SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
(15CSL67)

1a. Write a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.

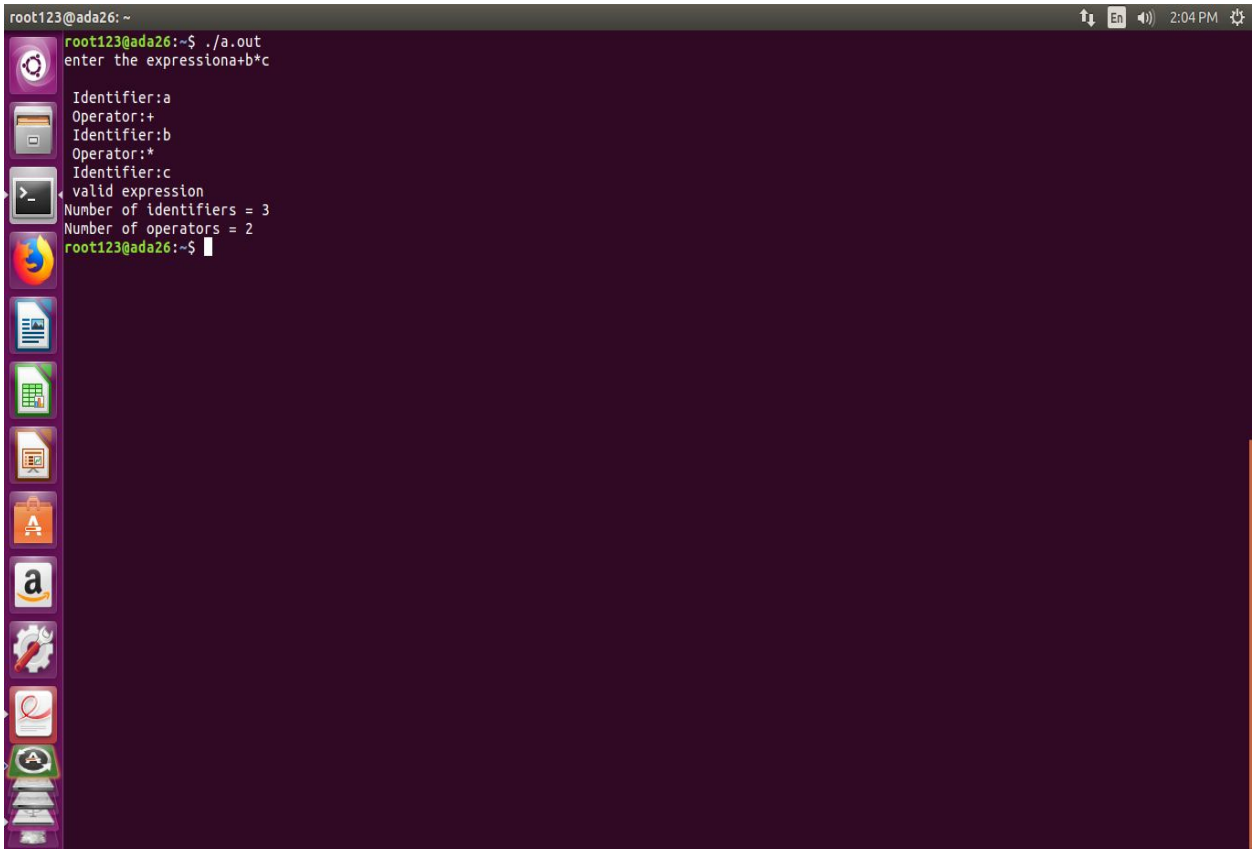
```
%{
#include<stdio.h>
int v=0,op=0,id=0,flag=0;
%}

%%
[a-z A-Z]+[0-9 A-Z a-z]*  {id++;printf("\n Identifier:");ECHO;}
[\+\-\*\/\=]    {op++;printf("\n Operator:");ECHO;}
"("    {v++;}
")"    {v--;}
";"    {flag=1;}
.|\n   {;}
%%

int main()
{
printf("enter the expression");
yylex();

if(((op+1)==id)&&(v==0)&&(flag==0))
{
  printf("\n valid expression\n");
 printf("Number of identifiers = %d\n",id);
 printf("Number of operators = %d\n",op);
}
else
  printf("\n Invalid expression\n");

}
int yywrap()
{
return 1;
}
```

Execution Steps:

Lex <lexfilename.l>

cc lex.yy.c –ll

. /a.out <temp.txt>



b. Write YACC program to evaluate arithmetic expression involving operators: +, -, * and /

