pr = i;
                    }
                }
            }
        }

        if (pr != pre) {
            if (pr == -1) {
                printf("%d Idle ", op);
            } else {
                printf("%d P%d ", op, pr + 1);
            }
        }

        op++;
```

```
        if (pr != -1) {
            p[pr] = p[pr] - 1;
            if (p[pr] == 0) {
                p[pr] = et[pr];
                ready[pr] = 0;
            }
        }

        pre = pr;
    }

    printf("\n");
}



void prop() {
    // Implementation for proportional share scheduling algorithm
}

int main() {
    int ch, k = 1;
    while (k) {
        printf("Enter your choice: \n1. Monotonic \n2. EDF \n3. Proportional \n4. Exit\n");
        scanf("%d", &ch);
        if(ch==4)
        exit(0);
        printf("Enter the number of processes: ");
        scanf("%d", &n);
        printf("Enter execution times: \n");
        for (i = 0; i < n; i++)
            scanf("%d", &et[i]);

        printf("Enter deadlines: \n");
        for (i = 0; i < n; i++)
            scanf("%d", &dl[i]);

        for (i = 0; i < n; i++)
            p[i] = et[i];

        for (i = 0; i < n; i++)
            ready[i] = 0;
```

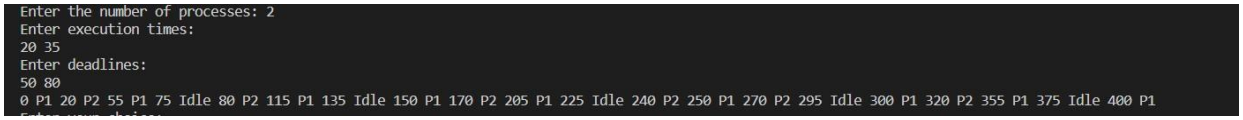
```
        switch (ch) {
            case 1:
                mono();
                break;

            case 2:
                edf();
                break;

            case 3:
                prop();
                break;

            case 4:
                k = 0;
                break;

            default:
                printf("Invalid choice.\n");
        }
    }

    return 0;
}
```

Output:

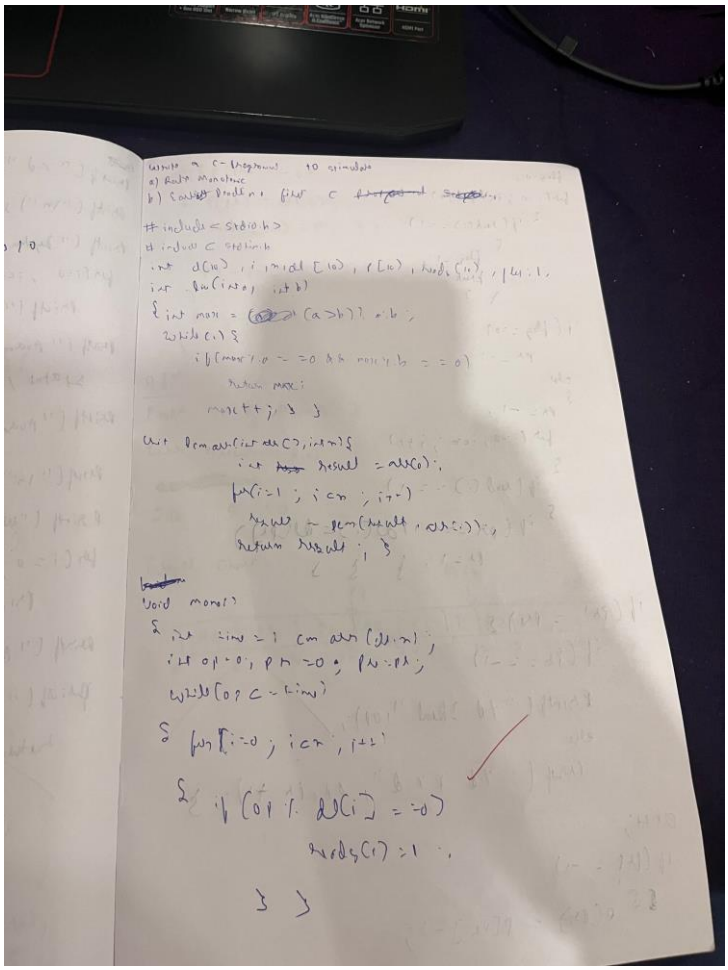
Rate Monotonic:

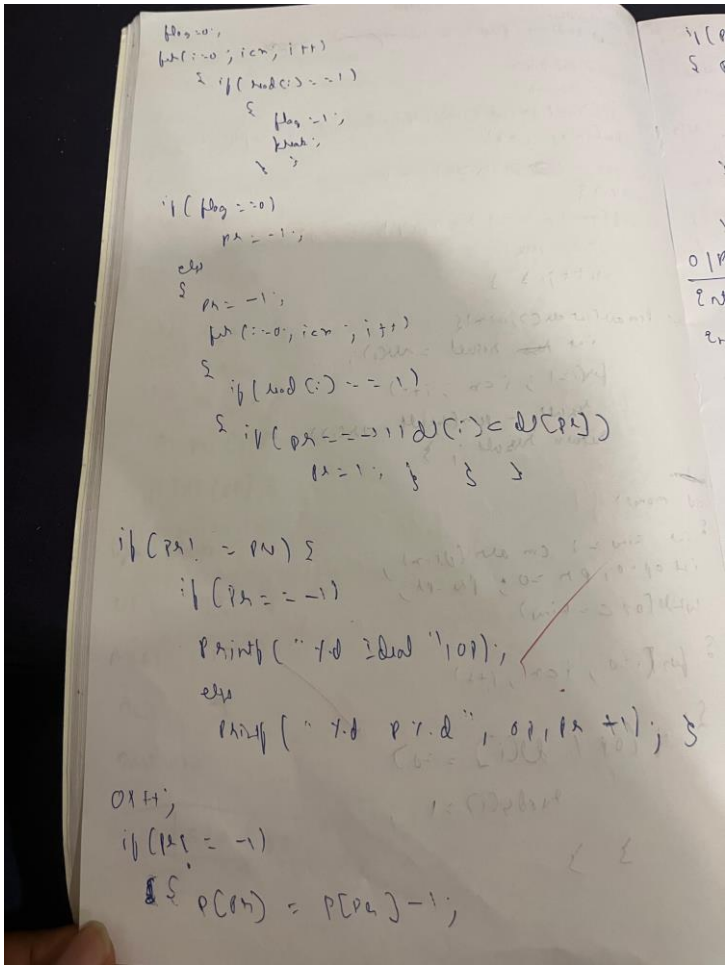


Earliest Deadline First:



Observation:





```
if (p(pi) == 0)
{ p(pi) = ct(pi);
  rembt(pi) = 0; } }

  px = pi;
}
printf("\n");
}
```

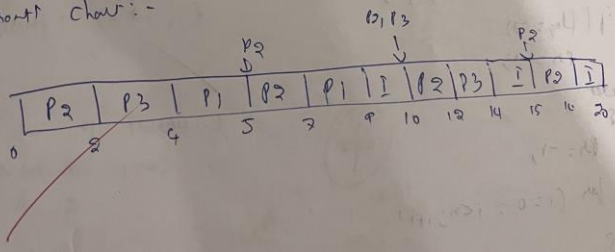
O/P

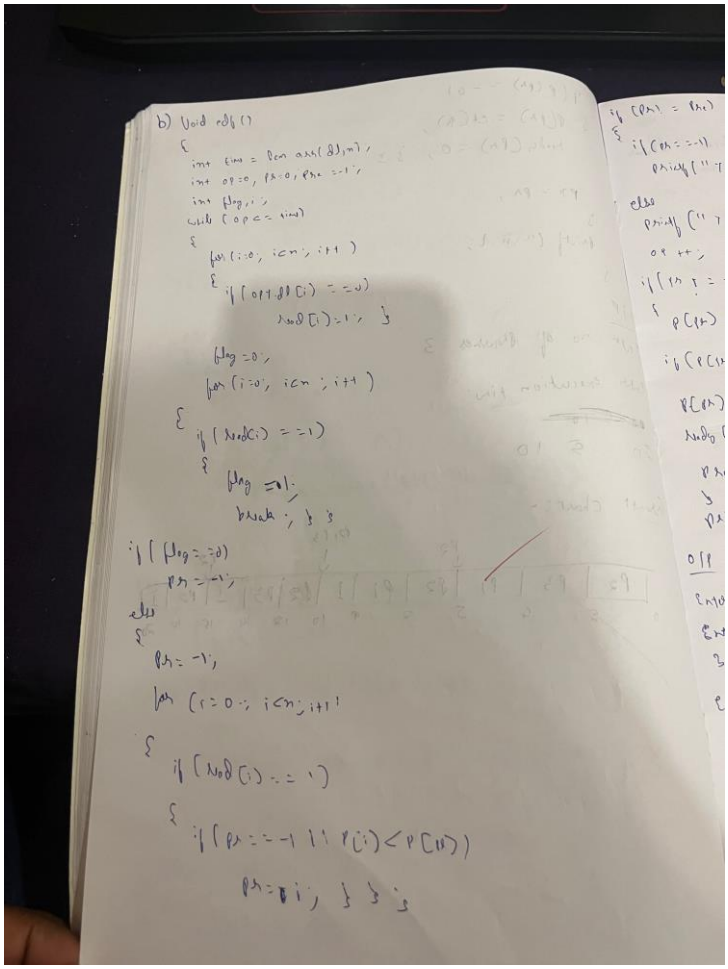
Enter no of processes : 3

Enter execution time:

20 5 10

Gantt chart :-





b) void edf()
{
int time = 0, n = 3, m;
int op = 0, ps = 0, pre = -1;
int flag;
while (ope < time)
{
for (i = 0; i < n; i++)
{
if (opt[i] == 0)
used[i] = 1; }
flag = 0;
for (i = 0; i < n; i++)
{
if (used[i] == 1)
{
flag = 1;
break; } }
if (flag == 0)
ps = -1;
else
{
ps = -1;
for (i = 0; i < n; i++)
{
if (used[i] == 1)
{
if (ps == -1 || p[i] < p[ps])
ps = i; } } }

```
if (pr != prc)
{
 if (pr == -1)
   printf(" %d : Idle ", op);
else
 printf (" %d P %d" ,op, pr+1);
 op ++;
if (pr != -1)
{ p[pr] -= 1;
if (p[pr] == 0){
p[pr] = ct[pr];
nodp [pr] = 0; } }
 prc = pr;
}
printf ("\n"); }
```

O/P

Enter no of processes : 3

Enter execution times :

3 2 2

Enter deadline :

20 5 10

P2	P3	P1	P2	Idle	P2	P3	I	P2	I

0, 2, 4, 7, 9, 10, 12, 14, 15, 17, 20

Tracing

10/10

19/7/23