ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

09EP707 – Professional Elective-III (COMPILER DESIGN AND NETWORKING LAB)

Name: ……………………………………………………………………………………

Reg. No. : ……………………………………………………………………………

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPRATMENT OF INFORMATION TECHNOLOGY

BONAFIDE CERTIFICATE

Certified that this is the bonafide record of work done by Mr./Ms……………………………………Reg.No………………………. Of VII Semester B.E (Information Technology) in the 09EP707 – Professional Elective – III (COMPILER DESIGN AND NETWORKING LAB) during the odd semester of the academic year 2019 – 2020.

Staff In-charge **Internal Examiner**

Place: Annmalainagar **External Examiner**

Date:

INDEX

Ex. No: 1

Date:

Implementation of Lexical Analyzer for 'if' Statement

Aim:

To write a C program to implement lexical analyzer for 'if' statement.

Algorithm:

1. Input: Programming language 'if' statement Output: A sequence of tokens.
2. Tokens have to be iden its respective attributes have to be printed.

Lexeme	**Token**
********	*******
If	<1,1>
variable-name	<2,#address>
numeric-constant	<3,#address>
;	<4,4>
(	<5,0>
)	<5,1>
{	<6,0>
}	<6,1>
>	<62,62>
>=	<620,620>
<	<60,60>
<=	<600,600>
!	<33,33>
!=	<330,330>
=	<61,61>
==	<610,610>

Program:

```
#include<stdio.h>
#include<ctype.h>
#include<conio.h>
#include<string.h>
char vars[100][100];
int vcnt;
char input[1000],c;
char token[50],tlen;
int state=0,pos=0,i=0,id;
```

```
char*getAddress(char str[])
{
for(i=0;i<vcnt;i++)
if(strcmp(str,vars[i])==0)
return vars[i];
strcpy(vars[vcnt],str);
return vars[vcnt++];
}
intisrelop(char c)
{
if(c=='>'||c=='<'||c=='|'||c=='=')
return 1;
else
return 0;
}
int main(void)
{
clrscr();
printf("Enter the Input String:");
gets(input);
do
{
c=input[pos];
putchar(c);
switch(state)
{
case 0:
if(c=='i')
state=1;
break;
case 1:
if(c=='f'
)
{
printf("\t<1,1>\n");
state =2;
}
break;
case 2:
if(isspace(c))
printf("\b");
if(isalpha(c))
{
token[0]=c;
tlen=1;
state=3;
}
if(isdigit(c))
state=4;
if(isrelop(c))
state=5;
if(c==';')printf("\ t<4,4>\ n");
if(c=='(')printf("\  t<5,0>\ n");
if(c==')')printf("\  t<5,1>\ n");
if(c=='{') printf("\ t<6,1>\ n");
if(c=='}') printf("\ t<6,2>\ n");
break;
case 3:
 if(!isalnum(c))
{
token[tlen]='\o';
printf("\b\t<2,%p>\n",getAddress(token));
state=2;
pos--;
}
else
token[tlen++]=c;
break;
case 4:
if(!isdigit(c))
{
printf("\b\t<3,%p>\n",&input[pos]);
state=2;
pos--;
}
break;
case 5:
id=input[pos-1];
if(c=='=')
printf("\t<%d,%d>\n",id*10,id*10);
else
{
printf("\b\t<%d,%d>\n",id,id);
pos--;
}
state=2;
break;
}
pos++;
}
while(c!=0);
getch();
return 0;
}
```

Sample Input & Output:

```
Enter the input string: if(a>=b) max=a;

if          <1,1>
(           <5,0>
a           <2,0960>
>=          <620,620>
b           <2,09c4>
)           <5,1>
max         <2,0A28>
=           <61,61>
a           <2,0A8c>
;           <4,4>
```

Result:

The above C program was successfully executed and verified.

Ex. No: 2

Date:

Implementation of Lexical Analyzer for Arithmetic Expression

Aim:

To write a C program to implement lexical analyzer for Arithmetic Expression.

Algorithm:

1. Input: Programming language arithmetic expression
   Output: A sequence of tokens.
2. Tokens have to be identified and its respective attributes have to be printed.

Lexeme	**Token**
*******	******
Variable name	<1,#adddress>
Numeric constant	<2,#address>
;	<3,3>
=	<4,4>
+	<43,43>
+=	<430,430>
-	<45,45>
-=	<450,450>
*	<42,42>
*=	<420,420>
/	<47,47>
/=	<470,470>
%	<37,37>
%=	<370,370>
^	<94,94>
^=	<940,940>

Program:

```
#include<stdio.h>
#include<ctype.h>
#include<conio.h>
#include<string.h>
char vars[100][100];
int vcnt;
char input[1000],c;
char token[50],tlen;
int state=0,pos=0,i=0,id;
```

```
char *getAddress(char str[])
{
for(i=0;i<vcnt;i++)
if(strcmp(str,vars[i])==0)
return vars[i];
strcpy(vars[vcnt],str);
return vars[vcnt++];
}
intisrelop(char c)
{
if(c=='+'||c=='-'||c=='*'||c=='/'||c=='%'||c=='^')
return 1;
else
return 0;
}
int main(void)
{
clrscr();
printf("Enter the Input String:");
gets(input);
do
{
c=input[pos];
putchar(c);
switch(state)
{
case 0:
if(isspace(c))
printf("\b");
if(isalpha(c))
{
token[0]=c;
tlen=1;
state=1;
}
if(isdigit(c))
state=2;
if(isrelop(c))
state=3;
if(c==';')
printf("\t<3,3>\n");
if(c=='=')
printf("\t<4,4>\n");
break;
case 1:
if(!isalnum(c))
{
token[tlen]='\o';
printf("\b\t<1,%p>\n",getAddress(token));
state=0;
pos--;
}
else
token[tlen++]=c;
break;
case 2:
if(!isdigit(c))
{
printf("\b\t<2,%p>\n",&input[pos]);
state=0;
pos--;
}
break;
case 3:
id=input[pos-1];
if(c=='=')
printf("\t<%d,%d>\n",id*10,id*10);
else
{
printf("\b\t<%d,%d>\n",id,id);
pos--;
}
state=0;
break;
}
pos++;
}
while(c!=0);
getch();
return 0;
```

Sample Input & Output:

```
Enter the Input String: a=a*2+b/c; a
=               <4,4>
                <1,08CE>
a               <1,08CE>
*               <42,42>
2               <2,04E9>
+               <43,43>
b               <1,0932>
/               <47,47>
c               <1,0996>
;               <3,3>
```

Result:

The above C program was successfully executed and verified.

Ex. No: 3

Date:

Construction of NFA from Regular Expression

Aim:

To write a C program to construct a Non Deterministic Finite Automata (NFA) from Regular Expression.

Algorithm:

1. Start the Program.
2. Enter the regular expression R over alphabet E.
3. Decompose the regular expression R into its primitive components
4. For each component construct finite automata.
5. To construct components for the basic regular expression way that corresponding to that way compound regular expression.
6. Stop the Program.