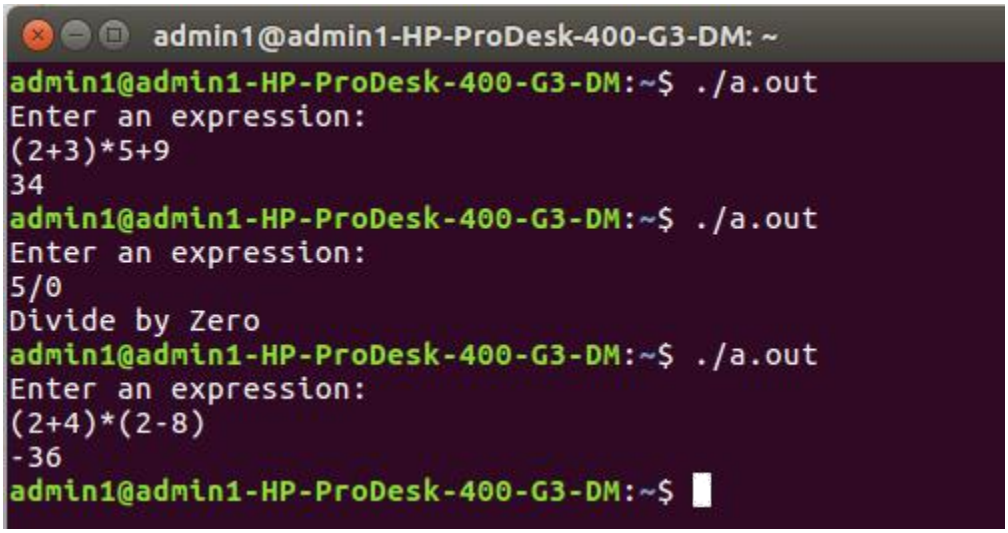
Lex Part

```
%{
#include "y.tab.h"

extern yylval;
%}
%%

[0-9]+ {yylval=atoi(yytext);return num;}  /* convert the
                                             string to number and
                                             send the value*/

[\+\-\*\/] {return yytext[0];}
← {return yytext[0];}
← {return yytext[0];}
. {;}

\n {return 0;}
%%
```

YACC Part

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

#include<stdlib.h>
%}
%token num
%left '+' '-'

%left '*' '/'
%%
input:exp {printf("%d\n",$$);exit(0);}
exp:exp'+'exp {$$=$1+$3;}
|exp'-'exp{$$=$1-$3;}
```

```
|exp'*'exp{$$=$1*$3;}

|exp'/'exp {
         if($3==0){printf("Divide by
         Zero\n");exit(0);} else
$$=$1/$3;}

|'('exp')'{$$=$2;}
|num{$$=$1;};
%%
int yyerror()
{

printf("error");
exit(0);
}

int main()
{
printf("Enter an expression:\n");

yyparse();
}
```



2. Develop, Implement and execute a program using YACC tool to recognize all strings ending with *b* preceded by *n a's* using the grammar $a^n b$ (note: input *n* value).

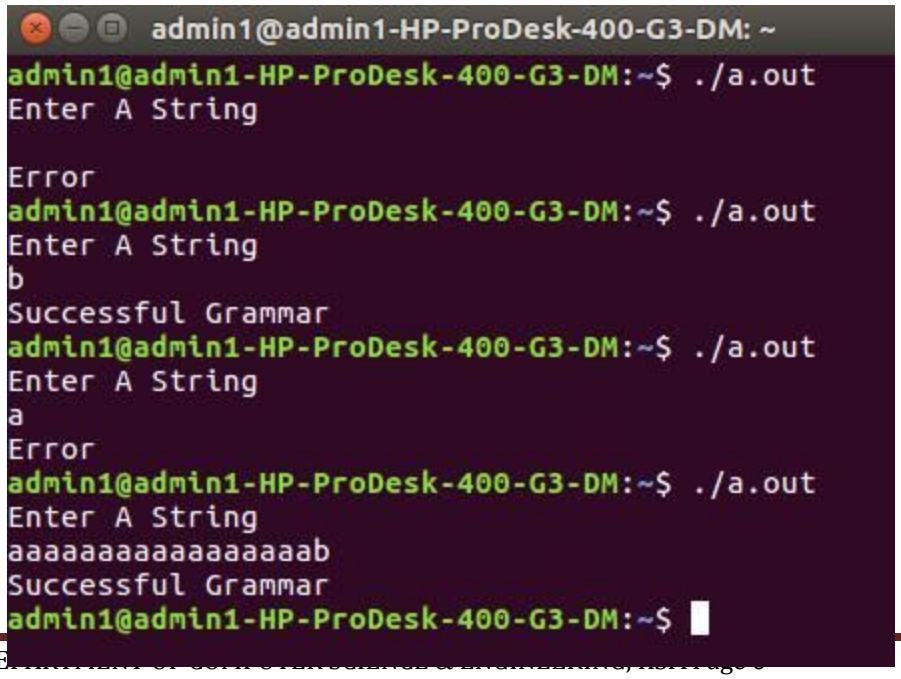
Lex Part

```
%{
#include "y.tab.h"

%}
%%
a {return A;}
b {return B;}
[\n] return '\n';

%%
```

YACC Part

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

%}
%token A B
```

```
%%
input:s'\n' {printf("Successful Grammar\n");exit(0);}

   s:   A
   s1
   B|
   B
   s1
   :
   ;
   |
   A
   s1

%%
main()
{

printf("Enter A
   String\n");
   yyparse();
}


int yyerror()

{
printf("Error \n");
exit(0);
}
```



