SONA COLLEGE OF TECHNOLOGY (AUTONOMOUS), SALEM
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
U19CS404 – OPERATING SYSTEMS LABORATORY
QUESTION SET

1. Write a C program to simulate the ‘ls’ command that will display all the files starting with a letter ‘l’.

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

int main(){
        system("ls l*");
        return 0;
}
```

2. Write a C program to simulate the ‘grep’ command that will count the number of occurrence of a give word in a file.

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h> int
main(){
        char str[50];
        char *path = "/bin/sh";
       //char *arg[] = {path,"-c","grep -o -i 's' p1.c | wc -l",NULL};
       printf("Enter your pattern: ");
       scanf("%s",str);   char
*command1 = "grep -o -i ";            char
*command2 = " p1.c | ";   char
*command3 = "wc -w";
        char *query ;
        query          =          (char          *)          malloc          (sizeof(char)          *
(strlen(command1)+strlen(command2)+strlen(str)+strlen(command3)));
       strncat(query,command1,sizeof(command1));
       strncat(query,str,sizeof(str));
       strncat(query,command2,sizeof(command2));
       strncat(query,command3,sizeof(command3));
       printf("%s",query);            char *arg[] = {path,"-
c",query,NULL};
       execv(path,arg);   //system(query);
        return 0;
}
```

3. Write a C program to display the number of words in each file in the current working directory.

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

int main(void){
		DIR *d;//Stores all sub directory and file information
	struct dirent *dir;//dir stores individual file / directory details    char
	*filename;//to store the filename
		char *command ="/bin/wc";
	char *arg1 = "-w";                    int
	i=0;

		 d=opendir(".");
		if(d){
		   while((dir=readdir(d))!=NULL){                    if(dir-
	>d_type==DT_REG){
						//Retrive the file name and pass it as third option
		filename = (char *) malloc(sizeof(char)*strlen(dir->d_name));
	strncat(filename,dir->d_name,strlen(dir->d_name));
					  //create a new child process and execute execl call
					if(fork()==0){
						 execl(command,command,arg1,filename,NULL);
						}
						i++;
					}
				}

				closedir(d);
		}
		 return 0;
	}
```

4. Write a C program to list the files in the specified directory

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

	int main(){
		char dirname_in[100];
	char *dname;
		char *p="/";
		  printf("Enter your directory name :");
		scanf("%s",dirname_in);    dname = (char *) malloc
	(sizeof(char)*strlen(dirname_in)+1);
		strncat(dname,p,strlen(p));
	strncat(dname,dirname_in,strlen(dirname_in));          char
	*command = "/bin/ls";       char *arr[]={command,"-
	l",NULL};            execv(command,arr);
		 return 0;
	}
```

5. Write a C program to create a specified number of child processes (given through command line) and display the pid of child processes along with its parent’s pid.

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

```
        #include<stdlib.h>
        #include<unistd.h> int
        main(){
           int n;
           printf("Please Enter the number of children processes to be created\n");
        scanf("%d",&n);     for(int i=0;i<n;i++){
              if(fork()==0){
                 printf("[child]pid %d from [parent] pid %d\n",getpid(),getppid());
        exit(0);
              }
           }
           return 0;
        }
```

6. Write a C program using fork() and execv() system calls to spawn a child and the child should print the date and the parent should print the child's pid and status

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

    int main(){
       pid_t pid;
       char*const paramList[]={"/bin/date",NULL};
    pid=fork();     if(pid==-1){
          printf("Error is creating child process\n");
       }
       else if(pid==0){
          execv("/bin/date",paramList);
       }
       else{
          printf("Child process pid is %d\n",getpid());
       }
       return 0;
    }
```

7. Write a shell script to display the content of file named sonacse.txt in the current working directory or in the subdirectories

```
    for d in ./*;do
                if [ -f "$d" ] && [ "$d" = "./sonacse" ];then
                         echo "$(cat "$d")";
                         break
    fi

                if [ -d "$d" ] ; then
                         cd "$d";
                         for m in ./*;do
                                  if [ -f "$m" ] && [ "$m" = "./sonacse" ];then
                                  echo "$(cat "$m")";
                                           break
                         fi                done
                         cd ..;
    fi
    done
```

8. Write a shell script which accepts two filenames from command line, copies the first file to the second and then displays it

```
cp $s1 $s2
cat $s2
```

9. Create a file named sample.txt with 20 lines and do the following using shell script
   i) Count the number of words in the file.
   ii) Display the first and last five lines of the contents
   iii) Find the occurrence of any word iv) Display the contents of the file.

   TEXT FILE NAME SHOULD BE : sample.txt

```
echo "1. Number of words in a file :";
wc -w sample.txt

echo "2. Display First and last 5 line: ";
echo "First 5 lines: "; head -5
sample.txt echo "Last 5 lines: ";
tail -5 sample.txt

echo "Occurence of the word 's' :";
grep -o -i s sample.txt | wc -w

echo "Display the content of the file: "; cat
sample.txt
```

10. Write a C program to create a specified number of child processes (given through command line) and display the pid of child processes along with its parent's pid

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h> int
main(){
  int n;
  printf("Please Enter the number of children processes to be created\n");
scanf("%d",&n);    for(int i=0;i<n;i++){       if(fork()==0){
       printf("[child]pid %d from [parent] pid %d\n",getpid(),getppid());
exit(0);
     }
  }
  return 0;
}
```

11. Write a C program to create a specified number of child processes (given through command line) and display the pid of child processes along with its parent's pid. also, child process should execute user specified program

```
#include<stdio.h>
#include<stdlib.h>
#include<unistd.h> int
main(){
  int n;
  printf("Please Enter the number of children processes to be created\n");
scanf("%d",&n);    for(int i=0;i<n;i++){       if(fork()==0){
```

```
            printf("[child]pid %d from [parent] pid %d\n",getpid(),getppid());
        exit(0);
              }
          }
          return 0;
        }
```

