SSN COLLEGE OF ENGINEERING, KALAVAKKAM
(An Autonomous Institution, Affiliated to Anna University, Chennai)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UCS1411 - OPERATING SYSTEMS LAB

Lab Exercise 3: Implementation of CPU Scheduling Policies: FCFS and SJF (Non- preemptive and Preemptive)

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PROGRAM:

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

typedef struct
{
        char pid[5];
        float at,bt,st,ft,tat,wt;
}process;

process * input(int n)
{
        static process p[100];
        //process *p=malloc(sizeof(process)*n);
        for(int i=0;i<n;i++)
        {
                printf("\n\t\tProcess ID  :    ");
                scanf("%s",p[i].pid);
                printf("\t\tArrival Time:     ");
                scanf("%f",&p[i].at);
                printf("\t\tBurst Time  :     ");
                scanf("%f",&p[i].bt);
        }

        return p;
}

void ganttchart(process p[100],int n)
{
        int i;
        printf("\nGANTT CHART\n\n");
```

```
	for( i=0;i<n;i++)
		printf("+----------------+");
	printf("\n");

	for( i=0;i<n;i++)
			printf("|	%2s	|",p[i].pid);
	printf("\n");

	for( i=0;i<n;i++)
		printf("+----------------+");
	printf("\n");

	for( i=0;i<n;i++)
		printf("%-.1f		",p[i-1].ft);
	printf("%-.1f",p[i-1].ft);
	printf("\n\n");

}

void output(process p[100], int n)
{

	printf("\n-----------------------------------------------------------------------------------------
----------\n");
	printf("Process ID\tArrival time\tBurst time\tTurnaround time\tWaiting time\n");
	printf("-----------------------------------------------------------------------------------------
----------\n");
	for (int i = 0; i < n; i++)

	printf("%s\t\t%.2f\t\t%.2f\t\t%.2f\t\t%.2f\n\n",p[i].pid,p[i].at,p[i].bt,p[i].st,p[i].ft,p[i].t
at,p[i].wt);
}

void fcfs(process p[100], int n)
{
	process temp;
	for(int i=0;i<n;i++)
		for(int j=i+1;j<n;j++)
			if(p[i].at>p[j].at)
			{
				temp=p[i];
				p[i]=p[j];
				p[j]=temp;
			}

	float tot_wt=0, tot_tat=p[0].bt;
	p[0].wt=0;
	p[0].tat=p[0].bt;
```

```
	p[0].st=0;
	p[0].ft=p[0].bt;

	for(int i=1;i<n;i++)
	{
		p[i].st  = p[i-1].ft;
		p[i].ft  = p[i].st + p[i].bt;
		p[i].tat = p[i].ft - p[i].at;
		p[i].wt  = p[i].tat - p[i].bt;

		tot_tat += p[i].tat;
		tot_wt += p[i].wt;
	}

	ganttchart(p,n);
	output(p,n);
	printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");
	printf("\t\t\t\t\t\t\t\tAverage\t\t%.2f\t\t%.2f\n",tot_tat/n,tot_wt/n);
	printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");
}

void sjf(process p[100],int n)
{
	printf("\n\n\t\tNON PREEMPTIVE SJF:\n\n");
	float tot_tat=0,tot_wt=0;
	int completed=0,lap=0,min=9999,small=0,done[n];
	int flag=0,st=0,ft=0;
	process temp[100];
	//process *temp=malloc(sizeof(process)*n);
	for(int i=0;i<n;++i)
	done[i]=0;

	while(completed!=n)
	{
		for(int i=0;i<n;++i)
		{
			if(p[i].at<=lap && p[i].bt<min && done[i]!=1)
			{
				min=p[i].bt;
				small=i;
				flag=1;
			}
		}

		lap+=p[small].bt;
		st=ft;
		ft+=p[small].bt;
		p[small].st=st;
```

```
                p[small].ft=ft;
                p[small].tat=p[small].ft-p[small].at;
                p[small].wt=p[small].tat-p[small].bt;

                tot_tat+=p[small].tat;
                tot_wt+=p[small].wt;

                done[small]=1;
                temp[completed]=p[small];
                completed++;
                min=9999;