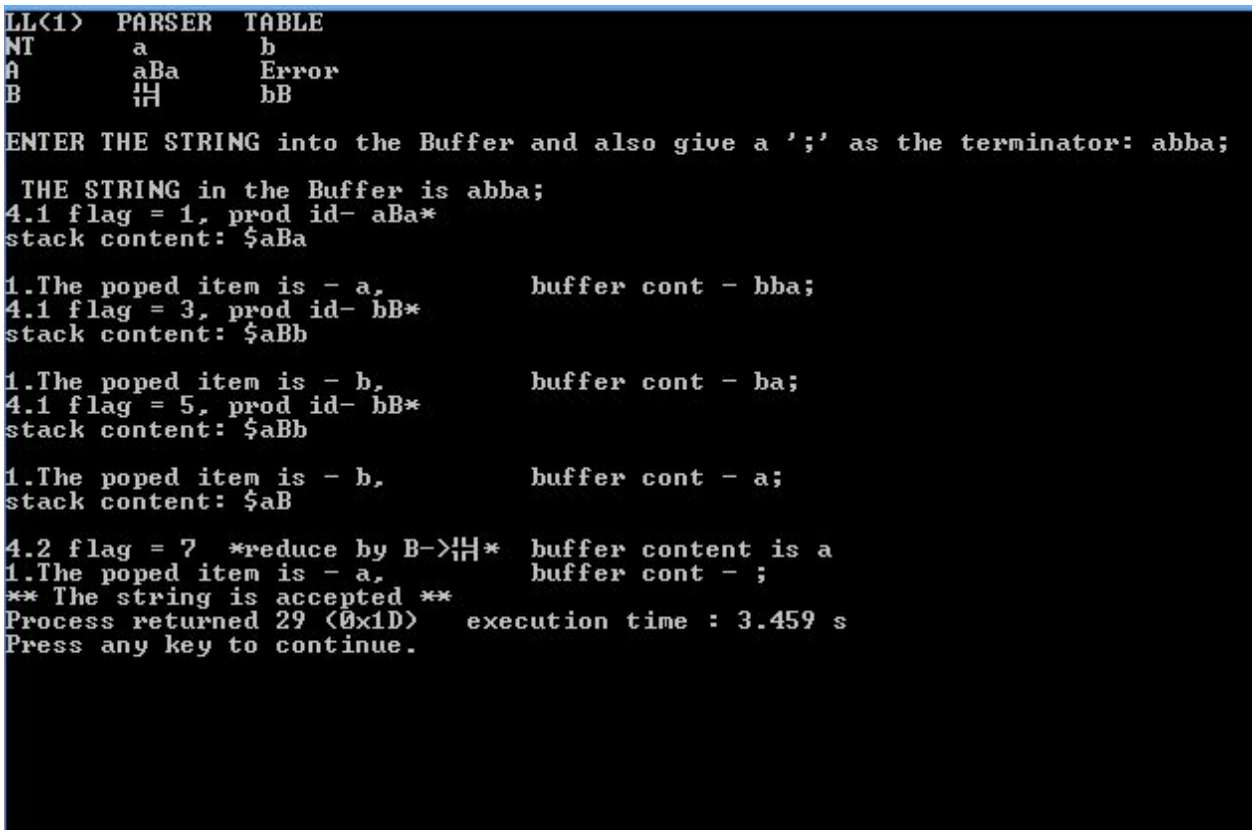
3. **Design, develop and implement YACC/C program to construct *Predictive / LL(1) Parsing Table* for the grammar rules*: A →aBa , B →bB | ε*. Use this table to parse the sentence*: abba$*.**

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

  char STACK[20]="\0";
  int TOP=-1,flag=0;
  int B_ptr = 0;
  char BUFFER[20],G_prod[20];
  char table [3][3][10] = {
```

```
                "NT", "a","b",
                "A", "aBa","Error",
                "B", "Îµ","bB",
                };
char pop()
{
 char ch;
 ch = STACK[TOP--];
 return ch;
}

void push(char ch)
{
 STACK[++TOP] = ch;
}

void stack_content()
{
    if (TOP != -1)
    {
            int i = 0;
           printf("\nstack content: ");
            while(i <= TOP)
            {
                printf("%c",STACK[i++]);
            }
            printf("\n");
    }
    return;
}

int isterm(char c)
{
 if (c >= 'a' && c <= 'z')
      return 1;
 else
      return 0;
}

int Parser_table(char stack_top,char buf_value,int flag)
{
 int r,c;
  switch(stack_top)
 {
      case 'A' : r = 1; break;
```

```
          case 'B' : if(flag<=5) r = 2; else r = 3;
      }
      switch(buf_value)
      {
          case 'a' : c = 1; break;
          case 'b' : c = 2;
      }

          if (strcmp(table[r][c],"error") == 0)
          return 0;

      if (strcmp(table[r][c],"Îµ") != 0)
      {
          strcpy(G_prod,table[r][c]);
      }
      return 1;
     }

     int main()
     {
            int i,j,stln;
            printf("LL(1)  PARSER  TABLE \n");
          for(i=0;i<3;i++)
              {
                for(j=0;j<3;j++)
                    {
                        printf("%s\t",table[i][j]);
                    }
                    printf("\n");
          }
printf("\n");
printf("ENTER THE STRING into the Buffer and also give a ';' as
the terminator: ");
scanf("%s",BUFFER);
printf("\n THE STRING in the Buffer is %s",BUFFER);

          if(BUFFER[strlen(BUFFER)-1] != ';')
          {
              printf("END OF STRING MARKER SHOULD BE ';'");
              exit(0);
          }
          push('$');
          push('A');
          while(STACK[TOP] != '$') // Stack is not Empty
         {
```