12. Write a C program to simulate the ls and grep commands along with its variations.

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

int main(){
printf("Using ls command to print all text files in a directory: \n");
printf("ls *.txt\n");
system("ls *.txt");
printf("\n\nUsing ls command to display all content in long format: \n");
printf("ls -l\n");
system("ls -l");
printf("\n\nUsing ls command to show hidden files: \n");
printf("ls -a\n");
system("ls -a");
printf("\n\nUsing ls command to show files sort by date and time: \n");
printf("ls -t\n");
system("ls -t");
printf("\n\nUsing ls command to show all files sort by size: \n");
printf("ls -s\n");
system("ls -s");
printf("\n\nUsing grep command to print number of occurence of a pattern in a file: \n");
printf("grep -i -n s p2.c\n");
system("grep -i -n s p2.c");
printf("\n\nUsing egrep command to print lines that contain exactly two consecutive 'm': \n");
printf("egrep m{2} p2.c\n");
system("egrep m{2} p2.c");
printf("\n\nUsing fgrep command to print occurence of a pattern in a file: \n");
printf("fgrep -i include p2.c\n");
system("fgrep -i include p2.c");
printf("\n\nUsing rgrep command to print all files, recursively for a string 'command': \n");
printf("rgrep -i command *\n");
system("rgrep -i command *");
return 0;
}
```

13. Write a shell script to display the message “Good Morning / Good Afternoon / Good Evening” depending upon the time the user logs in.

```
    // echo  â€œGood Nightâ€

hh="$(date +%H)";
if  [  $hh  -gt  12  ]  &&  [  $hh  -le  12  ]
then
      echo  â€œGood  Morningâ€
elif  [  $hh  -gt  12  ]  &&  [  $hh  -le  16  ]
then
     echo  â€œGood Afternoonâ€  else
     echo  â€œGood Nightâ€  fi
```

14. Write a shell script to find the number of occurrences of a given word in a word file

```
echo "Enter File Name :" read f
echo "Enter a word :" read
w
echo "\n Number of occurence of the word is: ";
grep -o -i "$w" "$f" | wc –w
```

15. Write a script that would take command line input a number and a word. It then prints the word n times, one word per line

```
for i in $(seq $1); do
    echo $2; done
```

16. Write a C program to find whether a file in the current working directory and a file in the immediate subdirectory exist with the same name. If so, remove the duplicate one

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

int main(void){
     DIR *d,*td;//Stores all sub directory and file information
      struct dirent *dir,*tempdir;//dir stores individual file / directory details
      char *filename="sonacse";//to store the filename
    char *fname="sonacse.txt";
    char *command ="/bin/cat";
    char *command2="/bin/rm";
    //char *arg1 = "-w";          int
tf=0;           int i=0;
     d=opendir(".");
    if(d){
       while((dir=readdir(d))!=NULL) {
             if(dir->d_type==DT_REG && strcmp(fname,dir->d_name)==0) {
                     if(tf!=1){
                               system("cat sonacse.txt");
                              tf=1;
                     break;
                     }

             }
       }
        closedir(d);
     }

    l1:
    printf("Start\n\n");
    d=opendir(".");
    if(d){
        while((dir=readdir(d))!=NULL){
            if(dir->d_type==DT_DIR && strcmp(".",dir->d_name)!=0 && strcmp("..",dir->d_name)!=0
){                  td = opendir(dir->d_name);                          while((tempdir=readdir(td))!=NULL){
                                if(tempdir->d_type==DT_REG && strcmp(fname,tempdir->d_name)==0)        {
                                                if(tf!=1){
                            chdir(dir->d_name);
                    system("cat sonacse.txt");
                                                        chdir("..");
                                                        tf=1;
                                                break;

                                                }else{
                                                        chdir(dir->d_name);

                                                        printf("\nDeteting file from %s",dir->d_name);
                                                        system("rm sonacse.txt");
                                                        chdir("..");

                                                        tf=1;
                                                break;
                                                }

                                }
                    }
                    closedir(td);

                }
        }
        closedir(d);
        }
        return 0;
}
```

17. Consider the following page reference string:
    1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

    How many page faults would occur for the FIFO replacement algorithm? Assume three frames. Remember that all frames are initially empty, so your first unique pages will all cost one fault each.
    Next, consider no. of free frame to be four and then find the page fault. Will it suffer from belady's anomaly?

```
#include<stdio.h>
int n, nf; int
in[100]; int p[50];
int hit = 0;
int i,j,k;
int pgfaultcnt=0;

void getData(){
   printf("\nEnter length of page reference sequence : ");     scanf("%d",
&n);
   printf("\nEnter the page reference sequence:");     for
(i = 0; i < n; i++) {
      scanf("%d", &in[i]);
   }
   printf("\nEnter no of frames: ");
scanf("%d", &nf);
```

```
}

void initialize()
{
   pgfaultcnt=0;
for(i=0; i<nf; i++)
p[i]=9999;
}

int isHit(int data)
{
hit=0;
   for(j=0; j<nf; j++)
   {
      if(p[j]==data)
      {
hit=1;
         break;
      }

   }

   return hit;
}


void dispPages()
{
   for (k=0; k<nf; k++)
   {
      if(p[k]!=9999)
         printf(" %d",p[k]);
   }

}

void dispPgFaultCnt()
{
   printf("\nTotal no of page faults:%d",pgfaultcnt);
}

void fifo()
{
initialize();
   for(i=0; i<n; i++)
   {
      printf("\nFor %d :",in[i]);

      if(isHit(in[i])==0)
      {

         for(k=0; k<nf-1; k++)
            p[k]=p[k+1];
            p[k]=in[i];
pgfaultcnt++;
            dispPages();
        }
        else
            printf("No page fault");
    }
    dispPgFaultCnt();
}


void main(){
getData();     fifo();
}
```