        }

        ganttchart(temp,n);
        output(p,n);
        printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");
        printf("\t\t\t\t\t\t\t\tAverage\t\t%.2f\t\t%.2f\n",tot_tat/n,tot_wt/n);
        printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");
}

void presjf(process p[100],int n)
{
        printf("\n\n\t\tPREEMPTIVE SJF:\n\n");
        float rt[n],tot_tat=0,tot_wt=0;
        int completed=0,lap=0,min=9999,small=0;
        int flag=0,k=0;
        float time[50];

        char id[50][10];

        for (int i = 0; i < n; ++i)
                rt[i]=p[i].bt;

        while(completed!=n)
        {
                for (int i = 0; i < n; ++i)
                {
                        if((p[i].at <= lap) && (rt[i]<min) && rt[i]>0)
                        {
                                min=rt[i];
                                small=i;
                                flag=1;
                        }
                }
                if(flag==0)
                {
                        if(strcmp(id[k],id[k-1]==0))
```

```
                {
                        strcpy(id[k],id[k-1]);
                        time[k-1]++;
                }
                lap++;
                continue;
        }

        if(k==0 || strcmp(id[k],id[k-1])!=0){
                strcpy(id[k],p[small].pid);
                time[k]=1;
                k++;
        }
        else
        {
                strcpy(id[k],id[k-1]);
                time[k-1]+=1;
        }

        rt[small]--;
        min=rt[small];
        if(min==0)
                min=9999;
        if(rt[small]==0)
        {
                completed++;
                flag=0;
                p[small].wt=(lap+1)-p[small].bt-p[small].at;
                if(p[small].wt<0)
                        p[small].wt=0;
        }
        lap++;
}

printf("%d",k);
int j=0;

float t_time[50]={0};

char t_id[50][10];

for (int i = 0; i < k-1; ++i)
{
        while(strcmp(id[i],id[i+1])==0)
                i++;
        strcpy(t_id[j],id[i]);
        t_time[j+1]=i+1;
        j++;
```

```
	}
	printf("\n\nGANTT CHART: \n");

	for( int i=0;i<j;i++)
		printf("+----------------+");
	printf("\n");

	for(int i=0;i<j;++i)
		printf("|	%2s	|",t_id[i]);
	printf("\n");

	for( int i=0;i<j;i++)
		printf("+----------------+");
	printf("\n");

	for(int i=0;i<j+1;++i)
		printf("%-.1f		",t_time[i]);
	printf("\n\n");

	for (int i = 0; i < n; ++i)
	{
		p[i].tat=p[i].bt+p[i].wt;
		tot_wt+=p[i].wt;
		tot_tat+=p[i].tat;
	}

	output(p,n);

	printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");
	printf("\t\t\t\t\t\t\tAverage\t\t%.2f\t\t%.2f\n",tot_tat/n,tot_wt/n);
	printf("\t\t\t\t\t\t\t\t\t\t------\t\t------\n");


}
int main()
{
int op;
char c;
process *p;
int n;


printf("\n\t\t\tCPU SCHEDULING ALGORITHMS\n\n");

do
{
	printf("\n1.FCFS\n2.SJF\n3.Exit\n\nEnter your option: ");
	scanf("%d",&op);
```

```
        if(op==1)
        {
                printf("\n\t\tFCFS CPU SCHEDULER\n\n");

                printf("\t\tNo. of processes: ");
                scanf("%d",&n);

                p=input(n);
                fcfs(p,n);
        }

        else if (op==2)
        {
                char ch;
                printf("\n\t\tSJF CPU SCHEDULER\n\n");

                printf("\t\ta.Non Preemptive SJF\n\t\tb.Preemptive SJF\n\n\t\tEnter your op-
tion: ");
                scanf(" %c",&ch);

                printf("\n\t\tNo. of processes: ");
                scanf("%d",&n);

                p=input(n);

                if(ch=='a')
                        sjf(p,n);

                else if(ch=='b')
                        presjf(p,n);
        }

        else
                exit(0);

        printf("Want to continue?(y/n): ");

        scanf(" %c",&c);

}while(c=='y');

return 0;
}
```

OUTPUT:

```
(base) MSMLs-iMac:ex3 msml$ ./fcfs_sjf
                CPU SCHEDULING ALGORITHMS