```
            flag++;
              if (STACK[TOP] == BUFFER[B_ptr]) // X is a
              {
                   printf("\n1.The poped item is - %c,",pop());
                   B_ptr++;
printf("\t buffer cont - %.*s",strlen(BUFFER),BUFFER+B_ptr);
              }
              else if(isterm(STACK[TOP])) // is X is terminal
                   {
                       printf("\n2. $ %c",STACK[TOP]);
                       printf("\t Error in Parsing \n");
                   }
              else
if (!Parser_table(STACK[TOP],BUFFER[B_ptr],flag))
printf("3. Error Entry in Parse Table ");
else
if (Parser_table(STACK[TOP],BUFFER[B_ptr],flag))
          {
          if (flag < 6 && strcmp(G_prod,"Îµ") != 0)
          {
          printf("\n4.1 flag = %d, prod id- %s*\t",flag,G_prod);
           pop();
           stln = strlen(G_prod);
           for(i=stln-1;i>=0;i--)
           push(G_prod[i]);
           stack_content();
           }
          else
          {
        stack_content();
        printf("\n4.2 flag = %d  *reduce by %s*",flag,"B->Îµ");
        pop();
        printf("\t buffer content is %c",BUFFER[B_ptr]);
                        }
                   }
              }
          if (STACK[TOP] == '$' && BUFFER[B_ptr] == ';')
     printf("\n** The string is accepted **");
     else
     printf("\n** The string is not accepted **");

    }
```

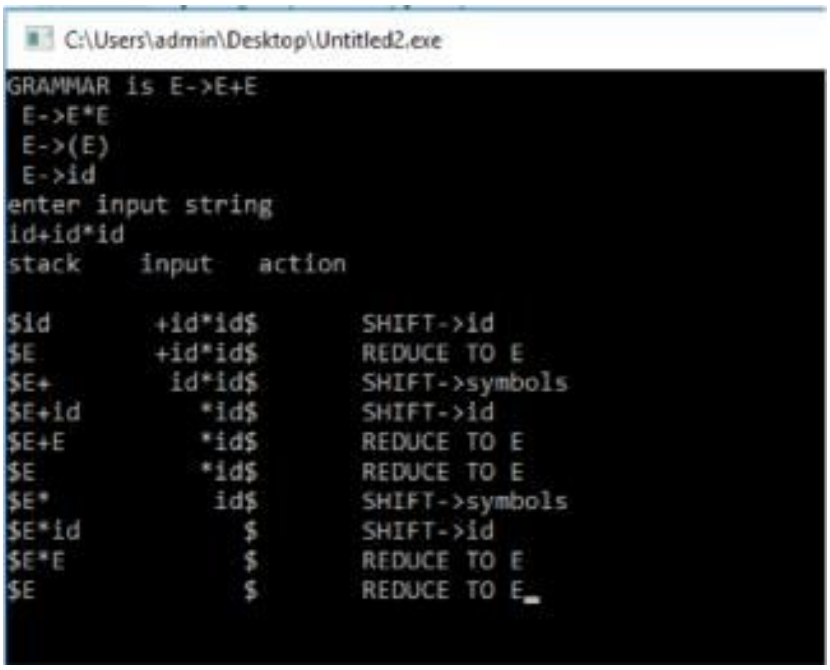


4. Design, develop and implement YACC/C program to demonstrate ***Shift Reduce Parsing*** technique for the grammar rules: ***E →E+T | T, T →T*F | F, F → (E) | id*** and parse the sentence***: id + id * id***.

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

```
#include<conio.h>
#include<string.h>
int k=0,z=0,i=0,j=0,c=0;
char a[16],ac[20],stk[15],act[10];

void check();
void main()
{
puts("GRAMMAR is E->E+E \n E->E*E \n E->(E) \n E->id");
puts("enter input string ");

gets(a);
c=strlen(a);
strcpy(act,"SHIFT->");
puts("stack \t input \t action");

for(k=0,i=0; j<c; k++,i++,j++)
{
if(a[j]=='i' && a[j+1]=='d')
{
stk[i]=a[j];

stk[i+1]=a[j+1];
stk[i+2]='\0';
a[j]=' ';
a[j+1]=' ';
printf("\n$%s\t%s$\t%sid",stk,a,act);

check();
     }
else
{
stk[i]=a[j];
stk[i+1]='\0';

a[j]=' ';
printf("\n$%s\t%s$\t%ssymbols",stk,a,act);
check();
}
}

getch();
}
void check()
{
```

```
strcpy(ac,"REDUCE TO E");
for(z=0; z<c; z++)
if(stk[z]=='i' && stk[z+1]=='d')
{
stk[z]='E';

stk[z+1]='\0';
printf("\n$%s\t%s$\t%s",stk,a,ac);
j++;
}
for(z=0; z<c; z++)

if(stk[z]=='E' && stk[z+1]=='+' && stk[z+2]=='E')
{
stk[z]='E';
stk[z+1]='\0';

stk[z+2]='\0';
printf("\n$%s\t%s$\t%s",stk,a,ac);
i=i-2;
}
for(z=0; z<c; z++)

if(stk[z]=='E' && stk[z+1]=='*' && stk[z+2]=='E')
{
stk[z]='E';
stk[z+1]='\0';

stk[z+1]='\0';
printf("\n$%s\t%s$\t%s",stk,a,ac);
i=i-2;
}
for(z=0; z<c; z++)

if(stk[z]=='(' && stk[z+1]=='E' && stk[z+2]==')')
{
stk[z]='E';
stk[z+1]='\0';
stk[z+1]='\0';
printf("\n$%s\t%s$\t%s",stk,a,ac);
i=i-2;
}