18. Given the rack partitions of rice storage, each of 100kg, 500kg, 200kg, 300kg and 600kg (in order) in a super market, the supervisor has to place the rice bags of 212kg, 417kg, 112kg and 426 kg (in order). Write an algorithm to help the supervisor for the effective utilization of rack partitions. Write a program for all the memory management schemes

```
#include <stdio.h>

#include <stdlib.h> void

sort(int a[],int n){

for(int i=0;i<n-1;i++){

int s=a[i];         int pos=i;

for(int j=i+1;j<n;j++){

if(a[j]<s){

pos=j;

            }

        }
        int tmp=a[pos];

a[pos]=a[i];         a[i]=tmp;

    }

}

void First_Fit(int inp[],int Weight[] ,int n,int in){

int dWeight[n];     for(int i=0;i<n;i++){

dWeight[i]=Weight[i];

    }

    for(int j=0;j<in;j++){         int tf=0;

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

```
if(inp[j]<=dWeight[i]){                  printf("%d

%d\n",inp[j],dWeight[i]);

dWeight[i]=0;

                tf=1;

break;

            }

        }

        if(tf==0){

printf("%d NA\n",inp[j]);

        }

    }

}

void Best_Fit(int inp[],int Weight[] ,int n,int in){

int dWeight[n];     for(int i=0;i<n;i++){

dWeight[i]=Weight[i];

    }

    for(int j=0;j<in;j++){
        int tf=0;         for(int i=0;i<n;i++){

if(inp[j]<=dWeight[i]){                  printf("%d

%d\n",inp[j],dWeight[i]);

dWeight[i]=0;

                tf=1;

break;

            }

        }

        if(tf==0){

printf("%d NA\n",inp[j]);

        }

    }

}
```

```
void Worst_Fit(int inp[],int Weight[] ,int n,int in){
int dWeight[n];     for(int i=0;i<n;i++){
dWeight[i]=Weight[i];
    }
    for(int j=0;j<in;j++){         int tf=0;
for(int i=n-1;i>=0;i--){
if(inp[j]<=dWeight[i]){                 printf("%d
%d\n",inp[j],dWeight[i]);
dWeight[i]=0;
                tf=1;
break;
            }
        }
        if(tf==0){
printf("%d NA\n",inp[j]);
}

    }
}
void main(){     int n=5,inp=4;
int arr[10],unsrt[10],inVal[10];
for(int i=0;i<n;i++){         scanf("
%d",&arr[i]);
unsrt[i]=arr[i];
    }
    for(int i=0;i<inp;i++){
scanf(" %d",&inVal[i]);
    }
    int *temp=arr;
sort(arr,n);
    First_Fit(inVal,unsrt,n,inp);
    Best_Fit(inVal,arr,n,inp);
    Worst_Fit(inVal,arr,n,inp);

}
```

19. The HCL Company is manufacturing the computers; the company is having the fixed stock size to hold the manufactured computers. The client can place the order if stock is not empty and company cannot manufacture the computers if the stock size full. Develop an application to handle the situation.

```
#include<stdio.h>
#include<pthread.h>
#include<semaphore.h>
#include<stdlib.h> int
maxitem; sem_t
full,empty; int
buffer[200];
int in=0,out=0; pthread_mutex_t
mutex;
void *producer(void *pno){
int item,i;
   for(i=0;i<maxitem;i++){
sem_wait(&empty);
pthread_mutex_lock(&mutex);
       item=random();
buffer[in]=item;
       printf("Tcl produces a %d item %d\n",buffer[in],i);
       in=(in+1)%maxitem;
       pthread_mutex_unlock(&mutex);
       sem_post(&full);
   }
}
void *consumer(void *cno){
   int item,i;
   for(i=0;i<maxitem;i++){
sem_wait(&full);
       pthread_mutex_lock(&mutex);
       printf("TCL sales a %d item %d\n",buffer[out],i);
out=(out+1)%maxitem;       pthread_mutex_unlock(&mutex);
       sem_post(&empty);
   }
}
int main(){    int stocksize;
printf("Enter stocksize: ");
scanf("%d",&stocksize);
printf("Enter no of items: ");
scanf("%d",&maxitem);
pthread_t pro,con;
   pthread_mutex_init(&mutex,NULL);
   sem_init(&full,0,0);
sem_init(&empty,0,stocksize);
   int id=1;
   pthread_create(&pro,NULL,(void *)producer,(void *)&id);
pthread_create(&con,NULL,(void *)consumer,(void *)&id);
pthread_join(pro,NULL);    pthread_join(con,NULL);
sem_destroy(&empty);    sem_destroy(&full);
pthread_mutex_destroy(&mutex);
```

```
    return 0;
}
```

20. Five persons are in a queue to book railway tickets. There is only one counter and all of them arrived at 9.30 AM. The counter will be open by 10.00 AM. The processing time for each person to book the tickets are 10 minutes, 20 minutes, 5 minutes, 7 minutes and 13 minutes respectively. Identify the scheduling algorithm and write a C program for the same.

