1. MULTILEVEL CPU SCHEDULING:

#include<stdio.h>

int a[10][4],b[10][4],tat=0,wt=0,time=0;

float tot\_tat=0,tot\_wt=0;

void swap(int \*x,int \*y)

{

int t;

t=\*x;

\*x=\*y;

\*y=t;

}

void sort(int j,int m)

{

int i,k,t;

if(m==1)

{

printf("Process %d executed for %d time units\n",a[j][0],a[j][2]);

tat+=a[j][2];

tot\_tat+=tat;

time+=a[j][2];

wt=tat-a[j][1];

tot\_wt+=wt;

printf("Turnaround time=%d, Waiting time=%d\n",tat,wt);

}

else

{

for(i=j;i<j+m;i++)

{

for(k=i+1;k<j+m;k++)

{

if(a[i][3]>a[k][3])

{

swap(&a[i][0],&a[k][0]);

swap(&a[i][1],&a[k][1]);

swap(&a[i][2],&a[k][2]);

swap(&a[i][3],&a[k][3]);

}

}

}

printf("Process %d executed for %d time units\n",a[j][0],a[j][2]);

tat+=a[j][2];

tot\_tat+=tat;

time+=a[j][2];

wt=tat-a[j][1];

tot\_wt+=wt;

printf("Turnaround time=%d, Waiting time=%d\n",tat,wt);

}

}

void main()

{

int n,i,j;

printf("Enter the number of processes:");

scanf("%d",&n);

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

{

a[i][0]=i+1;

printf("Enter process %d details: Arrival time,burst time, system(0)/user(1)\n",a[i][0]);

scanf("%d",&a[i][1]);

scanf("%d",&a[i][2]);

scanf("%d",&a[i][3]);

}

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

{

int k=0;

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

{

if(a[j][1]<=time)

{

k++;

}

}

sort(i,k);