}
```



5. Design, develop and implement a C/Java program to generate the machine code using ***Triples*** for the statement ***A = -B * (C +D)*** whose intermediate code in three-address form:

T1 = -B
T2 = C + D
T3 = T1 * T2
A = T3

```
#include<stdio.h>
 #include<stdlib.h>
 #include<ctype.h>
#include<string.h>
char tset[4][3][3]= { {"-","B","?"}, {"+","C","D"},
{"*","0","1"}, {"=","A","2"} };
int main()
{
      int row,col;
       for(row=0;row<4;row++)
      {
      col=2;
      if (tset[row][col][0]=='?')
```

```
            {
           printf("\nLD R0,%s%s",tset[row][0],tset[row][1]);
           }
           else
            {
           if(tset[row][0][0]=='+')
                {
                printf("\nLD R1,%s",tset[row][1]);
                printf("\nLD R2,%s",tset[row][2]);
                printf("\nADD R1,R1,R2");
                }
           else
                 {
                if(tset[row][0][0]=='*')
                 {
                printf("\nMUL R1,R1,R0");
                }
                 else
                 {
                 printf("\nST %s,R1",tset[row][1]);
                }
            }
      }
}
printf("\n"); return 0;
}
```

```
LD R0,-B
LD R1,C
LD R2,D
ADD R1,R1,R2
MUL R1,R1,R0
ST  A,R0
```

6. a) Write a LEX program to eliminate *comment lines* in a *C* program and copy the resulting program into a separate file.

```
%{
#include<stdio.h>
int c_count=0;
%}

%%
"/*"[^*/]*"*/" {c_count++;}
"//".*             {c_count++;}
%%
int main( int argc, char **argv)

{
FILE *f1,*f2;
if(argc>1)
```

```
{

f1=fopen(argv[1],"r");          /*open first file for reading*/
if(!f1)                         /*not able to open file*/
{
     printf("file error \n");

exit(1);
}
yyin=f1;
f2=fopen(argv[2],"w");     /*open second file for writing*/
if(!f2)                    /*not able to open file*/

{
printf("Error");
exit(1);
}

yyout=f2;

yylex();
printf("Number of Comment Lines: %d\n",c_count);
}

return 0;
}
```

```
admin1@admin1-HP-ProDesk-400-G3-DM: ~
admin1@admin1-HP-ProDesk-400-G3-DM:~$ cat > a.c
#include<stdio.h>
main()
{
 int a, b, c;
/* declaration */

printf("------------------------");
scanf("----------");

//for reading

getch();
}
admin1@admin1-HP-ProDesk-400-G3-DM:~$ ./a.out a.c b.c
Number of Comment Lines: 2
admin1@admin1-HP-ProDesk-400-G3-DM:~$ cat b.c
#include<stdio.h>
main()
{
 int a, b, c;
```

b) Write YACC program to recognize valid *identifier, operators* and *keywords* in the given text (C program) file.

Lex File

```
%{
#include <stdio.h>
#include "y.tab.h"

extern yylval;
```

```
%}
%%
[ \t] ;
[+|-|*|/|=|<|>] {printf("operator is %s\n",yytext);return OP;}

[0-9]+ {yylval = atoi(yytext); printf("numbers is %d\n",yylval);
  return DIGIT;}
int|char|bool|float|void|for|do|while|if|else|return|void
  {printf("keyword is
%s\n",yytext);return KEY;}
[a-zA-Z0-9]+ {printf("identifier is %s\n",yytext);return ID;}

. ;
%%
```

Yacc File

```
%{

#include <stdio.h>
#include <stdlib.h>
int id=0, dig=0, key=0, op=0;
%}
%token DIGIT ID KEY OP

%%
input:
DIGIT input { dig++; }
| ID input { id++; }

| KEY input { key++; }
| OP input {op++;}
| DIGIT { dig++; }
| ID { id++; }
| KEY { key++; }

| OP { op++;}
;
%%
#include <stdio.h>
extern int yylex();

extern int yyparse();
extern FILE *yyin;
```

```
main()
 {
FILE *myfile = fopen("sam_input.c", "r");
if (!myfile) {
printf("I can't open sam_input.c!");

return -1;
}
yyin = myfile;
do {
yyparse();

} while (!feof(yyin));
printf("numbers = %d\nKeywords = %d\nIdentifiers = %d\noperators
  = %d\n",
dig, key,id, op);
}

void yyerror() {
printf("EEK, parse error! Message: ");
exit(-1);
```

}

```
admin1@admin1-HP-ProDesk-400-G3-DM:~$ ./a.out
keyword is void
identifier is main