```
#include<stdio.h> void
main(){
        int n=5;
         int bt[20], wt[20], tat[20],i,j;
         float avwt=0, avtat=0;

        for(i=0;i<n;i++){
                scanf("%d", &bt[i]);
        }
        wt[0] = 0;

        for(i=1;i<n;i++){
                wt[i] = 0;
                for(j=0;j<i;j++){
                        wt[i] +=bt[j];
                }
        }
        for(i=0;i<n;i++){
                avwt +=wt[i];
                printf("\n%d", wt[i]);
                }
        avwt/=n;
        printf("\n%.1f ",avwt);
        for(i=0;i<n;i++){
            tat[i] = bt[i] + wt[i];
   avtat +=tat[i];   printf("\n%d", tat[i]);
                }
        avtat/=n;
        printf("\n%.1f ",avtat);
}
```

21. Six persons are in a queue to book railway tickets. There is only one counter and all of them arrived at 9.30 AM. The counter will be open by 10.00 AM. The processing time for each person to book the tickets are 10 minutes, 20 minutes, 5 minutes, 7 minutes, 2 minutes and 13 minutes respectively. The person with the minimum processing time has to be given preference. Identify the scheduling algorithm and write a C program for the same.

```
#include<stdio.h>
#include<stdlib.h> void
main(){
  int a_arr[6], i, e, wt[6], tat[6], sum=30;
  int wtsum =0, tatsum=0;
for(i=0;i<6;i++){
    scanf("%d", &e);
a_arr[i] = e;       wt[i]
=0;
    tat[i] =0;
    }
    int m=999, pos=0, j=0;
for(j=0;j<6;j++){
for(i=0;i<6;i++){
            if(m>a_arr[i]){
pos =i;
                m = a_arr[i];
            }
        }
        wt[pos] = sum;
wtsum +=sum;         sum
+= a_arr[pos];
tat[pos] = sum;
tatsum += sum;
a_arr[pos] = 999;
        m = 999;
    }
    for(i=0;i<6;i++){
printf("%d\n", wt[i]);
    }
    printf("%.1f\n", (float)wtsum/6);
    for(i=0;i<6;i++){
printf("%d\n", tat[i]);
    }
    printf("%.1f\n", (float)tatsum/6);
}
```

22. Three patients are in a Hospital to visit the doctor. The first patient is suffering from high temperature, the second patient is in unconscious state and the third patient is suffering from cold and cough. The time of each patient is 10 minutes, 30 minutes and 5 minutes respectively. Identify the scheduling algorithm and write a C program for the same.

```
 #include<stdio.h> int main(){     int n=5;

    int bt[10],wt[10],tat[10],q,i,j,sum=0,c;     int awt=0,atat=0;     for(i=0;i<n;i++){
scanf("%d\n",&bt[i]);

    }

    scanf("%d\n",&q);



    for(i=0;i<q;i++){         for(j=0;j<n;j++){             sum+=q;

        }

    }

    for(i=0;i<n;i++){         sum+=1;         tat[i]=sum;

    }
    for(i=0;i<n;i++){        wt[i]=tat[i]-10;        printf("%d\n",wt[i]);    }

    for(i=0;i<n;i++){        awt+=wt[i];

    }

    awt/=n;    printf("%d\n",awt);    for(i=0;i<n;i++){        atat+=tat[i];        printf("%d\n",tat[i]);

    }

    atat/=n;    printf("%d\n",atat);

  }
```

23. Group discussion is conducted for 5 students in a campus recruitment drive. The time each student had prepared is ten minutes. But the GD conductor will be giving only 3 minutes for each student. Identify the scheduling algorithm and write a C program for the same.

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

void main()
{

   int i, NOP, sum=0,count=0, y, quant, wt=0, tat=0, at[10], bt[10], temp[10];
   float avg_wt, avg_tat;
   printf(" Total number of process in the system: ");
   scanf("%d", &NOP);
   y = NOP;


   for(i=0; i<NOP; i++)
   {
   printf("\n Enter the Arrival and Burst time of the Process[%d]\n", i+1);
   printf(" Arrival time is: \t");
   scanf("%d", &at[i]);
   printf(" \nBurst time is: \t");
   scanf("%d", &bt[i]);
   temp[i] = bt[i];
   }

   printf("Enter the Time Quantum for the process: \t");
   scanf("%d", &quant);

   printf("\n Process No \t\t Burst Time \t\t TAT \t\t Waiting Time ");
   for(sum=0, i = 0; y!=0; )
   {
   if(temp[i] <= quant && temp[i] > 0)
   {
      sum = sum + temp[i];
      temp[i] = 0;
      count=1;
      }
```

```
        else if(temp[i] > 0)
        {
            temp[i] = temp[i] - quant;
            sum = sum + quant;
        }
        if(temp[i]==0 && count==1)
        {
            y--;
            printf("\nProcess No[%d] \t\t %d\t\t\t\t %d\t\t\t %d", i+1, bt[i], sum-at[i], sum-at[i]-bt[i]);
            wt = wt+sum-at[i]-bt[i];
            tat = tat+sum-at[i];
            count =0;
        }
        if(i==NOP-1)
        {
            i=0;
        }
        else if(at[i+1]<=sum)
        {
            i++;
        }
        else
        {
            i=0;
        }
    }

    avg_wt = wt * 1.0/NOP;
    avg_tat = tat * 1.0/NOP;
    printf("\n Average Turn Around Time: \t%f", avg_wt);
    printf("\n Average Waiting Time: \t%f", avg_tat);

}
```