Program:

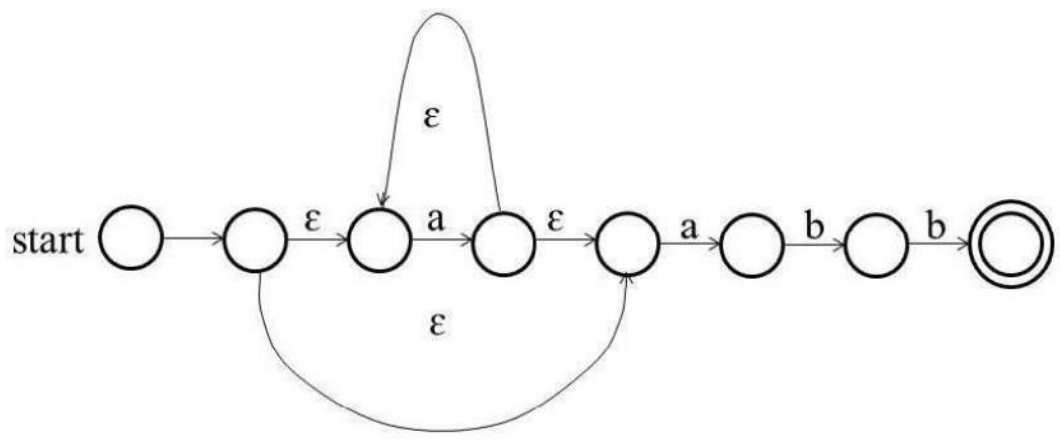
```
#include<stdio.h>
#include<conio.h>
#include<ctype.h>
#include<string.h>
#include<graphics.h>
#include<math.h>
#include<process.h>
int
minx=1000,miny=0;
void star(int *x1,int *y1,int *x2,int *y2)
{
char pr[10];
ellipse(*x1+(*x2-*x1)/2,*y2-10,0,180,(*x2-
*x1)/2,70); outtextxy(*x1-2,*y2-17,"v");
line(*x2+10,*y2,*x2+30,*y2);
outtextxy(*x1-15,*y1-
3,">"); circle(*x1-
40,*y1,10); circle(*x1-
80,*y1,10); line(*x1-
30,*y2,*x1-10,*y2);
outtextxy(*x2+25,*y2-
3,">"); sprintf(pr,"%c",238);
outtextxy(*x2+15,*y2-9,pr);
outtextxy(*x1-25,*y1-9,pr);
outtextxy((*x2-*x1)/2+*x1,*y1-30,pr);
outtextxy((*x2-*x1)/2+*x1,*y1+30,pr);
ellipse(*x1+(*x2-*x1)/2,*y2+10,180,360,(*x2-
*x1)/2+40,70); outtextxy(*x2+37,*y2+14,"^");
if(*x1-40<minx)minx=*x1-40;
miny=*y1;
}
void star1(int *x1,int *y1,int *x2,int *y2)
{
char pr[10];
ellipse(*x1+(*x2-*x1)/2+15,*y2-10,0,180,(*x2-
*x1)/2+15,70); outtextxy(*x1-2,*y2-17,"v");
line(*x2+40,*y2,*x2+60,*y2
); outtextxy(*x1-15,*y1-
3,">"); circle(*x1-
40,*y1,10); line(*x1-
30,*y2,*x1-10,*y2);
outtextxy(*x2+25,*y2-
3,">"); sprintf(pr,"%c",238);
outtextxy(*x2+15,*y2-9,pr);
outtextxy(*x1-25,*y1-9,pr);
outtextxy((*x2-*x1)/2+*x1,*y1-
30,pr); outtextxy((*x2-
*x1)/2+*x1,*y1+30,pr);
ellipse(*x1+(*x2-*x1)/2+15,*y2+10,180,360,(*x2-*x1)/2+50,70);
outtextxy(*x2+62,*y2+13,"^");
if(*x1-40<minx)minx=*x1-40;
miny=*y1;
}
void basis(int *x1,int *y1,char x)
{
char pr[5];
circle(*x1,*y1,10);
line(*x1+30,*y1,*x1+10,*y1
); sprintf(pr,"%c",x);
outtextxy(*x1+20,*y1-10,pr);
outtextxy(*x1+23,*y1-
3,">");
circle(*x1+40,*y1,10);
if(*x1<minx)minx=*x1;
miny=*y1;
}
void slash(int *x1,int *y1,int *x2,int *y2,int *x3,int *y3,int *x4,int *y4)
{
char
pr[10]; int
c1,c2;
c1=*x1;
if(*x3>c1)c1=*x3;
c2=*x2;
if(*x4>c2)c2=*x4;
line(*x1-10,*y1,c1-40,(*y3-*y1)/2+*y1-10);
```

```
outtextxy(*x1-15,*y1-3,">");
outtextxy(*x3-15,*y4-3,">");
circle(c1-40,(*y4-
*y2)/2+*y2,10);
sprintf(pr,"%c",238);
outtextxy(c1-40,(*y4-*y2)/2+*y2+25,pr);
outtextxy(c1-40,(*y4-*y2)/2+*y2-25,pr);
line(*x2+10,*y2,c2+40,(*y4-*y2)/2+*y2-
10); line(*x3-10,*y3,c1-40,(*y3-
*y1)/2+*y2+10); circle(c2+40,(*y4-
*y2)/2+*y2,10); outtextxy(c2+40,(*y4-
*y2)/2+*y2-25,pr); outtextxy(c2-40,(*y4-
*y2)/2+*y2+25,pr); outtextxy(c2+35,(*y4-
*y2)/2+*y2-15,"^"); outtextxy(c1+35,(*y4-
*y2)/2+*y2+10,"^");
line(*x4+10,*y2,c2+40,(*y4-
*y2)/2+*y2+10); minx=c1-40;
miny=(*y4-*y2)/2+*y2;
}
void main()
{
int d=0,l,x1=200,y1=200,len,par=0,op[10];
int
cx1=200,cy1=200,cx2,cy2,cx3,cy3,cx4,cy4;
char str[20];
int gd=DETECT,gm;
int stx[20],endx[20],sty[20],endy[20];
int pos=0,i=0;
clrscr();
initgraph(&gd,&gm,"c:\\dosapp\\tcplus\\bgi");
printf("\n enter the regular expression:");
scanf("%s",str);
len=(strlen(str));
while(i<len)
{
if(isalpha(str[i]))
{
if(str[i+1]=='*')x1=x1+40
; basis(&x1,&y1,str[i]);
stx[pos]=x1;
endx[pos]=x1+40;
sty[pos]=y1;
endy[pos]=y1;
x1=x1+40;
pos++;
}
if(str[i]=='*')
{
star(&stx[pos-1],&sty[pos-1],&endx[pos-1],&endy[pos-
1]); stx[pos-1]=stx[pos-1]-40;
endx[pos-1]=endx[pos-1]+40;
x1=x1+40;
}
if(str[i]=='(')
{
int s;
s=i;
while(str[s]!=')')s++;
if((str[s+1]=='*')&&(pos!=0))x1=x1+40;
op[par]=pos;
par++;
}
if(str[i]==')')
{
cx2=endx[pos-
1];
cy2=endy[pos-
1]; l=op[par-1];
cx1=stx[1];
cx2=sty[1];
par--;
if(str[i+1]=='*')
{
i++;
star1(&cx1,&cy1,&cx2,&cy2
); cx1=cx1-40;
cx2=cx2+40;
stx[1]=stx[1]-
40;
endx[pos-1]=endx[pos-1]+40;
x1=x1+40;
}
if(d==1)
{
slash(&cx3,&cy3,&cx4,&cy4,&cx1,&cy1,&cx2,&cy2);
if(cx4>cx2)x1=cx4+40;
else x1=cx2+40;
y1=(y1-
cy4)/2.0+cy4; d=0;
}
}
if(str[i]=='/')
{
cx2=endx[pos-
1];
cy2=endy[pos-
1]; x1=200;
y1=y1+100;
```

```
if(str[i+1]=='(')
{
d=1;
cx3=cx1
;
cy3=cy1
;
cx4=cx2
;
cy4=cy2
;
}
if(isalpha(str[i+1]))
{
i++;
basis(&x1,&y1,str[i]);
stx[pos]=x1;
endx[pos]=x1+40;
sty[pos]=y1;
endy[pos]=y1;
if(str[i+1]=='*')
{
i++;
star(&stx[pos],&sty[pos],&endx[pos],&endy[pos]
); stx[pos]=stx[pos]-40;
endx[pos]=endx[pos]+40;
}
slash(&cx1,&cy1,&cx2,&cy2,&stx[pos],&sty[pos],&endx[pos],&endy[pos]);
if(cx2>endx[pos])x1=cx2+40;
else
x1=endx[pos]+40;
y1=(y1-cy2)/2.0+cy2;
cx1=cx1-40;
cy1=(sty[pos]-cy1)/2.0+cy1;
cx2=cx2+40;
cy2=(endy[pos]-
cy2)/2.0+cy2; l=op[par-1];
stx[1]=cx1;
sty[1]=cy1;
endx[pos]=cx2;
endy[pos]=cy2;
pos++;
}
}
i++;
}
circle(x1,y1,13);
line(minx-30,miny,minx-10,miny);
outtextxy(minx-100,miny-
10,"start"); outtextxy(minx-
15,miny-3,">");
```

```
getch();
closegraph()
;
}
```

