4/29/2022

My System Software and Compiler Design Lab Manual

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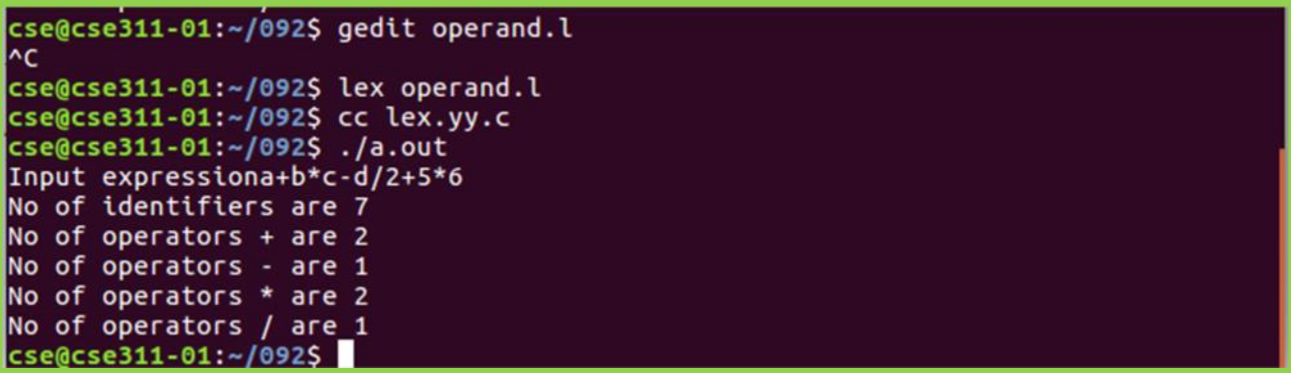
Program 1a: Write a Lex Program to count the no of identifiers, operators

```
%{
#include<stdio.h>
int a[]={0,0,0,0},opnd=0,valid=1,i=0;
void ext();
%}
%x oper
%%
[a-zA-Z0-9]+ {opnd++;BEGIN oper;}
<oper>"+" {if(valid){valid=0;i=0;} else ext();}
<oper>"-" {if(valid){valid=0;i=1;} else ext();}
<oper>"*" {if(valid){valid=0;i=2;} else ext();}
<oper>"/" {if(valid){valid=0;i=3;} else ext();}
<oper>[0-9a-zA-Z]+ {opnd++; if(valid==0){valid=1;a[i]++;}}
<oper>"\n" {if(valid==0)ext(); else return 0;}
.|\n {ext();}
%%
void ext()
{
printf("Invalid expression");
exit(0);
}
int yywrap(void){return 0;}
int main()
{
printf("Input expression");
yylex();
printf("No of identifiers are %d\n",opnd);
printf("No of operators + are %d\n",a[0]);
printf("No of operators - are %d\n",a[1]);
printf("No of operators * are %d\n",a[2]);
printf("No of operators / are %d\n",a[3]);
}
```

Output:



```
cse@cse311-01:~/092$ gedit operand.l
^C
cse@cse311-01:~/092$ lex operand.l
cse@cse311-01:~/092$ cc lex.yy.c
cse@cse311-01:~/092$ ./a.out
Input expressiona+b*c-d/2+5*6
No of identifiers are 7
No of operators + are 2
No of operators - are 1
No of operators * are 2
No of operators / are 1
cse@cse311-01:~/092$ 
```

Program 1b: Write a YACC to evaluate arithmetic expressions to evaluate arithmetic expressions involving +,-,*,/