24. A is the producer of random numbers and share memory buffer with B. B consumes the numbers generated by A. Help B to view numbers sent by A and print the odd numbers separately.

```
#include<stdio.h>
#include<pthread.h>
#include<semaphore.h>
#include<stdlib.h>
#define maxitem 5 #define
buffersize 5 sem_t
full,empty; int
buffer[buffersize]; int
```

```
in=0,out=0; pthread_mutex_t
mutex; void *producer(void
*pno){     int item,i;
   for(i=0;i<maxitem;i++){
sem_wait(&empty);
pthread_mutex_lock(&mutex);
item=random();        buffer[in]=item;
       printf("producer %d produces a %d at %d\n",*((int *)pno),buffer[in],i);
in=(in+1)%buffersize;        pthread_mutex_unlock(&mutex);
sem_post(&full);
   }
}
void *consumer(void *cno){
   int item,i;     for(i=0;i<maxitem;i++){        sem_wait(&full);
pthread_mutex_lock(&mutex);        printf("consumer %d consumes a %d at
%d\n",*((int *)cno),buffer[out],i);        out=(out+1)%buffersize;
pthread_mutex_unlock(&mutex);        sem_post(&empty);
   }
}
void oddprint(){
   int i=0;
   for(i=0;i<maxitem;i++){
if(buffer[i]%2!=0){
printf("%d\n",buffer[i]);
       }
   }
}
int main(){     pthread_t pro,con;
pthread_mutex_init(&mutex,NULL);
sem_init(&full,0,0);
sem_init(&empty,0,1);
   int id=1;
   pthread_create(&pro,NULL,(void *)producer,(void *)&id);
pthread_create(&con,NULL,(void *)consumer,(void *)&id);
pthread_join(pro,NULL);     pthread_join(con,NULL);
oddprint();     sem_destroy(&empty);     sem_destroy(&full);
pthread_mutex_destroy(&mutex);     return 0;
}
```

25. Write a C program that will simulate FCFS scheduling algorithm. For this algorithm, the program should compute waiting time, turnaround time of every job as well as the average waiting time and the average turnaround time. The average values should be consolidated in a table for easy comparison. You may use the following data to test your program. Using your program, consider that each context switching require 0.4 ms then find out the total context switching time.

Processes	Arrival time	CPU cycle(in ms)
1	0	6
2	3	2
3	5	1
4	9	7
5	10	5
6	12	3
7	14	4
8	16	5
9	17	7
10	19	2

```
#include<stdio.h>

int main(){

        int bt[10]={0},at[10]={0},tat[10]={0},wt[10]={0},ct[10]={0};
          int n,sum=0;
          float totalTAT=0,totalWT=0;

         printf("Enter number of processes   ");          scanf("%d",&n);

            printf("Enter arrival time and burst time for each process\n\n");

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

                   printf("Arrival time of process[%d]            ",i+1);
                  scanf("%d",&at[i]);

                  printf("Burst time of process[%d] ",i+1);
scanf("%d",&bt[i]);

                   printf("\n");
         }

           //calculate completion time of processes

         for(int j=0;j<n;j++)
         {
                  sum+=bt[j];
                  ct[j]+=sum;
         }
```

```
              //calculate turnaround time and waiting times

             for(int k=0;k<n;k++)
             {
                     tat[k]=ct[k]-at[k];
                    totalTAT+=tat[k];
             }


             for(int k=0;k<n;k++)
             {
                     wt[k]=tat[k]-bt[k];
                    totalWT+=wt[k];
             }

              printf("Solution: \n\n");
             printf("P#\t AT\t BT\t CT\t TAT\t WT\t\n\n");

             for(int i=0;i<n;i++)
             {
                    printf("P%d\t %d\t %d\t %d\t %d\t %d\n",i+1,at[i],bt[i],ct[i],tat[i],wt[i]);
             }

             printf("\n\nAverage Turnaround Time = %f\n",totalTAT/n);     printf("Average
     WT = %f\n\n",totalWT/n);

              return 0;
     }
```

26. Write a C program that will simulate SJF scheduling algorithm. For this algorithm, the program should compute waiting time, turnaround time of every job as well as the average waiting time and the average turnaround time. The average values should be consolidated in a table for easy comparison. You may use the following data to test your program. Using your program, consider that each context switching require 0.4 ms then find out the total context switching time.

Processes	Arrival time	CPU cycle(in ms)
1	0	6
2	3	2
3	5	1
4	9	7
5	10	5
6	12	3
7	14	4
8	16	5
9	17	7
10	19	

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

```
int main()
{
     int arrival_time[10], burst_time[10], temp[10];       int i,
smallest, count = 0, time, limit;       double wait_time = 0,
turnaround_time = 0, end;       float average_waiting_time,
average_turnaround_time;       printf("nEnter the Total
Number of Processes:t");       scanf("%d", &limit);
printf("nEnter Details of %d Processesn", limit);       for(i = 0;
i < limit; i++)
     {
          printf("nEnter Arrival Time:t");
scanf("%d", &arrival_time[i]);
printf("Enter Burst Time:t");            scanf("%d",
&burst_time[i]);
          temp[i] = burst_time[i];
     }
     burst_time[9] = 9999;
     for(time = 0; count != limit; time++)
     {
          smallest = 9;
          for(i = 0; i < limit; i++)
          {
               if(arrival_time[i] <= time && burst_time[i] < burst_time[smallest] && burst_time[i] > 0)
               {
                    smallest = i;
               }
          }
          burst_time[smallest]--;
          if(burst_time[smallest] == 0)
          {
               count++;
end = time + 1;
               wait_time = wait_time + end - arrival_time[smallest] - temp[smallest];
turnaround_time = turnaround_time + end - arrival_time[smallest];
          }
     }
     average_waiting_time = wait_time / limit;       average_turnaround_time
= turnaround_time / limit;       printf("nnAverage Waiting Time:t%lfn",
average_waiting_time);       printf("Average Turnaround Time:t%lfn",
average_turnaround_time);       return 0;
}
```

27. Write a C program that will simulate round robin scheduling algorithm. For this algorithm, the program should compute waiting time, turnaround time of every job as well as the average waiting time and the average turnaround time. The average values should be consolidated in a table for easy comparison. You may use the following data to test your program. The time quantum for round robin is 4 ms and the context switching time is zero. Using your program, consider that each context switching require 0.4 ms then find out the total context switching time.

Processes	Arrival time	CPU cycle(in ms)
1	0	6

2	3	2
3	5	1
4	9	7
5	10	5
6	12	3
7	14	4
8	16	5
9	17	7
10	19	2

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

void main()  {     int i, NOP, sum=0,count=0, y, quant, wt=0, tat=0, at[10],
bt[10], temp[10];     float avg_wt, avg_tat;     printf(" Total number of process
in the system: ");     scanf("%d", &NOP);     y = NOP;    for(i=0; i<NOP; i++)
  {
  printf("\n Enter the Arrival and Burst time of the Process[%d]\n", i+1);
printf(" Arrival time is: \t");     scanf("%d", &at[i]);     printf(" \nBurst
time is: \t");     scanf("%d", &bt[i]);     temp[i] = bt[i];
  }

  printf("Enter the Time Quantum for the process: \t");     scanf("%d",
&quant);

  printf("\n Process No \t\t Burst Time \t\t TAT \t\t Waiting Time ");
for(sum=0, i = 0; y!=0; )
  {
  if(temp[i] <= quant && temp[i] > 0)
  {
    sum = sum + temp[i];
temp[i] = 0;
count=1;
    }
    else if(temp[i] > 0)
    {
      temp[i] = temp[i] - quant;
sum = sum + quant;
    }
    if(temp[i]==0 && count==1)
    {
y--;
      printf("\nProcess No[%d] \t\t %d\t\t\t\t %d\t\t\t %d", i+1, bt[i], sum-at[i], sum-at[i]-bt[i]);
wt = wt+sum-at[i]-bt[i];          tat = tat+sum-at[i];          count =0;
    }
    if(i==NOP-1)
    {
i=0;
    }
    else if(at[i+1]<=sum)
```

```
        {

    i++;
    }
    else
    {
    i=0;
        }
      }

      avg_wt = wt * 1.0/NOP;       avg_tat = tat * 1.0/NOP;
    printf("\n Average Turn Around Time: \t%f", avg_wt);
    printf("\n Average Waiting Time: \t%f", avg_tat);
    }
```

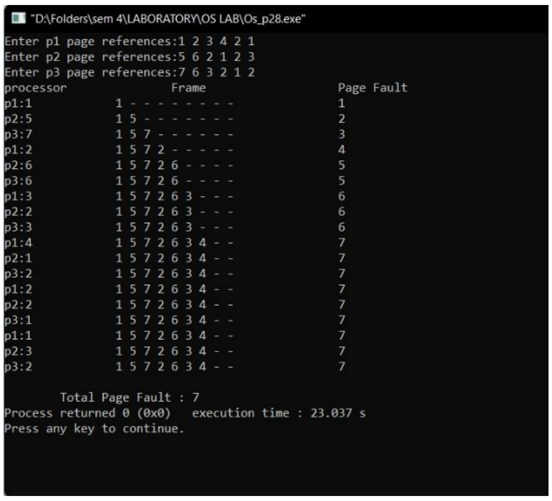
28. Consider that there are three processes in ready queue and 9 free memory frame and processes has the following page reference string:

    P1:1, 2, 3, 4, 2, 1
    P2: 5, 6, 2, 1, 2, 3
    P3: 7, 6, 3, 2, 1, 2

And use equal partitioning method and allocate initial set of frame to all the three process. How many page faults would occur for the FIFO replacement algorithm using local replacement policy? Remember that all frames are initially empty, so your first unique pages will all cost one fault each.

```
#include <stdio.h>
#include <stdlib.h>
#define Max_len 18
#define F_size 9
int check(int arr[],int n,int i){
    for(int j=0;j<n;j++){
        if(arr[j]==i){
            return 1;
        }
    }
    return 0;
}
int main(){
    int ready_q[Max_len],frame[F_size];
    int pnum=1,index=0,num=0;
    int page_fault=0;
    for(int i=0;i<3;i++){
        printf("Enter p%d page references:",i+1);
        for(int j=0;j<Max_len/3;j++){
            index=i+j*3;
            //printf(" %d",index);
            scanf(" %d",&num);
            ready_q[index]=num;
        }
    }

    for(int i=0;i<F_size;i++){
        frame[i]=-1;
    }
    int ni=0,fi=0;
    printf("processor\t\tFrame\t\t\tPage Fault\n");
    for(int i=0;i<Max_len;i++){
        printf("p%d:%d\t\t",i%3+1,ready_q[i]);
        if(check(frame,F_size,ready_q[i])==0){
            if(fi<F_size){
                frame[fi]=ready_q[i];
                fi++;

            }else{
                frame[ni]=ready_q[i];
                ni++;
                ni=ni%F_size;

            }
            page_fault++;
        }
        for(int j=0;j<F_size;j++){
            if(frame[j]!=-1){
                printf("%d ",frame[j]);
            }else{
                printf("- ");
            }
        }
        printf("\t\t%d\n",page_fault);
    }
    printf("\n\tTotal Page Fault : %d",page_fault);
}
```

OUTPUT:



```
"D:\Folders\sem 4\LABORATORY\OS LAB\Os_p28.exe"
Enter p1 page references:1 2 3 4 2 1
Enter p2 page references:5 6 2 1 2 3
Enter p3 page references:7 6 3 2 1 2
processor               Frame                   Page Fault
p1:1            1 - - - - - - - -               1
p2:5            1 5 - - - - - - -               2
p3:7            1 5 7 - - - - - -               3
p1:2            1 5 7 2 - - - - -               4
p2:6            1 5 7 2 6 - - - -               5
p3:6            1 5 7 2 6 - - - -               5
p1:3            1 5 7 2 6 3 - - -               6
p2:2            1 5 7 2 6 3 - - -               6
p3:3            1 5 7 2 6 3 - - -               6
p1:4            1 5 7 2 6 3 4 - -               7
p2:1            1 5 7 2 6 3 4 - -               7
p3:2            1 5 7 2 6 3 4 - -               7
p1:2            1 5 7 2 6 3 4 - -               7
p2:2            1 5 7 2 6 3 4 - -               7
p3:1            1 5 7 2 6 3 4 - -               7
p1:1            1 5 7 2 6 3 4 - -               7
p2:3            1 5 7 2 6 3 4 - -               7
p3:2            1 5 7 2 6 3 4 - -               7

        Total Page Fault : 7
Process returned 0 (0x0)   execution time : 23.037 s
Press any key to continue.
```

29. Consider that there are three processes in ready queue and 9 free memory frame and processes has the following page reference string:

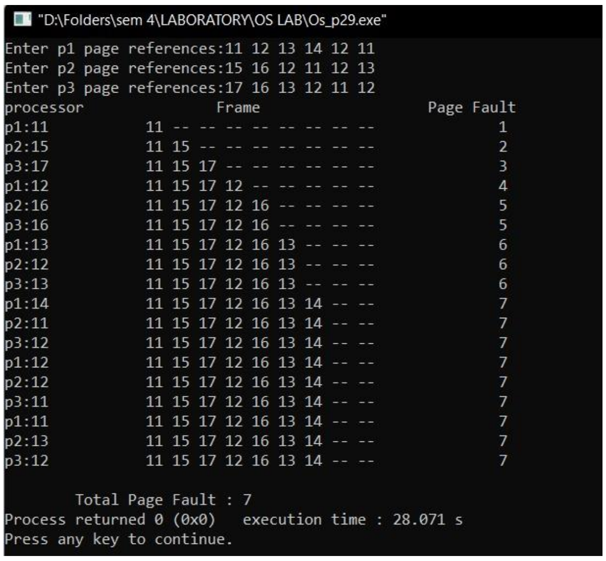
    P1:11, 12, 13, 14, 12, 11
    P2: 15, 16, 12, 11, 12, 13
    P3: 17, 16, 13, 12, 11, 12

And use equal partitioning method and allocate initial set of frame to all the three process. How many page faults would occur for the LRU replacement algorithm using local replacement policy? Remember that all frames are initially empty, so your first unique pages will all cost one fault each.

```
#include <stdio.h>
#include <stdlib.h>
#define Max_len 18
```

```
#define F_size 9
int check(int arr[],int n,int i){
    for(int j=0;j<n;j++){
        if(arr[j]==i){
            return 1;
        }
    }
    return 0;
}
int main(){
    int ready_q[Max_len],frame[F_size];
    int pnum=1,index=0,num=0;
    int page_fault=0;
    for(int i=0;i<3;i++){
        printf("Enter p%d page references:",i+1);
        for(int j=0;j<Max_len/3;j++){
            index=i+j*3;
            //printf(" %d",index);
            scanf(" %d",&num);
            ready_q[index]=num;
        }
    }

    for(int i=0;i<F_size;i++){
        frame[i]=-1;
    }
    int fi=0,ni=0;
    printf("processor\t\tFrame\t\t\tPage Fault\n");
    for(int i=0;i<Max_len;i++){
        printf("p%d:%d\t\t",i%3+1,ready_q[i]);
        if(check(frame,F_size,ready_q[i])==0){
            if(fi<F_size){
                frame[fi]=ready_q[i];
                fi++;

            }else{
                ni=i%F_size;
                frame[ni]=ready_q[i];
                fi++;

            }
            page_fault++;
        }
        for(int j=0;j<F_size;j++){
            if(frame[j]!=-1){
                printf("%d ",frame[j]);
            }else{
                printf("-- ");
            }
        }
        printf("\t\t%d\n",page_fault);
    }
    printf("\n\tTotal Page Fault : %d",page_fault);
}
```

OUTPUT:



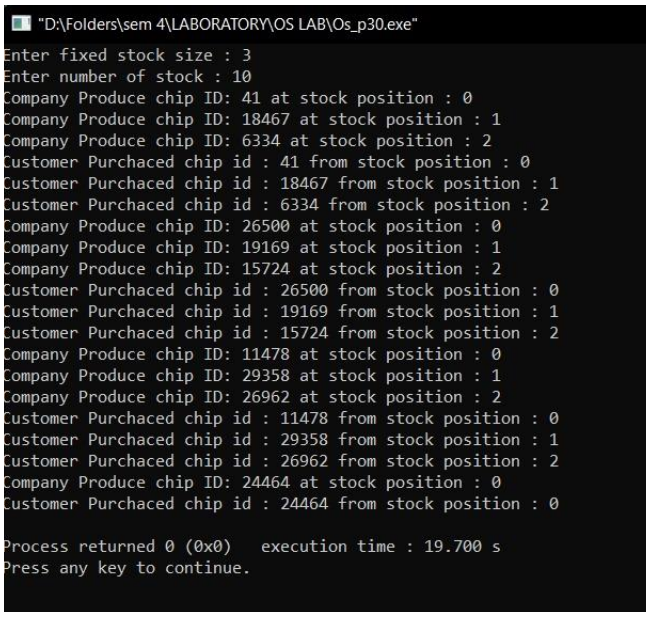
```
"D:\Folders\sem 4\LABORATORY\OS LAB\Os_p29.exe"
Enter p1 page references:11 12 13 14 12 11
Enter p2 page references:15 16 12 11 12 13
Enter p3 page references:17 16 13 12 11 12
processor               Frame                   Page Fault
p1:11           11 -- -- -- -- -- -- -- --              1
p2:15           11 15 -- -- -- -- -- -- --              2
p3:17           11 15 17 -- -- -- -- -- --              3
p1:12           11 15 17 12 -- -- -- -- --              4
p2:16           11 15 17 12 16 -- -- -- --              5
p3:16           11 15 17 12 16 -- -- -- --              5
p1:13           11 15 17 12 16 13 -- -- --              6
p2:12           11 15 17 12 16 13 -- -- --              6
p3:13           11 15 17 12 16 13 -- -- --              6
p1:14           11 15 17 12 16 13 14 -- --              7
p2:11           11 15 17 12 16 13 14 -- --              7
p3:12           11 15 17 12 16 13 14 -- --              7
p1:12           11 15 17 12 16 13 14 -- --              7
p2:12           11 15 17 12 16 13 14 -- --              7
p3:11           11 15 17 12 16 13 14 -- --              7
p1:11           11 15 17 12 16 13 14 -- --              7
p2:13           11 15 17 12 16 13 14 -- --              7
p3:12           11 15 17 12 16 13 14 -- --              7