1.FCFS
2.SJF
3.Exit

Enter your option: 1
        FCFS CPU SCHEDULER

        No. of processes: 5
        Process ID  :   P1      Arrival Time:   0       Burst Time  :   6
        Process ID  :   P2      Arrival Time:   1       Burst Time  :   2
        Process ID  :   P3      Arrival Time:   1       Burst Time  :   3
        Process ID  :   P4      Arrival Time:   2       Burst Time  :   1
        Process ID  :   P5      Arrival Time:   2       Burst Time  :   2
GANTT CHART

+---------++---------++---------++---------++---------+
|   P1    ||   P2    ||   P3.   ||   P4    ||   P5    |
+---------++---------++---------++---------++---------+
0.0       6.0       8.0       11.0      12.0      14.0


_____________________________________________________________________________
Process ID      Arrival time    Burst time      Turnaround time     Waiting time
_____________________________________________________________________________
P1              0.00            6.00            6.00                0.00

P2              1.00            2.00            7.00                5.00

P3              1.00            3.00            10.00               7.00

P4              2.00            1.00            10.00               9.00

P5              2.00            2.00            12.00               10.00

                                                ------              ------
                                Average         9.00                6.20
                                                ------              ------
Want to continue?(y/n): y

        CPU SCHEDULING ALGORITHMS


1.FCFS
2.SJF
```

3.Exit

Enter your option: 2

SJF CPU SCHEDULER

a.Non Preemptive SJF
b.Preemptive SJF

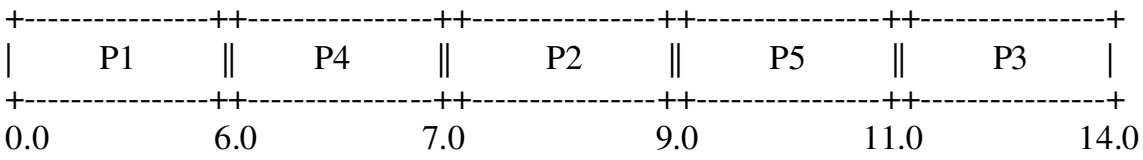
Enter your option: a

No. of processes: 5

Process ID :	P1	Arrival Time:	0	Burst Time :	6
Process ID :	P2	Arrival Time:	1	Burst Time :	2
Process ID :	P3	Arrival Time:	1	Burst Time :	3
Process ID :	P4	Arrival Time:	2	Burst Time :	1
Process ID :	P5	Arrival Time:	2	Burst Time :	2

NON PREEMPTIVE SJF:

GANTT CHART



Process ID	Arrival time	Burst time	Turnaround time	Waiting time
P1	0.00	6.00	6.00	0.00
P2	1.00	2.00	8.00	6.00
P3	1.00	3.00	13.00	10.00
P4	2.00	1.00	5.00	4.00
P5	2.00	2.00	9.00	7.00
		Average	8.20	5.40

Want to continue?(y/n): y

CPU SCHEDULING ALGORITHMS

1.FCFS
2.SJF
3.Exit

Enter your option: 2

SJF CPU SCHEDULER

a.Non Preemptive SJF
b.Preemptive SJF

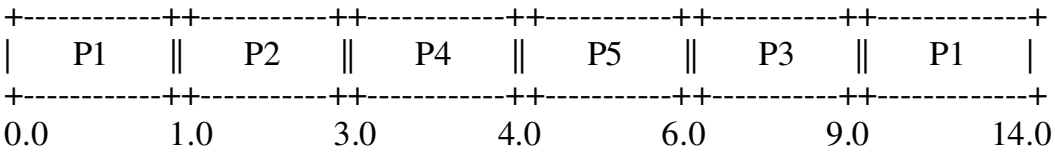
Enter your option: b

No. of processes: 5

Process ID :	P1	Arrival Time:	0	Burst Time :	6
Process ID :	P2	Arrival Time:	1	Burst Time :	2
Process ID :	P3	Arrival Time:	1	Burst Time :	3
Process ID :	P4	Arrival Time:	2	Burst Time :	1
Process ID :	P5	Arrival Time:	2	Burst Time :	2

PREEMPTIVE SJF:

GANTT CHART:



Process ID	Arrival time	Burst time	Turnaround time	Waiting time
P1	0.00	6.00	14.00	8.00
P2	1.00	2.00	2.00	0.00
P3	1.00	3.00	8.00	5.00
P4	2.00	1.00	2.00	1.00
P5	2.00	2.00	4.00	2.00
			------	------
		Average	6.00	3.20
			------	------

Want to continue?(y/n):n