Sample Input & Output:



Result:

The above C program was successfully executed and verified.

Ex.No: 4

Date:

Construction of DFA from NFA

Aim:

To write a C program to construct a DFA from the given NFA.

Algorithm:

1. Start the program.
2. Accept the number of state A and B.
3. Find the E-closure for node and name if as A.
4. Find v(a,a) and (a,b) and find a state.
5. Check whether a number new state is obtained.
6. Display all the state corresponding A and B.
7. Stop the program.

Program:

```
#include<stdio.h>
#include<conio.h>
#include<ctype.h>
#include<process.h>
typedef struct
{
int num[10],top;
}
stack;
stack
s;
int mark[16][31],e_close[16][31],n,st=0;
char data[15][15];
void push(int a)
{
s.num[s.top]=a;
s.top=s.top+1;
}
int pop()
{
int a;
if(s.top==0)
return(-1);
s.top=s.top-1;
a=s.num[s.top]
;
```

```
return(a);
}
void epi_close(int s1,int s2,int c)
{
int i,k,f;
for(i=1;i<=n;i++
)
{
if(data[s2][i]=='e')
{
f=0;
for(k=1;k<=c;k++)
if(e_close[s1][k]==i)
f=1;
if(f==0)
{
c++;
e_close[s1][c]=i;
push(i);
}
}
}
while(s.top!=0) epi_close(s1,pop(),c);
}
int move(int sta,char c)
{
int i;
for(i=1;i<=n;i++
)
{
if(data[sta][i]==c
) return(i);
}
return(0);
}
void e_union(int m,int n)
{
int i=0,j,t;
for(j=1;mark[m][i]!=-
1;j++)
{
while((mark[m][i]!=e_close[n][j])&&(mark[m][i]!=-
1)) i++;
if(mark[m][i]==-1)mark[m][i]=e_close[n][j];
}
}
void main()
{
int i,j,k,Lo,m,p,q,t,f;
clrscr();
```

```
printf("\n enter the NFA state table entries:");
scanf("%d",&n);
printf("\n");
for(i=0;i<=n;i++
) printf("%d",i);
printf("\n");
for(i=0;i<=n;i++
) printf(" --- ");
printf("\n");
for(i=1;i<=n;i++
)
{
printf("%d|",i);
fflush(stdin);
for(j=1;j<=n;j++)
scanf("%c",&data[i][j]);
}
for(i=1;i<=15;i++)
for(j=1;j<=30;j++)
{
e_close[i][j]=-1;
mark[i][j]=-1;
}
for(i=1;i<=n;i++)
{
e_close[i][1]=i
; s.top=0;
epi_close(i,i,1)
;
}
for(i=1;i<=n;i++)
{
for(j=1;e_close[i][j]!=-1;j++)
for(k=2;e_close[i][k]!=-1;k++)
if(e_close[i][k-1]>e_close[i][k])
{
t=e_close[i][k-1];
e_close[i][k-
1]=e_close[i][k];
e_close[i][k]=t;
}
}
printf("\n the epsilon closures are:");
for(i=1;i<=n;i++)
{
printf("\n E(%d)={",i);
for(j=1;e_close[i][j]!=-1;j++)
printf("%d",e_close[i][j])
; printf("}");
}
```

```
j=1;
while(e_close[1][j]!=-1)
{
mark[1][j]=e_close[1][j];
j++;
}
st=1;
printf("\n DFA Table is:");
printf("\n             a             b      ");
printf("\n ------------------------------------");

for(i=1;i<=st;i++)
{
printf("\n{");
for(j=1;mark[i][j]!=-
1;j++)
printf("%d",mark[i][j])
; printf("}");
while(j<7)
{
printf("
"); j++;
}
for(Lo=1;Lo<=2;Lo++
)
{
for(j=1;mark[i][j]!=-1;j++)
{
if(Lo==1)
t=move(mark[i][j],'a')
; if(Lo==2)
t=move(mark[i][j],'b')
; if(t!=0)
e_union(st+1,t);
}
for(p=1;mark[st+1][p]!=-1;p++)
for(q=2;mark[st+1][q]!=-1;q++)
{
if(mark[st+1][q-1]>mark[st+1][q])
{
t=mark[st+1][q];
mark[st+1][q]=mark[st+1][q-
1]; mark[st+1][q-1]=t;
}
}
f=1;
for(p=1;p<=st;p++)
{
j=1;
while((mark[st+1][j]==mark[p][j])&&(mark[st+1][j]!=-
1)) j++;
if(mark[st+1][j]==-1 && mark[p][j]==-
1) f=0;
}
if(mark[st+1][1]==-1)
f=0;
printf("\t{");
for(j=1;mark[st+1][j]!=-
1;j++)
{
printf("%d",mark[st+1][j]);
}
printf("}\t");
if(Lo==1)
printf(" ");
if(f==1)
st++;
if(f==0)
{
for(p=1;p<=30;p++
) mark[st+1][p]=-1;
}
}
}
getch();
}
```

Sample Input & Output:

Enter the NFA state table entries: 11

(**Note:***Instead of* '-' *symbol use blank spaces in the output window*)

```
0 1 2 3 4 5 6 7 8 9 10 11 -------------------------------------
---------------------------------
1   - e - - - - - e -  -  -
2   - -  e -  e - - - - -  -  -
3   - - - a - - - - - - -  -
4   - - - - - - e - - - -  -
5   - - - - - b - - - - -  -
6   - - - - - - -  e - - -  -
7   - e  - - - - - e - -  -
8   - - - - - - - - -  e -  -
9   - - - - - - - - - -  e  -
10-------------------------e
11 -  - - - - - - - - - - -

The Epsilon Closures Are:

 E(1)={12358}
 E(2)={235}
 E(3)={3}
 E(4)={234578}
 E(5)={5}
 E(6)={235678}
 E(7)={23578}
 E(8)={8}
 E(9)={9}
 E(10)={10}
 E(11)={11}

 DFA Table is:
            a            b
-------------------------------------------------
{12358}         {2345789}          {235678}
{2345789}       {2345789}          {23567810}
{235678}        {2345789}          {235678}
{23567810}      {2345789}          {23567811}
{23567811}      {2345789}          {235678}
```

Result:

The above C program was successfully executed and verified.