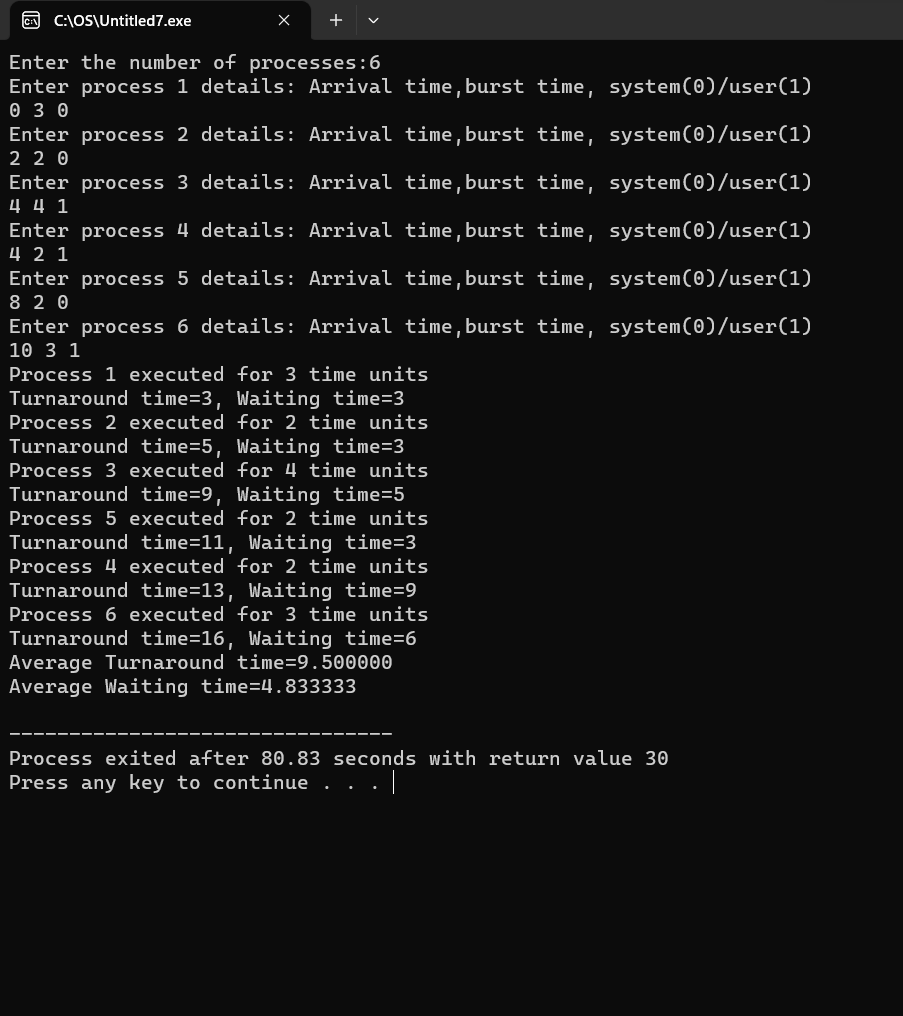
}

printf("Average Turnaround time=%f\n",tot\_tat/n);

printf("Average Waiting time=%f\n",tot\_wt/n);

}

OUTPUT:



1. RATE MONOMOTIC SCHEDULING:

#include <stdio.h>

#include <stdlib.h>

#include <math.h>

#include <stdbool.h>

#define MAX\_PROCESS 10

int num\_of\_process = 3, count, remain, time\_quantum;

int execution\_time[MAX\_PROCESS], period[MAX\_PROCESS], remain\_time[MAX\_PROCESS], deadline[MAX\_PROCESS], remain\_deadline[MAX\_PROCESS];

int burst\_time[MAX\_PROCESS], wait\_time[MAX\_PROCESS], completion\_time[MAX\_PROCESS], arrival\_time[MAX\_PROCESS];

// collecting details of processes

void get\_process\_info(int selected\_algo)

{

printf("Enter total number of processes (maximum %d): ", MAX\_PROCESS);

scanf("%d", &num\_of\_process);

if (num\_of\_process < 1)

{

printf("Do you really want to schedule %d processes? -\_-", num\_of\_process);

exit(0);

}

if (selected\_algo == 2)

{

printf("\nEnter Time Quantum: ");

scanf("%d", &time\_quantum);

if (time\_quantum < 1)

{

printf("Invalid Input: Time quantum should be greater than 0\n");

exit(0);

}

}

for (int i = 0; i < num\_of\_process; i++)

{

printf("\nProcess %d:\n", i + 1);

if (selected\_algo == 1)

{

printf("==> Burst time: ");

scanf("%d", &burst\_time[i]);

}

else if (selected\_algo == 2)

{

printf("=> Arrival Time: ");

scanf("%d", &arrival\_time[i]);

printf("=> Burst Time: ");

scanf("%d", &burst\_time[i]);

remain\_time[i] = burst\_time[i];

}

else if (selected\_algo > 2)

{

printf("==> Execution time: ");

scanf("%d", &execution\_time[i]);

remain\_time[i] = execution\_time[i];

if (selected\_algo == 4)

{

printf("==> Deadline: ");

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

}

else

{

printf("==> Period: ");

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

}

}

}

}

// get maximum of three numbers

int max(int a, int b, int c)

{

int max;

if (a >= b && a >= c)

max = a;

else if (b >= a && b >= c)

max = b;

else if (c >= a && c >= b)

max = c;

return max;

}

// calculating the observation time for scheduling timeline

int get\_observation\_time(int selected\_algo)

{

if (selected\_algo < 3)

{

int sum = 0;

for (int i = 0; i < num\_of\_process; i++)

{

sum += burst\_time[i];

}

return sum;

}

else if (selected\_algo == 3)

{

return max(period[0], period[1], period[2]);

}

else if (selected\_algo == 4)

{

return max(deadline[0], deadline[1], deadline[2]);

}

}

// print scheduling sequence

void print\_schedule(int process\_list[], int cycles)

{

printf("\nScheduling:\n\n");

printf("Time: ");

for (int i = 0; i < cycles; i++)

{

if (i < 10)

printf("| 0%d ", i);

else

printf("| %d ", i);

}

printf("|\n");

for (int i = 0; i < num\_of\_process; i++)

{

printf("P[%d]: ", i + 1);

for (int j = 0; j < cycles; j++)

{

if (process\_list[j] == i + 1)

printf("|####");

else

printf("| ");

}

printf("|\n");

}

}

void rate\_monotonic(int time)

{

int process\_list[100] = {0}, min = 999, next\_process = 0;

float utilization = 0;

for (int i = 0; i < num\_of\_process; i++)

{

utilization += (1.0 \* execution\_time[i]) / period[i];