keyword is float
identifier is a123

keyword is char
identifier is a

keyword is char
identifier is b123

keyword is char
identifier is c

keyword is if
identifier is sum
operator is =
```

```
1 void main()
2 {
3     float a123;
4     char a;
5     char b123;
6     char c;
7     if (sum == 10)
8         printf("pass");
9     else
10        printf("fail");
11 }
```

7. Design, develop and implement a C/C++/Java program to simulate the working of ***Shortest remaining time*** and ***Round Robin (RR)*** scheduling algorithms. Experiment with different quantum sizes for RR

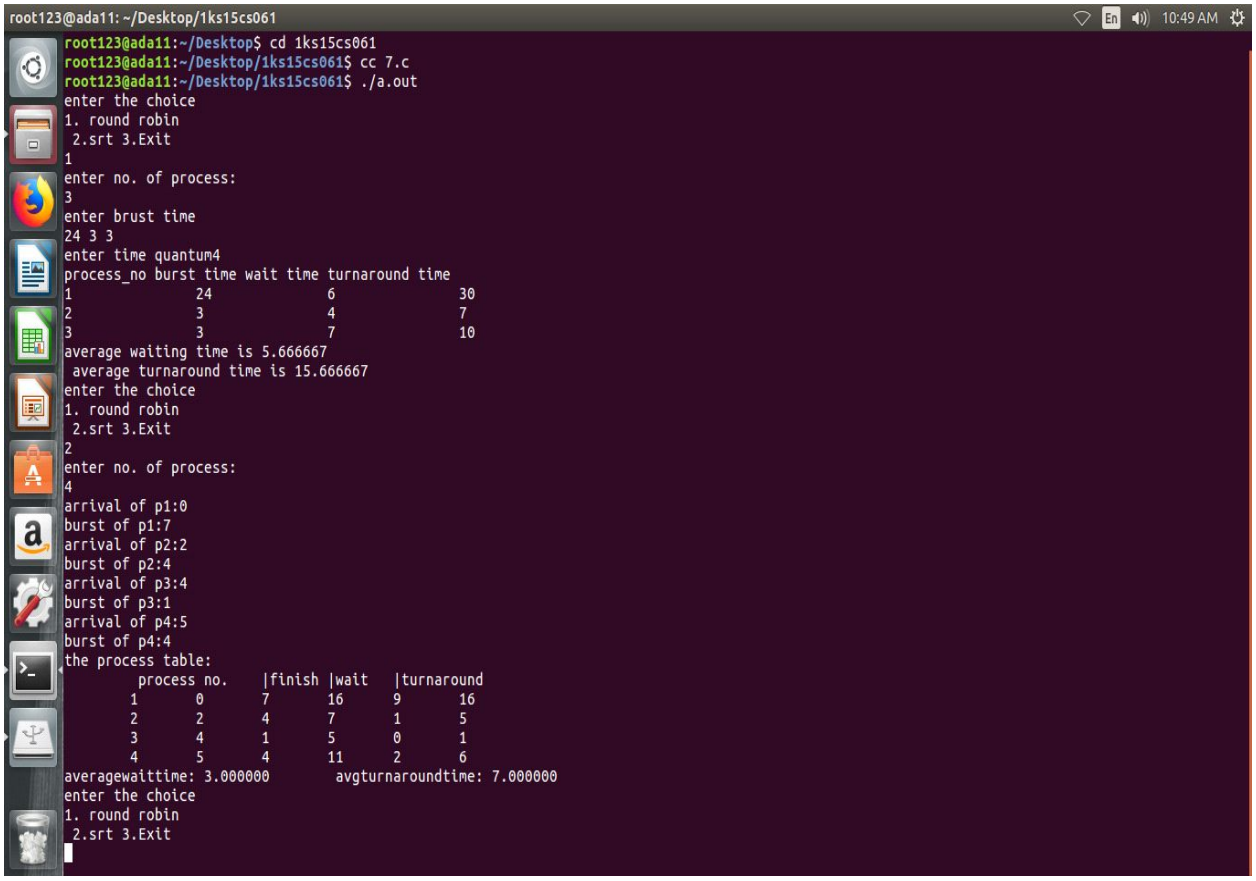
algorithm.

```
#include<stdio.h>
#include<stdlib.h>
int arrival[10];
int burst[10];
int rem[10];
int wait[10];
int finish[10];
int turnaround[10];
int flag[10];
void roundrobin(int,int,int[],int[]);
void srtf(int);

int main()
{
int n,tq,choice;
int bt[10],st[10],i,j;
for(;;)
{
printf("enter the choice\n1. round robin\n 2.srt 3.Exit\n");
scanf("%d",&choice);
switch(choice)
{
```

```
case 1:
printf("enter no. of process:\n");
scanf("%d",&n);
printf("enter brust time\n");
for(i=0;i<n;i++)
{
  scanf("%d",&bt[i]);
  st[i]=bt[i];
}
printf("enter time quantum");
scanf("%d",&tq);
roundrobin(n,tq,st,bt);
break;

case 2:
printf("enter no. of process:\n");
scanf("%d",&n);
srtf(n);
break;

case 3:return 0;
}
}
}
void roundrobin(int n,int tq,int st[],int bt[])
{
int time=0;
int tat[10],wt[10],i,count=0,swt=0,stat=0,temp1,sq=0;

while(1)
{
for(i=0,count=0;i<n;i++)
{
temp1=tq;
if(st[i]==0)
{
count++;
continue;
}
if(st[i]>tq)
  st[i]=st[i]-tq;
else
if(st[i]>=0)
{
temp1=st[i];
```

```
st[i]=0;
}

sq=sq+temp1;
tat[i]=sq;
}

if(n==count)
break;
}
for(i=0;i<n;i++)
{
wt[i]=tat[i]-bt[i];
swt=swt+wt[i];
stat=stat+tat[i];
}
printf("process_no burst time wait time turnaround time\n");
for(i=0;i<n;i++)
   printf("%d\t\t%d\t\t%d\t\t%d\n",i+1,bt[i],wt[i],tat[i]);
printf("average waiting time is %f\n average turnaround time is
%f\n",(float)swt/n,(float)stat/n);
}

void srtf(int n)
{
int stat=0,swt=0,time=0,count=0,i,j,min=999;
for(i=1;i<=n;i++)
{
printf("arrival of p%d:",i);
scanf("%d",&arrival[i]);
printf("burst of p%d:",i);
scanf("%d",&burst[i]);
rem[i]=burst[i];
flag[i]=0;
}

while(1)
{

for(i=1,min=999;i<=n;i++)
  if(arrival[i]<=time&&flag[i]==0)
     if(rem[i]<min)
       {
         min=rem[i];
         j=i;
```

```
        }
         time++;
         rem[j]-=1;
        if(rem[j]==0)
        {
          finish[j]=time;
          flag[j]=1;
          count++;
        }
        if(count==n)
          break;
}
for(i=1;i<=n;i++)
 {
   turnaround[i]=finish[i]-arrival[i];
   wait[i]=turnaround[i]-burst[i];
   stat+=turnaround[i];
   swt+=wait[i];
 }

printf("the process table:\n\t process
no.\t|finish\t|wait\t|turnaround\t\n");
for(i=1;i<=n;i++)
   printf("\t%d  \t%d  \t%d  \t%d  \t%d
\t%d\n",i,arrival[i],burst[i],finish[i],wait[i],turnaround[i]);
printf("averagewaittime: %f\t avgturnaroundtime:
%f\n",(float)swt/n,(float)stat/n);
return;
}
```



8. Design, develop and implement a C/C++/Java program to implement ***Banker's algorithm***. Assume suitable input required to demonstrate the results.

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

```
#include <stdlib.h>
int main()
{

   int Max[10][10], need[10][10], alloc[10][10],
     avail[10], completed[10], safeSequence[10];

int p, r, i, j, process, count;
count = 0;

printf("Enter the no of processes : ");
scanf("%d", &p);

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

printf("\n\nEnter the no of resources : ");
scanf("%d", &r);

printf("\n\nEnter the Max Matrix for each process : ");
for(i = 0; i < p; i++)

{
printf("\nFor process %d : ", i + 1);
for(j = 0; j < r; j++)
    scanf("%d", &Max[i][j]);
}
printf("\n\nEnter the allocation for each process : ");
for(i = 0; i < p; i++)

{
printf("\nFor process %d : ",i + 1);
for(j = 0; j < r; j++)
   scanf("%d", &alloc[i][j]);
}

printf("\n\nEnter the Available Resources : );
for(i = 0; i < r; i++)
  scanf("%d", &avail[i]);

  for(i = 0; i < p; i++)
for(j = 0; j < r; j++)
   need[i][j] = Max[i][j] - alloc[i][j];
```

```
do
{
printf("\n Max matrix:\tAllocation matrix:\n");

for(i = 0; i < p; i++)
{
  for( j = 0; j < r; j++)
printf("%d ", Max[i][j]);

  printf("\t\t");
  for( j = 0; j < r; j++)
printf("%d ", alloc[i][j]);
  printf("\n");
}

process = -1;

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

{
if(completed[i] == 0)//if not completed
{
process = i ;
for(j = 0; j < r; j++)

{
if(avail[j] < need[i][j])
{
process = -1;
            break;
}
}
}

if(process != -1)
break;
}

if(process != -1)

{
```

```
printf("\nProcess %d runs to completion!", process + 1);
        safeSequence[count] = process + 1; count++;
for(j = 0; j < r; j++)
{
avail[j] += alloc[process][j];
alloc[process][j] = 0;
Max[process][j] = 0;

completed[process] = 1;
}
}
}
while(count != p && process != -1);

if(count == p)
{
printf("\nThe system is in a safe state!!\n");

printf("Safe Sequence : < ");
for( i = 0; i < p; i++)
printf("%d ", safeSequence[i]);
printf(">\n");
}

else
printf("\nThe system is in an unsafe state!!");

}
```

Output:

Enter the no of processes : 5
Enter the no of resources : 3
Enter the Max Matrix for each process :
For process 1 : 7
5
3
For process 2 : 3
2
2
For process 3 : 7
0
2

```
For process 4 : 2
2
2
For process 5 : 4
3

3

Enter the allocation for each process :
For process 1 : 0
1
0
For process 2 : 2
0
0
For process 3 : 3
0
2
For process 4 : 2
1
1
For process 5 : 0
0
2
Enter the Available Resources : 3
  3
  2
   Max matrix:    Allocation matrix:
  7 5 3          0   1 0
  3 2 2          2   0 0
  7 0 2          3   0 2
  2 2 2          2   1 1
  4 3 3          0   0 2

  Process 2 runs to completion!
   Max matrix:    Allocation matrix:
  7 5 3          0   1 0
  0 0 0          0   0 0
  7 0 2          3   0 2
  2 2 2          2   1 1

  4 3 3           0 0 2

  Process 3 runs to completion!
  Max matrix:       Allocation matrix:
```

```
7 5 3          0 1 0
0 0 0          0 0 0
0 0 0          0 0 0
2 2 2          2 1 1
4 3 3          0 0 2

Process 4 runs to completion!
Max matrix:    Allocation matrix:
7 5 3          0 1 0
0 0 0          0 0 0
0 0 0          0 0 0
0 0 0          0 0 0
4 3 3          0 0 2

Process 1 runs to completion!
Max matrix:    Allocation matrix:
0 0 0          0 0 0
0 0 0          0 0 0
0 0 0          0 0 0
0 0 0          0 0 0
4 3 3          0 0 2

Process 5 runs to completion!
The system is in a safe state!!
  Safe Sequence: < 2 3 4 1 5 >
```

9. Design, develop and implement a C/C++/Java program to implement ***page replacement algorithms LRU*** and ***FIFO***. Assume suitable input required to demonstrate the results.

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

void FIFO()
{
     char s[200];
     char F[200];
     int l,f,i,j=0,k,flag=0,cnt=0;

     printf("\nEnter the number of frames : ");
     scanf("%d",&f);

     printf("\nEnter the length of the string: ");
     scanf("%d",&l);

     printf("\nEnter the string: ");
     scanf("%s", s);
```

```
	for(i=0;i<f;i++)
	F[i]=' ';

	printf("\n\tPAGE\t\tFRAMES\t\t\tFAULTS");
	for(i=0;i<l;i++)
	{
			for(k=0;k<f;k++)
			if(F[k]==s[i])
			flag=1;

			if(flag==0)
			{
				printf("\n\t%c\t",s[i]);
				F[j]=s[i];
				j++;
				for(k=0;k<f;k++)
				printf("\t%c",F[k]);
				printf("\tPage-fault%d",cnt);
				cnt++;
			}
			else
			{
				flag=0;
				printf("\n\t%c\t",s[i]);
				for(k=0;k<f;k++)
				printf("\t%c",F[k]);
				printf("\tNo page-fault");
			}
			if(j==f)
			j=0;
	}
}

int findLRU(int time[], int n)
{
	int i, minimum = time[0], pos = 0;
```

```
     for(i = 1; i < n; ++i)
     {
          if(time[i] < minimum)
          {
               minimum = time[i];
               pos = i;
          }
     }
     return pos;
}

int lru()
{
     int no_of_frames, no_of_pages, frames[10], counter = 0;
     int time[10], flag1, flag2, i, j, pos, faults = 0, page;
     char s[200];

     printf("\nEnter number of frames: ");
     scanf("%d", &no_of_frames);

     printf("\nEnter number of pages: ");
     scanf("%d", &no_of_pages);

     printf("\nEnter reference string: ");
     scanf("%s", s);

     for(i = 0; i < no_of_frames; ++i)
     frames[i] = -1;

     for(i = 0; i < no_of_pages; ++i)
     {
          flag1 = flag2 = 0;
          page = s[i] - '0';
          for(j = 0; j < no_of_frames; ++j)
          {
               if(frames[j] == page)
               {
```

```
                    counter++;
                    time[j] = counter;
                    flag1 = flag2 = 1;
                    break;
               }
          }
          if(flag1 == 0)
          {
               for(j = 0; j < no_of_frames; ++j)
               {
                    if(frames[j] == -1)
                    {
                         counter++;
                         faults++;
                         frames[j] = page;
                         time[j] = counter;
                         flag2 = 1;
                         break;
                    }
               }
          }
          if(flag2 == 0)
          {
               pos = findLRU(time, no_of_frames);
               counter++;
               faults++;
               frames[pos] = page;
               time[pos] = counter;
          }
          printf("\n");
          for(j = 0; j < no_of_frames; ++j)
          printf("%d\t", frames[j]);
     }
     printf("\n\nTotal Page Faults = %d", faults);
     return 0;
}
```

```
int main()
{
     int ch,YN=1,i,l,f;
     char F[10],s[25];
     do
     {
          printf("\nOptions : ");
          printf("\n\n1:FIFO\n2:LRU \n3:EXIT");
          printf("\n\nEnter your choice: ");
          scanf("%d",&ch);
          switch(ch)
          {
               case 1:   FIFO();
                    break;
               case 2: lru();
                    break;
               default:
                    exit(0);
          }
          printf("\n\nPress 1 to continue.. 0 to exit ");
          scanf("%d",&YN);
     }while(YN==1);
     return(0);
}
```

```
root123@root123-Inspiron-N5010:~$ ./a.out

Options :

1:FIFO
2:LRU
3:EXIT

Enter your choice: 1

Enter the number of frames : 4

Enter the length of the string: 13

Enter the string: 2342137543231

        PAGE            FRAMES                  FAULTS
        2               2                               Page-fault0
        3               2       3                       Page-fault1
        4               2       3       4               Page-fault2
        2               2       3       4               No page-fault
        1               2       3       4       1       Page-fault3
        3               2       3       4       1       No page-fault
        7               7       3       4       1       Page-fault4
        5               7       5       4       1       Page-fault5
        4               7       5       4       1       No page-fault
        3               7       5       3       1       Page-fault6
        2               7       5       3       2       Page-fault7
        3               7       5       3       2       No page-fault
        1               1       5       3       2       Page-fault8

Press 1 to continue.. 0 to exit

Options :

1:FIFO
2:LRU
3:EXIT

Enter your choice: 2

Enter number of frames: 4

Enter number of pages: 13

Enter reference string: 2342137543231

2       -1      -1      -1
2       3       -1      -1
2       3       4       -1
2       3       4       -1
2       3       4       1
2       3       4       1
2       3       7       1
5       3       7       1
5       3       7       4
5       3       7       4
5       3       2       4
5       3       2       4
1       3       2       4

Total Page Faults = 9

Press 1 to continue.. 0 to exit
```