        Total Page Fault : 7
Process returned 0 (0x0)   execution time : 28.071 s
Press any key to continue.
```

30. The Chip manufacturing Company is manufacturing the chips; the company is having the fixed stock size to hold the manufactured chips. The client can place the order if stock is not empty and company cannot manufacture the computers if the stock size full. Develop an application to handle the situation.

```
#include <pthread.h>
#include <semaphore.h>
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>

/*
This program provides a solution for producer-consumer problem using mutex and semaphore.
*/

#define MaxItems 5 // Maximum items a producer can produce or a consumer can //consume
#define BufferSize 5 // Size of the buffer

sem_t empty;
sem_t full;
int in = 0;
int out = 0;
int max=MaxItems;
int bfs = BufferSize;
int buffer[BufferSize];
pthread_mutex_t mutex;

void *producer(void *pno)
{
   int item;
   for(int i = 0; i < max; i++) {
      item = rand(); // Produce an random item
      sem_wait(&empty); //Before storing the produced item in the buffer, producer waits on empty value
      pthread_mutex_lock(&mutex); // Producer waits on mutex to get exclusive access to the buffer
      buffer[in] = item; //Producer stores the produced item into the buffer
      printf("%s Produce chip ID: %d at stock position : %d\n", (char *)pno,buffer[in],in);
      in = (in+1)%bfs; //Producer increments the buffer position to the next empty slot
      pthread_mutex_unlock(&mutex); //Producer releases the buffer lock, signal operation is performed
```

```
        sem_post(&full); //Producer performs the signal operation
    }
}

void *consumer(void *cno)
{
    for(int i = 0; i < max; i++) {
        sem_wait(&full); //Consumer waits for the buffer to have at least one item
        pthread_mutex_lock(&mutex); //Consumer waits for the exclusive access to the buffer
        int item = buffer[out]; // Consumer consumes the item in the buffer
        printf("Customer Purchaced chip id : %d from stock position : %d\n",item, out);
        out = (out+1)%bfs;//Consumer increments the buffer size to point to the next full slot
        pthread_mutex_unlock(&mutex); //Consumer releases the buffer lock
        sem_post(&empty); // Consumer performs the signal operation
    }
}

int main()
{


    printf("Enter fixed stock size : ");
    scanf(" %d",&bfs);
    printf("Enter number of stock : ");
    scanf(" %d",&max);
    pthread_t pro,con; // We have one producer and one consumer
    pthread_mutex_init(&mutex, NULL); // Initialize the mutex thread value
    sem_init(&empty,0,bfs); //Initialize the empty semaphore value to full size of the buffer
    sem_init(&full,0,0); //Initialize the full semaphore value to zero

    char * company_name = "Company";

    //The following statement creates the producer
        pthread_create(&pro, NULL, (void *)producer, (void *)company_name);

    //The following statement creates the consumer
        pthread_create(&con, NULL, (void *)consumer, (void *)company_name);

    // The following statement runs the producer
        pthread_join(pro, NULL);
      // The following statement runs the producer
        pthread_join(con, NULL);

    //Once the producer and consumer stop executing destroy all the threads and semaphores used in this
program
    pthread_mutex_destroy(&mutex);
    sem_destroy(&empty);
    sem_destroy(&full);

    return 0;

}
```

OUTPUT:



```
"D:\Folders\sem 4\LABORATORY\OS LAB\Os_p30.exe"
Enter fixed stock size : 3
Enter number of stock : 10
Company Produce chip ID: 41 at stock position : 0
Company Produce chip ID: 18467 at stock position : 1
Company Produce chip ID: 6334 at stock position : 2
Customer Purchaced chip id : 41 from stock position : 0
Customer Purchaced chip id : 18467 from stock position : 1
Customer Purchaced chip id : 6334 from stock position : 2
Company Produce chip ID: 26500 at stock position : 0
Company Produce chip ID: 19169 at stock position : 1
Company Produce chip ID: 15724 at stock position : 2
Customer Purchaced chip id : 26500 from stock position : 0
Customer Purchaced chip id : 19169 from stock position : 1
Customer Purchaced chip id : 15724 from stock position : 2
Company Produce chip ID: 11478 at stock position : 0
Company Produce chip ID: 29358 at stock position : 1
Company Produce chip ID: 26962 at stock position : 2
Customer Purchaced chip id : 11478 from stock position : 0
Customer Purchaced chip id : 29358 from stock position : 1
Customer Purchaced chip id : 26962 from stock position : 2
Company Produce chip ID: 24464 at stock position : 0
Customer Purchaced chip id : 24464 from stock position : 0

Process returned 0 (0x0)   execution time : 19.700 s
Press any key to continue.
```