}

int n = num\_of\_process;

if (utilization > n \* (pow(2, 1.0 / n) - 1))

{

printf("\nGiven problem is not schedulable under the said scheduling algorithm.\n");

exit(0);

}

for (int i = 0; i < time; i++)

{

min = 1000;

for (int j = 0; j < num\_of\_process; j++)

{

if (remain\_time[j] > 0)

{

if (min > period[j])

{

min = period[j];

next\_process = j;

}

}

}

if (remain\_time[next\_process] > 0)

{

process\_list[i] = next\_process + 1; // +1 for catering 0 array index.

remain\_time[next\_process] -= 1;

}

for (int k = 0; k < num\_of\_process; k++)

{

if ((i + 1) % period[k] == 0)

{

remain\_time[k] = execution\_time[k];

next\_process = k;

}

}

}

print\_schedule(process\_list, time);

}

int main(int argc, char \*argv[])

{

int option = 0;

printf("3. Rate Monotonic Scheduling\n");

printf("Select > ");

scanf("%d", &option);

printf("-----------------------------\n");

get\_process\_info(option); // collecting processes detail

int observation\_time = get\_observation\_time(option);

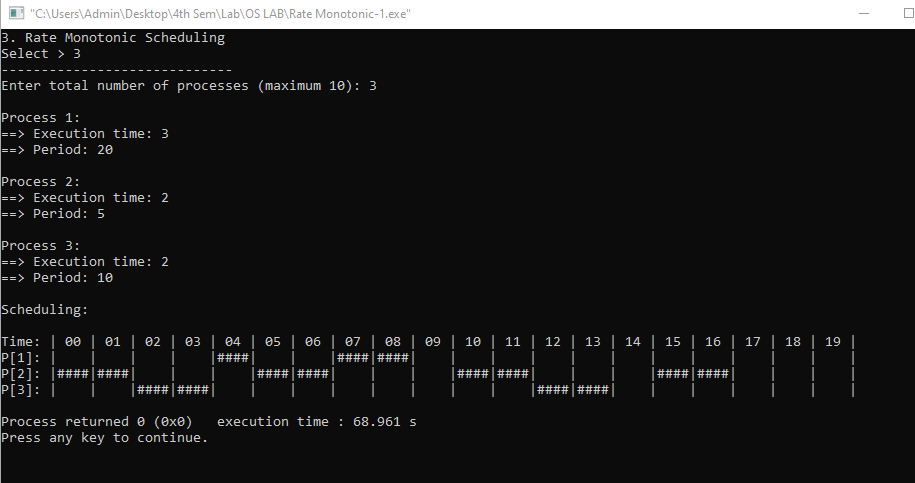
if (option == 3)

rate\_monotonic(observation\_time);

return 0;

}

OUTPUT:



3. EARLIEST DEADLINE FIRST

#include <stdio.h>

#define arrival 0

#define execution 1

#define deadline 2

#define period 3

#define abs\_arrival 4

#define execution\_copy 5

#define abs\_deadline 6

typedef struct

{

int T[7],instance,alive;

}task;

#define IDLE\_TASK\_ID 1023

#define ALL 1

#define CURRENT 0

void get\_tasks(task \*t1,int n);

int hyperperiod\_calc(task \*t1,int n);

float cpu\_util(task \*t1,int n);

int gcd(int a, int b);

int lcm(int \*a, int n);

int sp\_interrupt(task \*t1,int tmr,int n);

int min(task \*t1,int n,int p);

void update\_abs\_arrival(task \*t1,int n,int k,int all);

void update\_abs\_deadline(task \*t1,int n,int all);

void copy\_execution\_time(task \*t1,int n,int all);

int timer = 0;

int main()

{

task \*t;

int n, hyper\_period, active\_task\_id;

float cpu\_utilization;

printf("Enter number of tasks\n");

scanf("%d", &n);

t = malloc(n \* sizeof(task));

get\_tasks(t, n);

cpu\_utilization = cpu\_util(t, n);

printf("CPU Utilization %f\n", cpu\_utilization);

if (cpu\_utilization < 1)

printf("Tasks can be scheduled\n");

else

printf("Schedule is not feasible\n");

hyper\_period = hyperperiod\_calc(t, n);

copy\_execution\_time(t, n, ALL);

update\_abs\_arrival(t, n, 0, ALL);

update\_abs\_deadline(t, n, ALL);

while (timer <= hyper\_period)