Soln
In a separate file named arithmatic.l

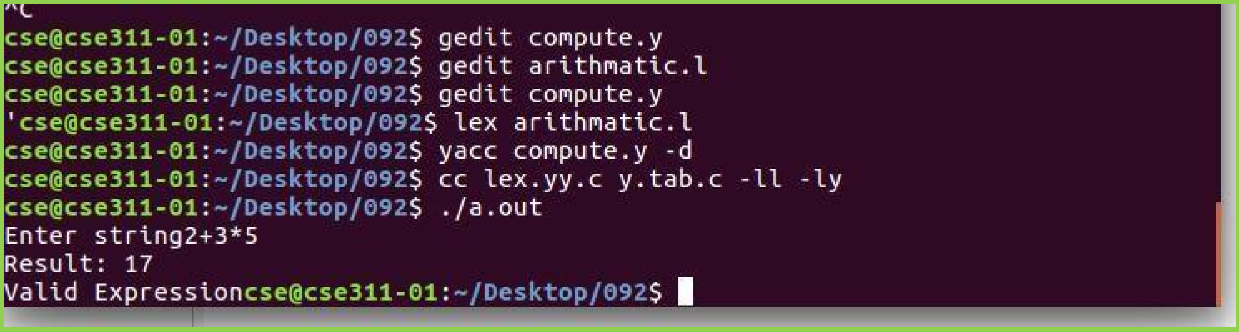
```
%{

#include<stdio.h>

#include<stdlib.h>

 #include "y.tab.h"

 extern int yylval;

%}

%%

[0-9]+ {yylval=atoi(yytext);return NUM;}

\t {;}

\n {return 0;}

. {return yytext[0];}

%%
```

In a separate file named compute.y

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

int yylex();

int yyerror(); %}

%token NUM

%left '+' '-'

 %left '*' '/'
```

```
%%
str:e {printf("Result: %d\n",$1); return 0;}
;
e:e'+'e {$$=$1+$3;}
|e'-'e {$$=$1-$3;}
|e'*'e {$$=$1*$3;}
|e'/'e {$$=$1/$3;}
|'('e')' {$$=$2;}
|NUM
;
%%
void main()
{
printf("Enter string");
yyparse();
printf("Valid Expression");
}
int yyerror()
{
printf("Invalid expression");
return 0;
}
```

Output



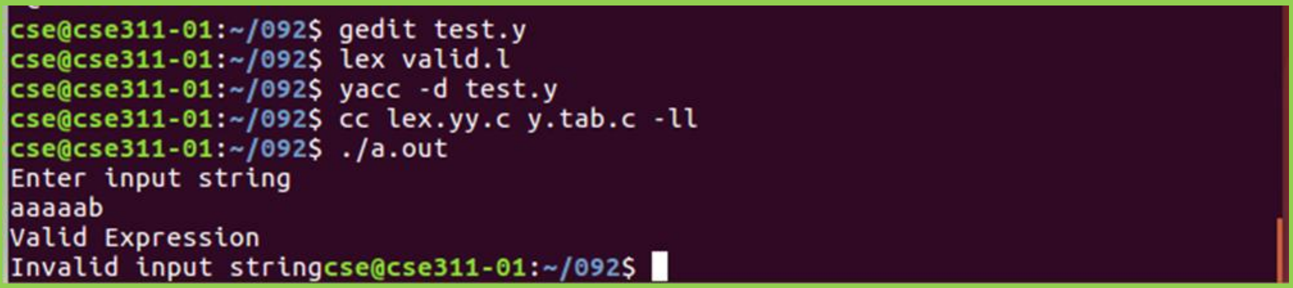
```
^C
cse@cse311-01:~/Desktop/092$ gedit compute.y
cse@cse311-01:~/Desktop/092$ gedit arithmatic.l
cse@cse311-01:~/Desktop/092$ gedit compute.y
'cse@cse311-01:~/Desktop/092$ lex arithmatic.l
cse@cse311-01:~/Desktop/092$ yacc compute.y -d
cse@cse311-01:~/Desktop/092$ cc lex.yy.c y.tab.c -ll -ly
cse@cse311-01:~/Desktop/092$ ./a.out
Enter string2+3*5
Result: 17
Valid Expressioncse@cse311-01:~/Desktop/092$ 
```

2) To recognize a string ending with b and preceeded by n a’s
lex program

```
%{
#include<stdio.h>
#include"y.tab.h"
%}
%%
a {return A;}
b {return B;}
\n {return yytext[0];}
. {return yytext[0];}
%%
```

yacc program

```
%{
#include<stdio.h>
int yyerror();
int yylex();
%}
%token A B
%%
str:s'\n' {printf("Valid Expression");}
;
s:x B
;
x:x A | A
;
%%
int yywrap()
        {
        return 0;
        }
int main()
{
printf("Enter input string\n");
if(!yyparse())
{
printf("Valid String");
return 0;
}
}
int yyerror()
{
printf("Invalid input string");
return 0;
}
```



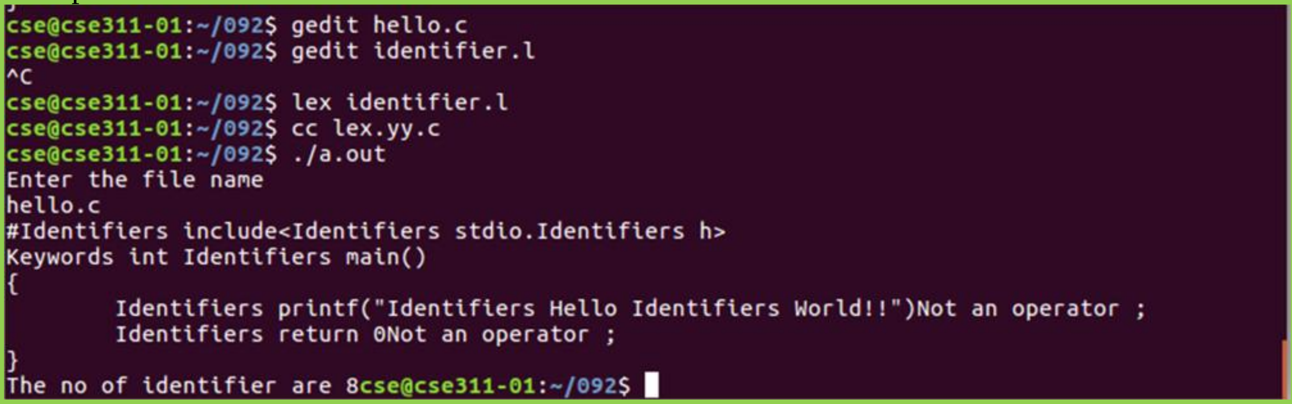
```
cse@cse311-01:~/092$ gedit test.y
cse@cse311-01:~/092$ lex valid.l
cse@cse311-01:~/092$ yacc -d test.y
cse@cse311-01:~/092$ cc lex.yy.c y.tab.c -ll
cse@cse311-01:~/092$ ./a.out
Enter input string
aaaaab
Valid Expression
Invalid input stringcse@cse311-01:~/092$ 
```

6)

Soln)

```
%{
#include<stdio.h>
int count=0;
%}
op[\+\-\*\/\=]
nop[\,\;]
digit[0-9]
letter[a-zA-Z]
id{letter}+|({letter}{digit})+
nid({digit}{letter})+
%%
("if")|("for")|("int") {printf("Keywords %s",yytext);}
{id} {printf("Identifiers %s",yytext);count++;}
{op} {printf("Operator %s",yytext);}
{nop} {printf("Not an operator %s",yytext);}
{nid} {printf("Not an identifier %s",yytext);}
%%
int yywrap(){}
int main()
{
FILE *fp;
char file[10];
printf("Enter the file name\n");
scanf("%s",file);
fp=fopen(file,"r");
yyin=fp;
yylex();
printf("The no of identifier are %d",count);
return 0;
}
```

Output:



```
cse@cse311-01:~/092$ gedit hello.c
cse@cse311-01:~/092$ gedit identifier.l
^C
cse@cse311-01:~/092$ lex identifier.l
cse@cse311-01:~/092$ cc lex.yy.c
cse@cse311-01:~/092$ ./a.out
Enter the file name
hello.c
#Identifiers include<Identifiers stdio.Identifiers h>
Keywords int Identifiers main()
{
        Identifiers printf("Identifiers Hello Identifiers World!!")Not an operator ;
        Identifiers return 0Not an operator ;
}
The no of identifier are 8cse@cse311-01:~/092$ 
```

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

7a) Round Robin

Soln)

```
package myLab;

import java.util.*;

public class RoundRobin{

        public static void main(String args[]){

        Scanner sc = new Scanner(System.in);

        int num,rp,quantum,bt[],rt[];

        bt=new int[10];

        rt=new int[10];

        System.out.println("ENTER NO. OF PROCESSES");

        num = sc.nextInt();

        System.out.println("ENTER BURST TIME");

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

                System.out.println("P["+(i+1)+"]");

                bt[i]=sc.nextInt();

                rt[i]=bt[i];

        }
```

```
    System.out.println("ENTER QUANTUM");
    quantum=sc.nextInt();
    int time=0,i=0;
    rp=num;
    System.out.println("|PROCESS|TIME(0)|");
    System.out.println("");
    System.out.println("");
    while(rp>0){
        if(rt[i]>quantum){
            rt[i]=rt[i]-quantum;
            System.out.print("|     P"+(i+1)+"|");
            time = time + quantum;
            System.out.println(time);
        }
        else if(rt[i]<=quantum && rt[i]>0){
            time = time +rt[i];
            rt[i]=rt[i]-rt[i];
            System.out.print("|     P"+(i+1)+"|");
            System.out.println(time);
            rp--;
        }
        i++;
        if(i==num)
            i=0;
        }
    }
}
```

7b)

```
package myLab;
import java.util.*;
public class ShortestRemainingTime {

	public static void main(String[] args) {
		// TODO Auto-generated method stub
		int process[],bt[],wt[],tat[],i,j,n,total=0;
		int pos,temp;
		float avg_wt,avg_tat;
		Scanner sc = new Scanner(System.in);
		System.out.println("Enter no of process");
		n = sc.nextInt();
		process=new int[n];
		bt = new int[n];
		wt = new int[n];
		tat = new int[n];
		System.out.println("Enter bt");
		for(i=0;i<n;i++)
		{
			System.out.println("p["+(i+1)+"]");
			bt[i]=sc.nextInt();
			process[i]=i+1;
		}
		//Sorting Code Here
		for(i=0;i<n;i++)
		{
			pos=i;
			for(j=i+1;j<n;j++)
			{
        if(bt[j]<bt[pos])
        {
            pos=j;
        }
    }
    temp=bt[i];
    bt[i]=bt[pos];
    bt[pos]=temp;
    temp=process[i];
    process[i]=process[pos];
    process[pos]=temp;
}
//ending of loop
wt[0]=0;
for(i=0;i<n;i++)
{
    wt[i]=0;
    for(j=0;j<i;j++)
    {
        wt[i]=wt[i]+bt[j];
    }
    total=total+wt[i];
}
avg_wt=(float)total/n;
System.out.println("Process\t"+"BT\t"+"WT\t"+"TAT");
total=0;
for(i=0;i<n;i++)
{
    tat[i]=wt[i]+bt[i];
    total=total+tat[i];
```

```
            System.out.println("P"+process[i]+"\t"+bt[i]+"\t"+wt[i]+"\t"+tat[i]);
        }
        avg_tat=(float)total/n;
        System.out.println("Avg Wt: \t"+avg_wt);
        System.out.println("Avg Tat: \t"+avg_tat);
    }
}
```

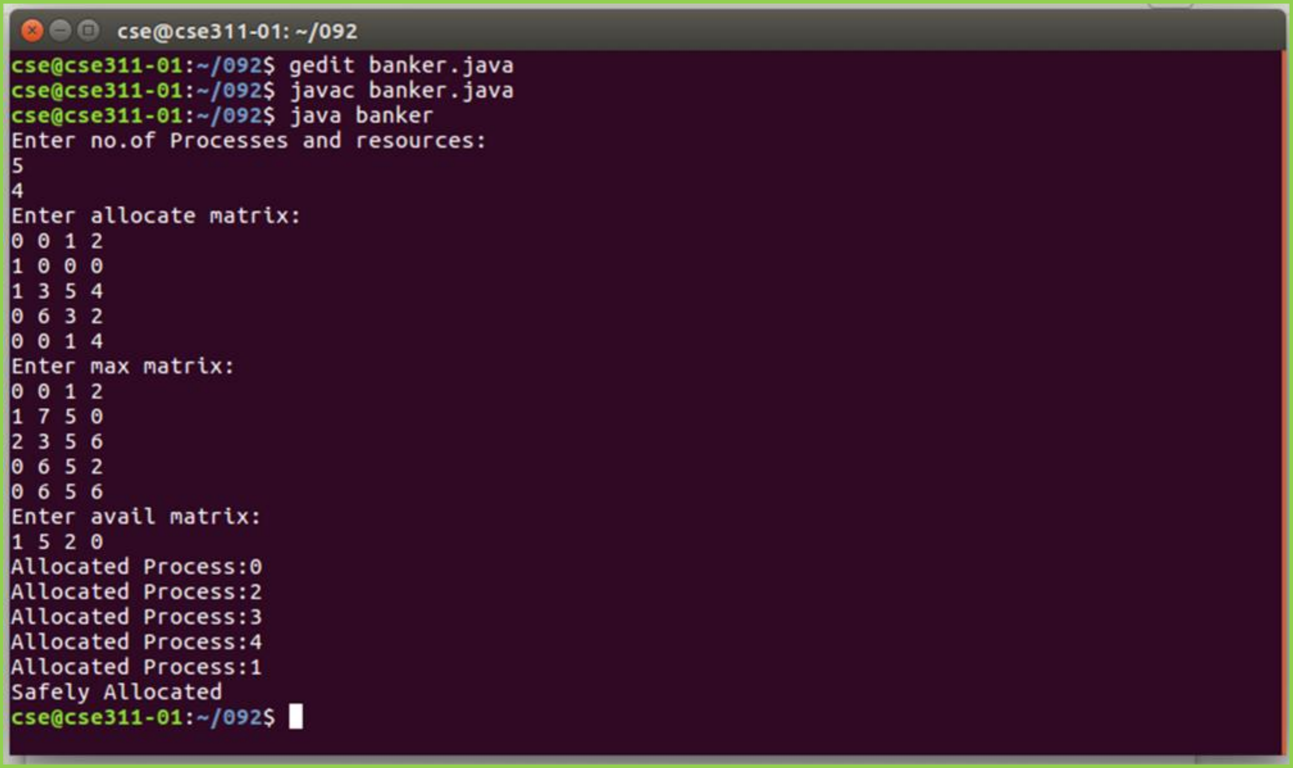
Output:

```
Enter no of process
4
Enter bt
p[1]
8
p[2]
4
p[3]
9
p[4]
5
Process         BT      WT      TAT
P2      4       0       4
P4      5       4       9
P1      8       9       17
P3      9       17      26
Avg Wt:         7.5
Avg Tat:        14.0
```

8) Bankers

```
import java.util.*;
public class banker
{
    private int np,nr,need[][],allocate[][],max[][],avail[][];
    private void input()
    {
        Scanner sc=new Scanner(System.in);
        System.out.println("Enter no.of Processes and resources:");
        np=sc.nextInt();
        nr=sc.nextInt();
        need=new int [np][nr];
        allocate=new int [np][nr];
        max=new int [np][nr];
        avail=new int [1][nr];
        System.out.println("Enter allocate matrix:");
        for(int i=0;i<np;i++)
            for(int j=0;j<nr;j++)
                allocate[i][j]=sc.nextInt();
        System.out.println("Enter max matrix:");
        for(int i=0;i<np;i++)
            for(int j=0;j<nr;j++)
                max[i][j]=sc.nextInt();
        System.out.println("Enter avail matrix:");
        for(int j=0;j<nr;j++)
            avail[0][j]=sc.nextInt();
        sc.close();
    }
    private int[][] calcneed()
    {
        for(int i=0;i<np;i++)
            for(int j=0;j<nr;j++)
                need[i][j]=max[i][j]-allocate[i][j];
        return need;
    }
    private boolean check(int i)
    {
        for(int j=0;j<nr;j++)
            if(avail[0][j]<need[i][j])
                return false;
        return true;
    }
    public void isSafe()
    {
        input();
        calcneed();
        boolean done[]=new boolean[np];
        int j=0;
        while(j<np)
        {
            boolean allocated =false;
            for(int i=0;i<np;i++)
            {
                if(!done[i] && check(i))
                {
                    for(int k=0;k<nr;k++)
                    {
                        avail[0][k]=avail[0][k]-need[i][k]+max[i][k];
                    }
                    System.out.println("Allocated Process:"+i);
                    allocated=done[i]=true;
                    j++;
                }
            }
            if(!allocated)
                break;
        }
        if(j==np)
            System.out.println("Safely Allocated");
        else
            System.out.println("All processes cannot be allocated safely");
    }
    public static void main(String[]args)
    {
        new banker().isSafe();
    }
}
```

Output:



```
cse@cse311-01:~/092$ gedit banker.java
cse@cse311-01:~/092$ javac banker.java
cse@cse311-01:~/092$ java banker
Enter no.of Processes and resources:
5
4
Enter allocate matrix:
0 0 1 2
1 0 0 0
1 3 5 4
0 6 3 2
0 0 1 4
Enter max matrix:
0 0 1 2
1 7 5 0
2 3 5 6
0 6 5 2
0 6 5 6
Enter avail matrix:
1 5 2 0
Allocated Process:0
Allocated Process:2
Allocated Process:3
Allocated Process:4
Allocated Process:1
Safely Allocated
cse@cse311-01:~/092$ 
```

Program 9a)

```
package myLab;
import java.util.*;
class frame {
        int pagenumber=-1;
        int lastaccesstime=-1;
        void replaceframe(int pagenumber, int lastaccesstime)
        {
                this.pagenumber=pagenumber;
                this.lastaccesstime=lastaccesstime;
        }
        void refreshframe(int lastaccesstime)
        {
                this.lastaccesstime=lastaccesstime;
        }
}
public class LRU
{
        public static frame cache[];
        public static int nF;

        public static void main(String[] args) {
                // TODO Auto-generated method stub
                Scanner sc=new Scanner(System.in);
                System.out.println("Enter the no of page requests");
                int nR=sc.nextInt();
                int pnumbers[]=new int[nR];
                System.out.println("Enter the page requests");
                for(int i=0;i<nR;i++)
                {
```

```
            pnumbers[i]=sc.nextInt();
        }
        System.out.println("Enter the no of frames");
        nF=sc.nextInt();
        cache=new frame[nF];
        for(int i=0;i<nF;i++)
        {
            cache[i]=new frame();
        }
        int hit=0,fault=0;
        for(int i=0;i<nR;i++)
        {
            int index=findpagenumber(pnumbers[i]);
            if(index!=-1)
            {
                hit++;
                cache[index].refreshframe(i);
            }
            else
            {
                fault=fault+1;
                int temp=getlruindex();
                cache[temp].replaceframe(pnumbers[i],i);
            }
            cacheprint();
        }
        System.out.println("hit= "+hit);
        System.out.println("fault= "+fault);
        sc.close();
    }
```

```
public static int findpagenumber(int pn)
{
        for(int i=0;i<nF;i++)
        {
                if(pn==cache[i].pagenumber)
                {
                        return i;
                }
        }
        return -1;
}
public static int getlruindex()
{
        int min=cache[0].lastaccesstime;
        int index=0;
        for(int i=0;i<nF;i++)
        {
                if(cache[i].lastaccesstime<min)
                {
                        min=cache[i].lastaccesstime;
                        index=i;
                }

        }
        return index;
}
public static void cacheprint()
{
        for(int i=0;i<nF;i++)
        {
            System.out.print(cache[i].pagenumber+" ");
        }
        System.out.println();
    }
}
```

Output:

```
Enter the no of page requests
12
Enter the page requests
1 2 3 4 1 2 5 1 2 3 4 5
Enter the no of frames
3
1 -1 -1
1 2 -1
1 2 3
4 2 3
4 1 3
4 1 2
5 1 2
5 1 2
5 1 2
3 1 2
3 4 2
3 4 5
hit= 2
fault= 10
```

Program 9b)

Soln)

```
package myLab;
import java.io.*;
public class FIFO {

    public static void main(String[] args) throws IOException{
        // TODO Auto-generated method stub
        int frames[] = new int[3];
        int n;
        BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
        System.out.println("Enter number of inputs");
        n = Integer.parseInt(br.readLine());
        int ip[] = new int[n];
        System.out.println("Enter inputs");
        for(int i = 0;i<n;i++)
        {
            ip[i] = Integer.parseInt(br.readLine());
        }
        for(int i=0;i<3;i++) //setting frame
        {
            frames[i] = -1;
        }
        int hit = 0,fault = 0,j = 0;
        boolean check;
        for(int i = 0;i<n;i++)
        {
            check = false;
            for(int k=0;k<3;k++)
            {
                if(ip[i] == frames[k])
                {
                    hit = hit+1;
                    check = true;

                }
            }
            if(check == false)
            {
                frames[j] = ip[i];
                fault = fault+1;
                j = j+1;
            }
            if(j>=3)
            {
                j=0;
            }
        }
        System.out.println("Hit : "+hit);
        System.out.println("Fault: "+fault);
    }

}
```

Miscellaneous

1) Count the number of lines in a line (To terminate the output press ctrl+d)

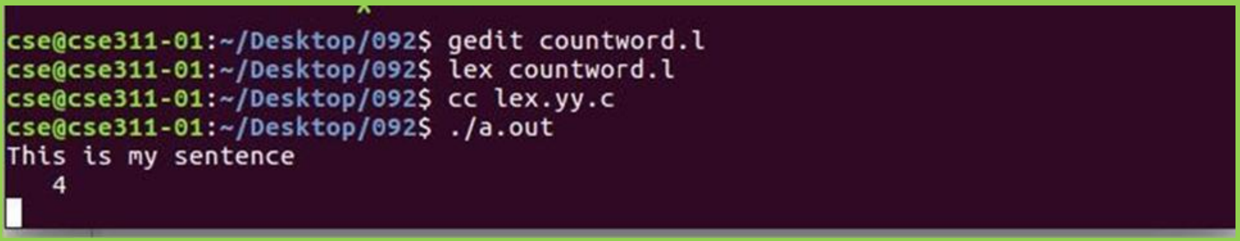
```
%{
#include<stdio.h>
int count=0;
%}
%%
\n {count++;}
. {;}
%%
int yywrap(void){return -1;}
int main()
{
yylex();
printf("No of lines %d\n",count);
return 0;
}
```

2) Count the number of words in a line

```
%{
#include<stdio.h>
int i=0;
%}
%%
([a-zA-z0-9])* {i++;}
\n {printf("%d\n",i); i=0;}
%%
int yywrap(void){return -1;}
int main()
```

```
{
yylex();
return 0;
}
```

Output:

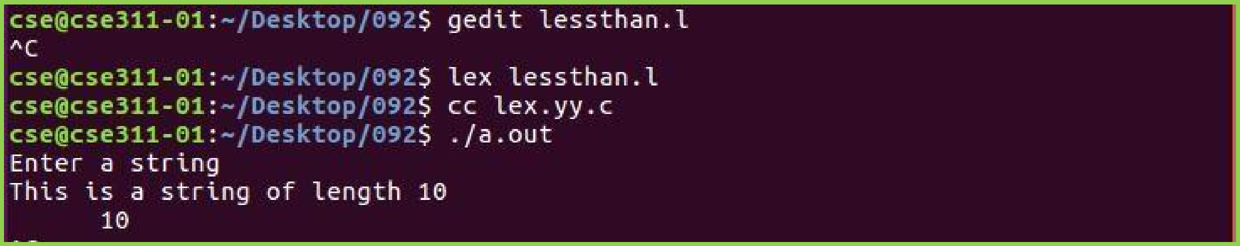


```
cse@cse311-01:~/Desktop/092$ gedit countword.l
cse@cse311-01:~/Desktop/092$ lex countword.l
cse@cse311-01:~/Desktop/092$ cc lex.yy.c
cse@cse311-01:~/Desktop/092$ ./a.out
This is my sentence
   4
```

3) Write a lex code to count words tht are less than 10 greater than 5 characters

```
%{
#include<stdio.h>
#include<string.h>
int len=0,count=0;
%}
%%
[a-zA-Z]+ {
len=strlen(yytext);
if(len<10 && len>5){count++;}
}
%%
int yywrap(void){return -1;}
int main()
{
printf("Enter a string\n");
yylex();
printf("Count: %d",count);
return 0;

}
```

Output



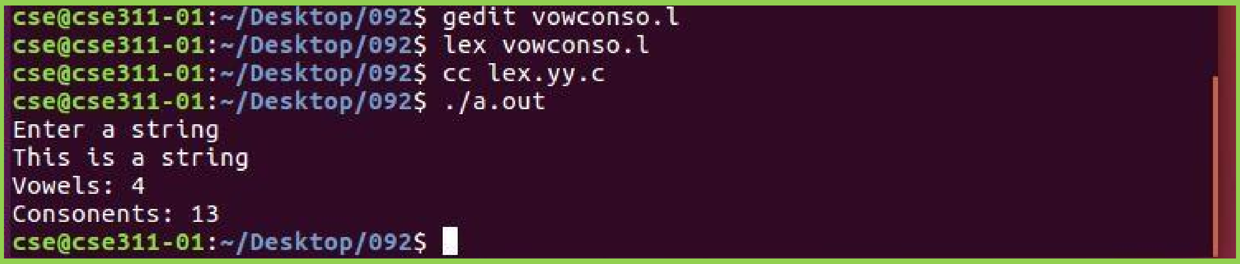
```
cse@cse311-01:~/Desktop/092$ gedit lessthan.l
^C
cse@cse311-01:~/Desktop/092$ lex lessthan.l
cse@cse311-01:~/Desktop/092$ cc lex.yy.c
cse@cse311-01:~/Desktop/092$ ./a.out
Enter a string
This is a string of length 10
      10
```

4) Write a lex code to count the number of vowels and consonents in a given strings

Soln)

```
%{

#include<stdio.h>

#include<string.h>

int ctrvow=0,ctrconso=0;

%}

%%

[aeiouAEIOU] {ctrvow++;}

[^aeiouAEIOU] {ctrconso++;}

%%

int yywrap(void){}

int main()

{

printf("Enter a string\n");

yylex();

printf("Vowels: %d\n",ctrvow);

printf("Consonents: %d\n",ctrconso);

return 0;

}
```

Output:



```
cse@cse311-01:~/Desktop/092$ gedit vowconso.l
cse@cse311-01:~/Desktop/092$ lex vowconso.l
cse@cse311-01:~/Desktop/092$ cc lex.yy.c
cse@cse311-01:~/Desktop/092$ ./a.out
Enter a string
This is a string
Vowels: 4
Consonents: 13
cse@cse311-01:~/Desktop/092$ 
```