Ex.No: 5

Date:

Implementation of Shift Reduce Parsing Algorithm

Aim:

To write a C program to implement the shift-reduce parsing algorithm.

Algorithm:

Grammar:

E>E+E

E>E*E

E->E/E

E->a/b

Method:

Stack	Input Symbol	Action
$	id1*id2$	shift
$id1	*id2 $	shift *
$*	id2$	shift id2
$id2	$	shift
$	$	accept

Shift: Shifts the next input symbol onto the stack.

Reduce: Right end of the string to be reduced must be at the top of the stack.

Accept: Announce successful completion of parsing.

Error: Discovers a syntax error and call an error recovery routine.

Program:

```
#include<conio.h
>
#include<stdio.h>
#include<stdlib.h
>
#include<string.h
>
char
ip_sym[15],stack[15]; int
ip_ptr=0,st_ptr=0,len,i;
char temp[2],temp2[2];
char act[15];
void
check();
void main()
{
clrscr();
printf("\n\n\t Shift Reduce Parser\
n"); pri\ntf(" n t***** ******
******\"); printf(" \n \Grammar n n");
printf("E->E+E\ nE->E/E\
n"); printf("E->\E*E nE-
>a/b");
printf("\n Enter the Input Symbol\ t");
gets(ip_sym);
printf("\n\n\t Stack Implementation Table");
printf("\n Stack\t\t Input Symbol\ t\t Action");
printf("\n $\t\t %s$\t\t\t --",ip_sym);
strcpy(act,"shift");
temp[0]=ip_sym[ip_ptr]
; temp[1]\=' 0';
strcat(act,temp);
len=strlen(ip_sym);
for(i=0;i<=len-1;i++)
{
stack[st_ptr]=ip_sym[ip_ptr];
stack[st_ptr+1]=\ 0';
ip_sym[ip_ptr]=' ';
ip_ptr++;
printf("\n$%s\t\t%s$\t\t\
t%s",stack,ip_sym,act); strcpy(act,"shift");
temp[0]=ip_sym[ip_ptr
]; temp[1]\=' 0';
strcat(act,temp);
check();
st_ptr++;
}
st_ptr++
;
check();
getch();
}

void check()
{
int flag=0;
temp2[0]=stack[st_ptr]
; temp[1]='\0';
if((!strcmpi(temp2,"a"))||(!strcmpi(temp2,"b")))
{
stack[st_ptr]='E';
if(!strcmpi(temp2,"a"))
printf("\n$%s\t\t%s$\t\t\tE->a",stack,ip_sym);
else
printf("\n$%s\t\t%s$\t\t\tE->a",stack,ip_sym);
flag=1;
}
if((!strcmpi(temp2,"+"))||(strcmpi(temp2,"*"))||(!strcmpi(temp2,"/")))
{
flag=1;
}
if((!strcmpi(stack,"E+E"))||(!strcmpi(stack,"E/E"))||(!strcmpi(stack,"E*E")))
{
strcpy(stack,"E");
st_ptr=0;
if(!strcmpi(stack,"E+E"))
printf("\n$%s\t\t%s$\t\t\tE->E+E",stack,ip_sym);
else
if(!strcmpi(stack,"E/E"))
printf("\n$%s\t\t\t%s$\t\tE-
>E/E",stack,ip_sym); else
printf("\n$%s\t\t%s$\t\t\tE-
>E*E",stack,ip_sym); flag=1;
}
if(!strcmpi(stack,"E")&&ip_ptr==len)
{
printf("\n$%s\t\t%s$\t\t\tAccept",ip_sym);
getch();
exit(0);
}
if(flag==0)
{
printf("\n %s\t\t\t %s \t\t Reject",stack,ip_sym);
}
return;
}
```

Sample Input & Output:

```
Shift Reduce Parser
***** ****** *****
Grammar

E-
>E+E
E->E/E
E-
>E*E
E->a/b

Enter the input symbol:      if(a*b)

Stack Implementation Table

Stack         Input Symbol        Action
$             if(a*b)$            --
$i            f(a*b)$             shift i
$if           (a*b)$              shift f
$if(          a*b)$               shift (
$if(a         *b)$                shift a
$if(E         *b)$                E->a
$if(E*        b)$                 shift *
if(E*         b)                  reject

Press any key to continue...
```

Result:

The above C program was successfully executed and verified.

Ex.No: 6

Date:

Implementation of Operator Precedence Parser

Aim:

To write a C program to implement Operator Precedence Parser.

Algorithm:

Input: String of terminals from the operator grammar

Output: Sequence of shift reduce step1

Method:

1- Let the input string to be initially the stack contains, when the reduce action takes place we have to reach create parent child relationship.

2- See IP to pointer to the first symbol of input string and repeat forever if only $ is on the input accept and break else begin.

3- Let 'd' be the top most terminal on the stack and 'b' be current input IF(a<b) or a=b then Begin push 'b' onto the stack.

4- Advance Input to the stack to the next Input

symbol end;

else if(a>b)

5- Repeat pop the stack until the top most terminal is related by < to the terminal most recently popped else error value routine

end;

Program:

```
#include<stdio.h>
#include<conio.>
#include<string.>
#include<ctype.>
char q[9][9]={
{'>','>','<','<','<','<','>','<','>' },
{'>','>','<','<','<','<','>','<','>' },
{'>','>','>','>','<','<','>','<','>' },
{'>','>','>','>','<','<','>','<','>' },
{'>','>','<','<','<','<','>','<','>' },
{'<','<','<','<','<','<','=','<','E' },
{'>','>','>','>','>','E','>','E','>' },
{'>','>','>','>','>','E','>','E','>' },
{'<','<','<','<','<','<','E','<','A' }
};
char
s[30],st[30],qs[30]; int
top=-1,r=-1,p=0; void
push(char a)
{
top++;
st[top]=a
;
}
char pop()
{
char a;
a=st[top]
; top--;
return a;
}
int find(char a)
{
switch(a)
{
case '+':return 0;
case '-':return 1;
case '*':return 2;
case '/':return 3;
case '^':return 4;
case '(':return 5;
case ')':return 6;
case 'a':return 7;
case '$':return 8;
default :return -1;
}
}
void display(char a)
{
printf("\n Shift %c",a);
}
void display1(char a)
{
if(isalpha(a))
printf("\n Reduce E->%c",a);
else if((a=='+')||(a=='-')||(a=='*')||(a=='/')||(a=='^'))
printf("\n Reduce E->E%cE",a);
else if(a==')')

printf("\n Reduce E->(E)");
```

```
}
intrel(char a,char b,char d)
{
if(isalpha(a)!=0
) a='a';
if(isalpha(b)!=0
) b='a';
if(q[find(a)][find(b)]==d)
return 1;
else
return 0;
}
void main()
{
char s[100];
int i=-1;
clrscr();
printf("\n\t Operator Preceding Parser\ n");
printf("\n Enter the Arithmetic Expression End with $..");
gets(s);
push('$')
;
while(i)
{
if((s[p]=='$')&&(st[top]=='$'))
{
printf("\n\nAccepted");
break;
}
else if(rel(st[top],s[p],'<')||rel(st[top],s[p],'='))
{
display(s[p]);
push(s[p])
; p++;
}
else if(rel(st[top],s[p],'>'))
{
do
{
r++;
qs[r]=pop();
display1(qs[r]);
}
while(!rel(st[top],qs[r],'<'));
}
}
getch();
}
```

Sample Input & Output:

```
Enter the Arithmetic Expression End with $: a-

(b*c)^d$ Shift a
Reduce E->a
Shift -
Shift (
Shift b
Reduce E-
>b Shift *
Shift c
Reduce E-
>c
Reduce E->E*E
Shift )
Reduce E->(E)
Shift ^
Shift d
Reduce E-
>d
Reduce        E-
>E^E    Reduce
E->E-E
Accepted
```

Result:

The above C program was successfully executed and verified.

Ex.No: 7

Date:

Implementation of Code Optimization Techniques

Aim:

To write a C program to implement Code Optimization Techniques.

Algorithm:

Input: Set of ‘L’ values with corresponding ‘R’ values.

Output: Intermediate code & Optimized code after eliminating common expressions.

Program:

```
#include<stdio.h>
#include<conio.>
#include<string.>
struct op
{
char l;
char
r[20];
}
op[10],pr[10];
void main()
{
int a,i,k,j,n,z=0,m,q;
char *p,*l;
char
temp,t;
char *tem;
clrscr();
printf("Enter the Number of Values:");
scanf("%d",&n);
for(i=0;i<n;i++)
{
printf("left: ");
op[i].l=getche();
printf("\tright: ");
scanf("%s",op[i].r);
}
printf("Intermediate Code\n") ;
for(i=0;i<n;i++)
{
printf("%c=",op[i].l);
printf("%s\n",op[i].r);
}
```

```
for(i=0;i<n-1;i++)
{
temp=op[i].l;
for(j=0;j<n;j++
)
{
p=strchr(op[j].r,temp);
if(p)
{
pr[z].l=op[i].l;
strcpy(pr[z].r,op[i].r);
z++;
}
}
}
pr[z].l=op[n-1].l;
strcpy(pr[z].r,op[n-1].r);
z++;
printf("\nAfter Dead Code Elimination\n");
for(k=0;k<z;k++)
{
printf("%c\t=",pr[k].l);
printf("%s\n",pr[k].r);
}
for(m=0;m<z;m++)
{
tem=pr[m].r;
for(j=m+1;j<z;j++)
{
p=strstr(tem,pr[j].r);
if(p)
{
t=pr[j].l;
pr[j].l=pr[m].l;
for(i=0;i<z;i++
)
{
l=strchr(pr[i].r,t)
; if(l)
{
a=l-pr[i].r;
printf("pos: %d",a);
pr[i].r[a]=pr[m].l;
}
}
}
}
}
```

```
printf("Eliminate Common Expression\n");
for(i=0;i<z;i++)
{
printf("%c\t=",pr[i].l);
printf("%s\n",pr[i].r);
}
for(i=0;i<z;i++)
{
for(j=i+1;j<z;j++)
{
q=strcmp(pr[i].r,pr[j].r);
if((pr[i].l==pr[j].l)&&!q)
{
pr[i].l='\0';
strcpy(pr[i].r,'\0');
}
}
}
printf("Optimized Code\n");
for(i=0;i<z;i++)
{
if(pr[i].l!='\0')
{
printf("%c=",pr[i].l);
printf("%s\n",pr[i].r);
}
}
getch();
}
```

Sample Input & Output:

```
Enter the Number of Values:
5 Left:  a        right: 9
Left:  b          right: c+d
Left:  e          right: c+d
Left:  f          right: b+e
Left:  r          right: f

Intermediate Code
a=9
b=c+
d
e=c+d
f=b+e
r=:f

After Dead Code
Elimination b   =c+d
e      =c+d
f      =b+e
r      =:f

Eliminate Common
Expression b    =c+d
b      =c+d
f      =b+b
r=:f

Optimized Code
b=c+d
f=b+
b r=:f
```

Result:

The above C program was successfully executed and verified.

Ex.No: 8

Date:

Implementation of Code Generator

Aim:

To write a C program to implement Simple Code Generator.

Algorithm:

Input: Set of three address code sequence.

Output: Assembly code sequence for three address codes (opd1=opd2, op, opd3).

Method:

```
1-  Start
2-  Get address code sequence.
3-  Determine current location of 3 using address (for 1st
operand). 4- If current location not already exist generate move
(B,O).
5- Update address of A(for 2nd operand).
6- If current value of B and () is
null,exist. 7- If they generate operator ()
A,3 ADPR. 8- Store the move instruction
in memory
9- Stop.
```

Program:

```
#include<stdio.h>
#include<conio.h>
#include<string.h>
#include<ctype.h>
#include<graphics.h>
typedef struct
{
char
var[10]; int
alive;
}
regist;
regist preg[10];
void substring(char exp[],int st,int end)
{
int i,j=0;
char dup[10]="";
for(i=st;i<end;i++
)
dup[j++]=exp[i];
dup[j]='0';

strcpy(exp,dup);
}
int getregister(char var[])
{
int i;
for(i=0;i<10;i++
)
{
if(preg[i].alive==0)
```

```
{
strcpy(preg[i].var,var);
break;
}
}
return(i);
}
void getvar(char exp[],char v[])
{
int i,j=0;
char var[10]="";
for(i=0;exp[i]!='\
0';i++)
if(isalpha(exp[i]))
var[j++]=exp[i];
else
break;
strcpy(v,var)
;
}
void main()
{
char
basic[10][10],var[10][10],fstr[10],op; int
i,j,k,reg,vc,flag=0;
clrscr();
printf("\nEnter the Three Address Code\: n");
for(i=0;;i++)
{
gets(basic[i]);
if(strcmp(basic[i],"exit")==0)
break;
}
printf("\nThe Equivalent Assembly Code is\:
n"); for(j=0;j<i;j++)
{
getvar(basic[j],var[vc++]
); strcpy(fstr,var[vc-1]);
substring(basic[j],strlen(var[vc-1])+1,strlen(basic[j]));
getvar(basic[j],var[vc++]);
reg=getregister(var[vc-1]);
if(preg[reg].alive==0)
{
printf("\nMov R%d,%s",reg,var[vc-1]);
preg[reg].alive=1;
}
op=basic[j][strlen(var[vc-1])];
substring(basic[j],strlen(var[vc-
1])+1,strlen(basic[j])); getvar(basic[j],var[vc++]);
switch(op)
{
case '+': printf("\ nAdd"); break;
case '-': printf("\ nSub"); break;
case '*': printf("\ nMul"); break;
case '/': printf("\ nDiv"); break;
}
flag=1;
for(k=0;k<=reg;k++)
{
if(strcmp(preg[k].var,var[vc-1])==0)
{
printf("R%d, R%d",k,reg);
preg[k].alive=0;
flag=0
;
break;
}
}
if(flag)
{
printf(" %s,R%d",var[vc-1],reg);
printf("\nMov
%s,R%d",fstr,reg);
}
strcpy(preg[reg].var,var[vc-3]);
getch();
}
}
```

Sample Input & Output:

```
Enter the Three Address Code:
a=b+
c
c=a*c
exit

The Equivalent Assembly Code is:

Mov
R0,b Add
c,R0
Mov
a,R0
Mov
R1,a Mul
c,R1
Mov
c,R1
```

Result:

The above C program was successfully executed and verified.

Ex.No: 09

Date:

Network Primitives

Aim:

To write a Java program to figure out the network primitives.

Class:

InetAddress

The InetAddress class is used to encapsulate both the numerical IP address and the domain name for that address. There are no public constructors in the InetAddress class.

However,InetAddress has three static methods that return suitably initialized InetAddress objects. They are:

static InetAddress getLocalHost( ) :

The getLocalHost( ) method simply returns the InetAddress object that represents the local host. If these methods are unable to resolve the host name, they throw an UnknownHostException.

static InetAddress getByName(String hostName) :

The getByName( ) method returns an InetAddress for a host name passed to it.

static InetAddress[ ] getAllByName(String hostName) :

The getAllByName( ) factory method returns an array of InetAddresses that represent all of the addresses that a particular name resolves to. It will also throw an UnknownHostException if it can't resolve the name to at least one address.

Program:

```
import java.net.*;
class ex11a
{
public static void main(String args[])throws UnknownHostException
{
InetAddress Ia=InetAddress.getLocalHost();
System.out.println(Ia);
}
}
```

Sample Input& Output:

```
D:\Program Files\Java\jdk1.6.0_20\bin>javac
ex11a.java D:\Program Files\Java\jdk1.6.0_20\bin> java
ex11a

Sys-166/192.168.1.166
```

Result:

Thus the above Java Program was successfully executed and verified.

Ex.No: 10 (A)

Date:

To Find IP Address of The Local Host

Aim:

To write a Java program to find the IP Address of a Local Host.

Class:

InetAddress

The InetAddress class is used to encapsulate both the numerical IP address and the domain name for that address. There are no public constructors in the InetAddress class.

However,InetAddress has three static methods that return suitably initialized InetAddress objects. They are:

static InetAddress getLocalHost( ) :

The getLocalHost( ) method simply returns the InetAddress object that represents the local host. If these methods are unable to resolve the host name, they throw an UnknownHostException.

static InetAddress getByName(String hostName) :

The getByName( ) method returns an InetAddress for a host name passed to it.

static InetAddress[ ] getAllByName(String hostName) :

The getAllByName( ) factory method returns an array of InetAddresses that represent all of the addresses that a particular name resolves to. It will also throw an UnknownHostException if it can’t resolve the name to at least one address.

Program:

```
import java.net.*;
class ex11a
{
public static void main(String args[])throws UnknownHostException
{
InetAddress Ia=InetAddress.getLocalHost();
System.out.println(Ia);
}
}
```

Sample Input& Output:

```
D:\Program Files\Java\jdk1.6.0_20\bin>javac
ex11a.java D:\Program Files\Java\jdk1.6.0_20\bin> java
ex11a

Sys-166/192.168.1.166
```

Result:

Thus the above Java Program was successfully executed and verified.

Ex.No:10(B)

Date:

To Find IP Address of The Remote Host

Aim:

To write a Java program to find the IP Address of a Remote Host.

Class:

InetAddress

The InetAddress class is used to encapsulate both the numerical IP address and the domain name for that address. There are no public constructors in the InetAddress class.

However,InetAddress has three static methods that return suitably initialized InetAddress objects. They are:

static InetAddress getLocalHost( ) :

The getLocalHost( ) method simply returns the InetAddress object that represents the local host. If these methods are unable to resolve the host name, they throw an UnknownHostException.

static InetAddress getByName(String hostName) :

The getByName( ) method returns an InetAddress for a host name passed to it.

static InetAddress[ ] getAllByName(String hostName) :

The getAllByName( ) factory method returns an array of InetAddresses that represent all of the addresses that a particular name resolves to. It will also throw an UnknownHostException if it can't resolve the name to at least one address.

Program:

```
import java.net.*;
import java.lang.*;
class ex11b
{
public static void main(String args[])throws UnknownHostException
{
InetAddress add=InetAddress.getByName(args[0]);
System.out.println("The InetAddress:"+add); }

}
```

Sample Input & Output:

```
D:\Program Files\Java\jdk1.6.0_20\bin>javac ex11b.java
D:\Program Files\Java\jdk1.6.0_20\bin> java ex11b sys-165

The Inet Address: sys-165/199.168.1.165
```

Result:

Thus the above Java Program was successfully executed and verified.

Ex.No:11

Date:

Implementation of Echo Server and Client using TCP Sockets

Aim:

To implement echo server and client in java using TCP sockets.

Algorithm:

Server:

1. Create a server socket.
2. Wait for client to be connected.
3. Read text from the client
4. Echo the text back to the client.
5. Repeat steps 4-5 until 'bye' or 'null' is read.
6. Close the I/O streams
7. Close the server socket
8. Stop

Client:

1. Create a socket and establish connection with the server
2. Get input from user.
3. If equal to bye or null, then go to step 7.
4. Send text to the server.
5. Display the text echoed by the server
6. Repeat steps 2-4
7. Close the I/O streams
8. Close the client socket
9. Stop

Program:

TCP Echo Server - tcpechoserver.java

```
import java.net.*;
import java.io.*;
public class tcpechoserver
{
public static void main(String[] arg) throws IOException
{
ServerSocket sock = null;
BufferedReader fromClient = null;
OutputStreamWriter toClient = null;
Socket client = null;
try
{
sock = new ServerSocket(4000);
System.out.println("Server Ready");
client = sock.accept();
System.out.println("Client
Connected"); fromClient = new
BufferedReader(new
InputStreamReader(client.getInputStream()));
toClient = new
OutputStreamWriter(client.getOutputStream()); String line;
while (true)
{
line = fromClient.readLine();
if ((line == null) ||
line.equals("bye")) break;
System.out.println ("Client [ " + line + " ]");
toClient.write("Server [ "+ line +" \] n");
toClient.flush();
}
fromClient.close();
toClient.close();
client.close();
sock.close();
System.out.println("Client Disconnected");
}
catch (IOException ioe)
{
System.err.println(ioe);
}
}
}
```

TCP Echo Client - tcpechoclient.java

```
import java.net.*;
import java.io.*;
public class tcpechoclient
{
public static void main(String[] args) throws IOException
{
BufferedReader fromServer = null;
BufferedReader fromUser = null;
PrintWriter toServer = null;
Socket sock = null;
try
{
if (args.length == 0)
sock = new
Socket(InetAddress.getLocalHost(),4000); else
sock = new Socket(InetAddress.getByName(args[0]),4000);
fromServer = new BufferedReader(new
InputStreamReader(sock.getInputStream())); fromUser = new
BufferedReader(new InputStreamReader(System.in));
toServer = new PrintWriter(sock.getOutputStream(), true);
String Usrmsg, Srvmsg;
System.out.println("Type\"bye\" to
quit"); while (true)
{
System.out.print("Enter msg to server : ");
Usrmsg = fromUser.readLine();
if(Usrmsg==null || Usrmsg.equals("bye"))
{
toServer.println("bye")
; break;
}
else
toServer.println(Usrmsg);
Srvmsg = fromServer.readLine();
System.out.println(Srvmsg);
}
fromUser.close();
fromServer.close();
toServer.close();
sock.close();
}
catch (IOException ioe)
{
System.err.println(ioe);
}
}
}
```

Sample Input & Output:

Server:

```
$ javac tcpechoserver.java
$ java tcpechoserver
Server Ready
Client Connected
Client [ hello ]
Client [ how are you ]
Client [ i am fine ]
Client [ ok ]
Client Disconnected
```

Client:

```
$ javac tcpechoclient.java
$ java tcpechoclient
Type "bye" to quit
Enter msg to server : hello
Server [ hello ]
Enter msg to server : how are
you Server [ how are you ]
Enter msg to server : i am fine
Server [ i am fine ]
Enter msg to server :
ok Server [ ok ]
Enter msg to server : bye
```

Result:

Thus data from client to server is echoed back to the client to check reliability/noise level of the channel**.**

Ex. No: 12

Date:

Implementation of Echo Server and Client using UDP Sockets

Aim:

To implement date server and client in java using TCP sockets.

Algorithm:

Server:

1. Create an array of hosts and its ip address in another array
2. Create a datagram socket and bind it to a port
3. Create a datagram packet to receive client request
4. Read the domain name from client to be resolved
5. Lookup the host array for the domain name
6. If found then retrieve corresponding address
7. Create a datagram packet and send ip address to client
8. Repeat steps 3-7 to resolve further requests from clients
9. Close the server socket
10. Stop

Client:

1. Create a datagram socket
2. Get domain name from user
3. Create a datagram packet and send domain name to the server
4. Create a datagram packet to receive server message
5. Read server's response
6. If ip address then display it else display "Domain does not exist"
7. Close the client socket
8. Stop

Program:

UDP DNS Server -- udpdnsserver.java

```
import java.io.*;
import java.net.*;
public class udpdnsserver
{
private static int indexOf(String[] array, String str)
{
str = str.trim();
for (int i=0; i < array.length; i++)
{
if (array[i].equals(str))
return i;
}
return -1;
}
public static void main(String arg[])throws IOException
{
String[] hosts = {"yahoo.com", "gmail.com", "google.com", "facebook.com"};
String[] ip = {"68.180.206.184", "209.85.148.19", "80.168.92.140",
"69.63.189.16"}; System.out.println("Press Ctrl + C to Quit"); while (true)

{
DatagramSocket                              serversocket=new
DatagramSocket(1362);    byte[]    senddata    =    new
byte[1021]; byte[] receivedata = new byte[1021];
DatagramPacket recvpack = new
DatagramPacket(receivedata, receivedata.length);
serversocket.receive(recvpack);
String sen = new String(recvpack.getData());
InetAddress ipaddress =
recvpack.getAddress(); int port =
recvpack.getPort();
String capsent;
System.out.println("Request for host " + sen);
if(indexOf (hosts, sen) != -1)
capsent = ip[indexOf (hosts, sen)];
else
capsent = "Host Not Found";
senddata = capsent.getBytes();
DatagramPacket pack = new
DatagramPacket(senddata,
senddata.length,ipaddress,port);
serversocket.send(pack);
serversocket.close();
}
}
}
```

UDP DNS Client -- udpdnsclient.java

```
import java.io.*;
import java.net.*;
public class udpdnsclient
{
public static void main(String args[])throws IOException
{
BufferedReader br = new BufferedReader(new
InputStreamReader(System.in)); DatagramSocket clientsocket = new
DatagramSocket(); InetAddress ipaddress;
if(args.length == 0)
ipaddress = InetAddress.getLocalHost();
else
ipaddress = InetAddress.getByName(args[0]);
byte[] senddata = new byte[1024];
byte[] receivedata = new
byte[1024]; int portaddr = 1362;
System.out.print("Enter the hostname : ");
String sentence = br.readLine();
senddata = sentence.getBytes();
DatagramPacket pack = new DatagramPacket(senddata, senddata.length,
ipaddress,portaddr); clientsocket.send(pack);
DatagramPacket recvpack =new
DatagramPacket(receivedata, receivedata.length);
clientsocket.receive(recvpack);
String modified = new String(recvpack.getData());
System.out.println("IP Address: " + modified);
clientsocket.close();
}
}
```

Sample Input & Output:

Server:

```
$ javac udpdnsserver.java
$ java udpdnsserver Press Ctrl + C to Quit

Request for host yahoo.com
Request for host google.com
Request for host
youtube.com
```

Client:

```
$ javac udpdnsclient.java

$ java udpdnsclient
Enter the hostname :
yahoo.com IP Address:
68.180.206.184

$ java udpdnsclient
Enter the hostname : google.com
IP Address: 80.168.92.140

$ java udpdnsclient
Enter the hostname :
youtube.com IP Address: Host
Not Found
```

Result:

Thus domain name requests by the client are resolved into their respective logical address using lookup method.

Ex.No: 13

Date:

Send and Receive Message between Client and Server using TCP

Aim:

To write a Java program to send and receive message between Client and Server using TCP.

Class:

ServerSocket:

This class implements server sockets. A server socket waits for requests to come in over the network. It performs some operation based on that request, and then possibly returns a result to the requester.

Methods:

ServerSocket()	Creates an unbound server socket
ServerSocket(int port)	Creates a server socket, bound to specified port
accept()	Listens for a connection to be made to this socket and accepts it.
getInetAddress()	Returns the local address of this server socket.
getLocalPart()	Returns the port on which this socket is listening.
close()	Closes this socket

Program:

Client:

```
import java.net.*;
import java.io.*;
import java.lang.*;
public class
ex14client
{
public static void main(String args[])throws IOException
{
InetAddress a=InetAddress.getLocalHost();
Socket soc=new Socket(a,8888);
try
{
BufferedReader in=new BufferedReader(new
InputStreamReader(soc.getInputStream()));
PrintWriter out =new PrintWriter(new BufferedWriter(new
OutputStreamWriter(soc.getOutputStream())),true);
for(int i=0;i<5;i++)
{
out.println("lines#"+i);
String str=in.readLine();
System.out.println(str);
}
out.println("end");
}
finally
{
System.out.println("closing");
soc.close();
}
}
}
```

Server:

```
import java.io.*;
import java.net.*;
import java.lang.*;
public class
ex14server
{
public static final int PORT=8888;
public static void main(String args[ ]) throws IOException
{
ServerSocket s=new
ServerSocket(PORT); try
{
Socket soc=s.accept( );
try
{
System.out.println("Connection accepted.. ");
BufferedReader in=new BufferedReader(new
InputStreamReader(soc.getInputStream()));
PrintWriter out =new PrintWriter(new BufferedWriter(new
                                        OutputStreamWriter(soc.getOutputStream())),true);
while(true)
{
String str=in.readLine();
if(str.equals("end"))
break;
System.out.println("'echoing .."+str);
out.println(str);
}
}
finally
{
System.out.println("closing");
soc.close();
}
}
finally
{
s.close();
}
}
}
```

Sample Input & Output:

Client:

```
D:\Program Files\ Java\ jdk1.6.0_20\
bin\>javacex14client.java D: Program Files Java
jdk1.6.0_20 bin> java ex14client

Connection accepted.....
'echoing . lines#0
'echoing . lines#1
'echoing . lines#2
'echoing . lines#3
'echoing . lines#4
closing
```

Server:

```
D:\Program Files\ Java\ jdk1.6.0_20\
bin\>javacex14server.java D: Program Files Java
jdk1.6.0_20 bin> java  ex14server

lines#
0
lines#
1
lines#
2
lines#
3
lines#
4
closin
g
```

Result:

Thus the above Java Program was successfully executed and verified.

Ex.No: 14

Date:

Send and Receive Message between Client and Server using UDP

Aim:

To write a Java program to send and receive message between Client and Server using UDP.

Class:

DatagramSocket:

This class represents a socket for sending and receiving datagram packets. A datagram socket is the sending or receiving point for a packet delivery service. Each packet sent or received on a datagram socket is individually addressed and routed. Multiple packets sent from one machine to another may be routed differently, and may arrive in any order. User Datagram Protocol (UDP) broadcasts always enabled on a DatagramSocket. In order to receive broadcast packets a DatagramSocket should be bound to the wildcard address. In some implementations, broadcast packets may also be received when a DatagramSocket is bound to a more specific address.

DatagramPacket:

Datagram packets are used to implement a connectionless packet delivery service. Multiple packets sent from one machine to another might be routed differently, and might arrive in any order. Packet delivery is not guaranteed.

Methods:

DatagramSocket(int port)	Constructs a datagram socket and binds it to any available port on the local host machine.
receive(DatagramPacket p)	Receives a datagram packet from this socket.
send(DatagramPacket p)	Sends a datagram packet from this socket.
DatagramPacket(byte[] buf, int length)	Constructs a DatagramPacketfor receiving packets of length.
DatagramPacket(byte[] buf,int length, InetAddress address, int port	Constructs a datagram packet for sending packets of length to the specified port number on the specified host.
getData()	Returns the data buffer

Program:

Client:

```
import java.net.*;
import java.io.*;
import java.lang.*;
public class
ex15client
{
public static void main(String args[]) throws IOException
{
byte[] buff=new byte[512];
DatagramSocket soc=new DatagramSocket();
String s="HELLO SERVER-FROM
CLIENT";
buff=s.getBytes();
InetAddress a=InetAddress.getLocalHost();
DatagramPacket pac=new DatagramPacket(buff,buff.length,a,8888);
soc.send(pac);
System.out.println("End of Sending");
byte[] buff1=new byte[512];
pac=new DatagramPacket(buff,buff1.length);
soc.receive(pac);
String messg=new String(pac.getData());
System.out.println(messg);
System.out.println("End Of Sending ");
}
}
```

Server:

```
import java.io.*;
import java.net.*;
import java.lang.*;
public class
ex15server
{
public static void main(String args[]) throws IOException
{
byte[ ] buff=new byte[512];
DatagramSocket soc=new DatagramSocket(8888);
DatagramPacket pac=new
DatagramPacket(buff,buff.length);
System.out.println("Server started ");

soc.receive(pac);
String msg=new String(pac.getData());
System.out.println(msg);
System.out.println("End of Reception");
String s="FROM SERVER HELLO CLIENT";
byte[ ] buff1=new byte[512];
buff1 =s.getBytes();

InetAddress a=pac.getAddress();
int port=pac.getPort();
pac=new DatagramPacket(buff,buff1.length,a,port);
soc.send(pac);
System.out.println("End of Sending");
}
}
```

Sample Input & Output:

Server:

```
D:\Program Files\Java\jdk1.6.0_20\bin>javac
ex15server.java D:\Program Files\Java jdk1.6.0_20 bin>
java  ex15server

Server started
HELLO SERVER-FROM CLIENT
End of Reception
End of Sending
```

Client:

```
D:\Program Files\Java\jdk1.6.0_20 bin>javac
ex15client.java D:\Program Files\Java jdk1.6.0_20 bin>
java ex15client

End of Sending
```

Result:

Thus the above Java Program was successfully executed and verified.

Ex.No: 15

Date:

Sliding Window Protocols

Aim:

To write a Java program to implement Sliding Window Protocols.

Class:

DataInputStream:

Class lets an application read primitive Java data types from an underlying input stream in a machine-independent way.

Following are the important points about DataInputStream:

i) An application uses a data output stream to write data that can later be read by a data input stream.
ii) DataInputStream is not necessarily safe for multithreaded access. Thread safety is optional and is the responsibility of users of methods in this class.

PrintStream:

Class adds functionality to another output stream, the ability to print representations of various data values conveniently.

Program:

Sender:

```
import java.io.*;
import java.net.*;
import java.rmi.*;
public class sender
{
public static void main(String a[])throws Exception
{
ServerSocket ser=new ServerSocket(10);
Socket s=ser.accept();
DataInputStream in=new DataInputStream(System.in);
DataInputStream in1=new DataInputStream(s.getInputStream());
String sbuff[]=new String[8];
PrintStream p;
int sptr=0,sws=8,nf,ano,i;
String ch;
do
{
p=new PrintStream(s.getOutputStream());
System.out.print("Enter The Number of Frames:");
nf=Integer.parseInt(in.readLine());
p.println(nf);
if(nf<=sws-
1)
{
System.out.println("Enter "+nf+"Message To Be Send");
for(i=0;i<=nf;i++)
{
sbuff[sptr]=in.readLine();
p.println(sbuff[sptr]);
sptr=++sptr%8;
}
sws-=nf;
System.out.println("Acknowledgement Received");
ano=Integer.parseInt(in1.readLine());
System.out.println("for"+ano+"frames");
sws+=nf;
}
else
{
System.out.println("The Number Of Frames Exceeds Window Size");
break;
}
System.out.println("\ n Do You Want To Send Some More Frames:");
ch=in.readLine();
p.println(ch);
}
while(ch.equals("yes"));
s.close();
}
}
```

Receiver:

```
import java.io.*;
import java.net.*;
public class receiver
{
public static void main(String a[])throws Exception
{
Socket s=new Socket(InetAddress.getLocalHost(),10);
DataInputStream in=new
DataInputStream(s.getInputStream()); PrintStream p=new
PrintStream(s.getOutputStream()); int i=0,rptr=-
1,nf,rws=8; String rbuff[]=new String[8];
String ch;
System.out.println();
do
{
nf=Integer.parseInt(in.readLine()
); if(nf<=rws-1)
{
for(i=1;i<=nf;i++)
{
rptr=++rptr%8;
rbuff[rptr]=in.readLine();
System.out.println("The Received Frame "+rptr+"is:"+rbuff[rptr]);
}
rws-=nf;
System.out.println("\ n Acknowledgement Send\ n");
p.println(rptr+1);
rws+=nf;
}
else
break
;
ch=in.readLine();
}
while(ch.equals("yes"));
}
}
```

Sample Input & Output:

Sender:

```
C:\Program files\ Java\ jdk1.5.0_06\ bin>javac
sender.java C: Program\ files Java\ jdk1.5.0_06
bin>java sender Enter The Number of Frames: 4
Enter 4 Message To Be Send
Hai..
Hello..
How Are You..?
Bye..!

Acknowledgement Received
For 4 frames

Do You Want To Send Some More Frames: No
```

Receiver:

```
C:\Program files\Java\jdk1.5.0_06\bin>javac
receiver.java C:\Program files Java\jdk1.5.0_06
bin>java receiver


The Recieved Frame 0 is: Hai..
The Recieved Frame 1 is: Hello..
The Recieved Frame 2 is: How Are
You..? The Recieved Frame 3 is: Bye..!
The Recieved Frame 4 is:

Acknowledgement Send
```

Result:

Thus the above Java Program was successfully executed and verified.