{

if (sp\_interrupt(t, timer, n))

{

active\_task\_id = min(t, n, abs\_deadline);

}

if (active\_task\_id == IDLE\_TASK\_ID)

{

printf("%d Idle\n", timer);

}

if (active\_task\_id != IDLE\_TASK\_ID)

{

if (t[active\_task\_id].T[execution\_copy] != 0)

{

t[active\_task\_id].T[execution\_copy]--;

printf("%d Task %d\n", timer, active\_task\_id + 1);

}

if (t[active\_task\_id].T[execution\_copy] == 0)

{

t[active\_task\_id].instance++;

t[active\_task\_id].alive = 0;

copy\_execution\_time(t, active\_task\_id, CURRENT);

update\_abs\_arrival(t, active\_task\_id, t[active\_task\_id].instance, CURRENT);

update\_abs\_deadline(t, active\_task\_id, CURRENT);

active\_task\_id = min(t, n, abs\_deadline);

}

}

++timer;

}

free(t);

return 0;

}

void get\_tasks(task \*t1, int n)

{

int i = 0;

while (i < n)

{

printf("Enter Task %d parameters\n", i + 1);

printf("Arrival time: ");

scanf("%d", &t1->T[arrival]);

printf("Execution time: ");

scanf("%d", &t1->T[execution]);

printf("Deadline time: ");

scanf("%d", &t1->T[deadline]);

printf("Period: ");

scanf("%d", &t1->T[period]);

t1->T[abs\_arrival] = 0;

t1->T[execution\_copy] = 0;

t1->T[abs\_deadline] = 0;

t1->instance = 0;

t1->alive = 0;

t1++;

i++;

}

}

int hyperperiod\_calc(task \*t1, int n)

{

int i = 0, ht, a[10];

while (i < n)

{

a[i] = t1->T[period];

t1++;

i++;

}

ht = lcm(a, n);

return ht;

}

int gcd(int a, int b)

{

if (b == 0)

return a;

else

return gcd(b, a % b);

}

int lcm(int \*a, int n)

{

int res = 1, i;

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

{

res = res \* a[i] / gcd(res, a[i]);

}

return res;

}

int sp\_interrupt(task \*t1, int tmr, int n)

{

int i = 0, n1 = 0, a = 0;

task \*t1\_copy;

t1\_copy = t1;

while (i < n)

{

if (tmr == t1->T[abs\_arrival])

{

t1->alive = 1;

a++;

}

t1++;

i++;

}

t1 = t1\_copy;

i = 0;

while (i < n)

{

if (t1->alive == 0)

n1++;

t1++;

i++;

}

if (n1 == n || a != 0)

{

return 1;

}

return 0;

}

void update\_abs\_deadline(task \*t1, int n, int all)

{

int i = 0;

if (all)

{

while (i < n)

{

t1->T[abs\_deadline] = t1->T[deadline] + t1->T[abs\_arrival];

t1++;

i++;

}

}

else

{

t1 += n;

t1->T[abs\_deadline] = t1->T[deadline] + t1->T[abs\_arrival];

}

}

void update\_abs\_arrival(task \*t1, int n, int k, int all)

{

int i = 0;

if (all)

{

while (i < n)

{

t1->T[abs\_arrival] = t1->T[arrival] + k \* (t1->T[period]);

t1++;

i++;

}

}

else

{

t1 += n;

t1->T[abs\_arrival] = t1->T[arrival] + k \* (t1->T[period]);

}

}

void copy\_execution\_time(task \*t1, int n, int all)

{

int i = 0;

if (all)

{

while (i < n)

{

t1->T[execution\_copy] = t1->T[execution];

t1++;

i++;

}

}

else

{

t1 += n;

t1->T[execution\_copy] = t1->T[execution];

}

}

int min(task \*t1, int n, int p)

{

int i = 0, min = 0x7FFF, task\_id = IDLE\_TASK\_ID;

while (i < n)

{

if (min > t1->T[p] && t1->alive == 1)

{

min = t1->T[p];

task\_id = i;

}

t1++;

i++;

}

return task\_id;

}

float cpu\_util(task \*t1, int n)

{

int i = 0;

float cu = 0;

while (i < n)

{

cu = cu + (float)t1->T[execution] / (float)t1->T[deadline];

t1++;

i++;

}

return cu;

}

OUTPUT:

