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Course Code – CO406U | **Course Name** - CDL

Practical no. 7

Aim: Write a C program to implement operator precedence parsing.

Theory :

Operator Precedence Parsing is also a type of Bottom-Up Parsing that can be used to a class of Grammars known as Operator Grammar.

A Grammar G is Operator Grammar if it has the following properties −

- Production should not contain ϵ on its right side.
- There should not be two adjacent non-terminals at the right side of production.

Example1 − Verify whether the following Grammar is operator Grammar or not.
E → E A E |(E)|id
A → +| − | *

Solution
No, it is not an operator Grammar as it does not satisfy property 2 of operator Grammar.
As it contains two adjacent Non-terminals on R.H.S of production E → E A E.
We can convert it into the operator Grammar by substituting the value of A in E → E A E.
E → E + E |E − E |E * E |(E) | id.
Operator Precedence Relations
Three precedence relations exist between the pair of terminals.

Relation	Meaning
p <. q	p has less precedence than q.
p >. q	p has more precedence than q.
p =. q	p has equal precedence than q.

Depending upon these precedence Relations, we can decide which operations will be executed or parsed first.

Association and Precedence Rules

- If operators have different precedence

Since * has higher precedence than +

Example−
In a statement a + b * c
∴ + <. *
In statement a * b + c
∴ * . > +

- If operators have Equal precedence, then use Association rules.

(a) Example minus; In statement a + b + c here + operators are having equal precedence.
As '+' is left Associative in a + b + c
∴ (a + b) will be computed first, and then it will be added to c.
i.e., (a + b) + c
+ .> +
Similarly, '*' is left Associative in a * b * c

(b) Example − In a statement a ↑ b ↑ c here, ↑ is the Right Associative operator
∴ It will become a ↑ (b ↑ c)
∴ (b ↑ c) will be computed first.
∴ ↑<. ↑

- Identifier has more precedence then all operators and symbols.

∴ θ <. id $ <. id
id . > θ id . > $
id . >)
(<. id.

- $ has less precedence than all other operators and symbols.

$ <. (id . > $
$ <. +). > $
$ <.*

Example2 − Construct the Precedence Relation table for the Grammar.

$$E \rightarrow E + E \mid E * E/id$$

Solution

Operator-Precedence Relations

	Id	+	*	$
Id		.>	.>	.>
+	<.	.>	<.	.>
*	<.	.>	.>	.>
$	<.	<.	<.	

Advantages of Operator Precedence Parsing

- It is accessible to execute.

Disadvantages of Operator Precedence Parsing

- Operator Like minus can be unary or binary. So, this operator can have different precedence's in different statements.
- Operator Precedence Parsing applies to only a small class of Grammars.

Program Code:

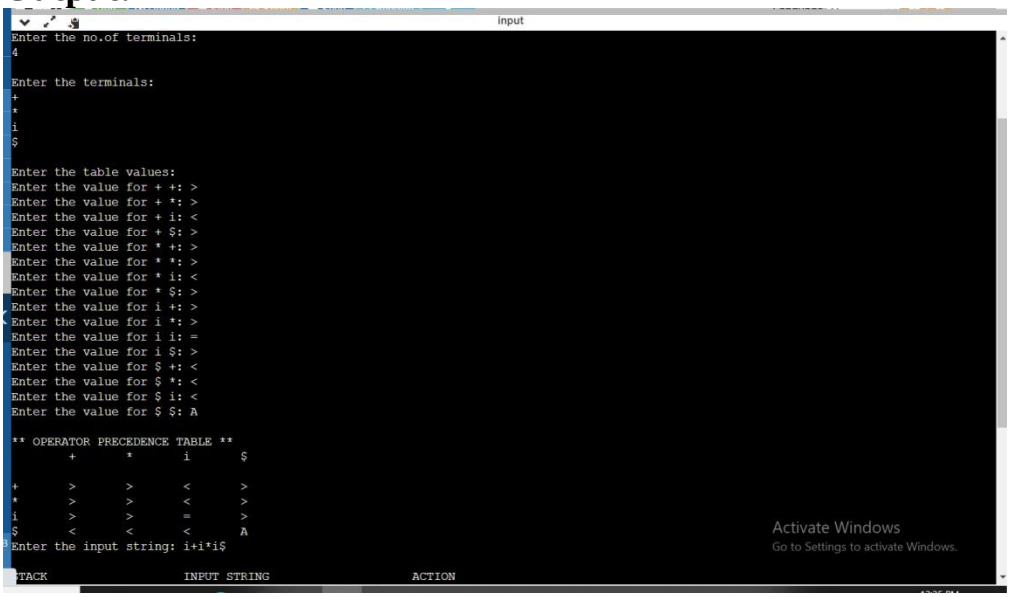
```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
void main()
{
 char stack[20],ip[20],opt[10][10][1],ter[10];
 int i,j,k,n,top=0,col,row;
 for(i=0;i<10;i++)
 {
 stack[i]=NULL;
 ip[i]=NULL;
 for(j=0;j<10;j++)
 {
 opt[i][j][1]=NULL;
 }
 }
 printf("Enter the no.of terminals:\n");
 scanf("%d",&n);
```

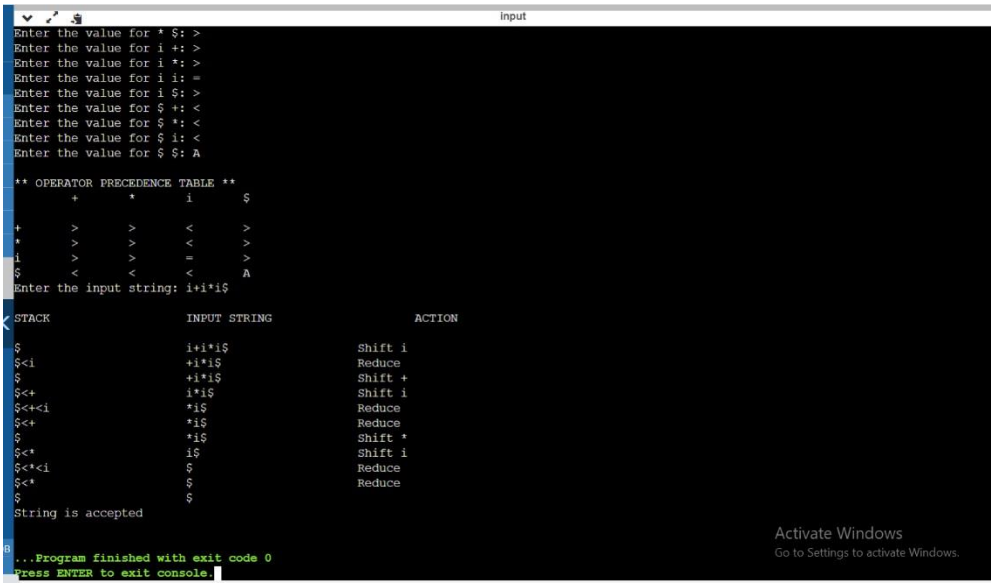
```
printf("\nEnter the terminals:\n");
for(i=0;i<n;i++)
{
scanf("%s",&ter[i]);
}
printf("\nEnter the table values:\n");
for(i=0;i<n;i++)
{
for(j=0;j<n;j++)
{
printf("Enter the value for %c %c: ",ter[i],ter[j]);
scanf("%s",opt[i][j]);
}
}
printf("\n** OPERATOR PRECEDENCE TABLE **\n");
for(i=0;i<n;i++)
{
printf("\t%c",ter[i]);
}
printf("\n");
for(i=0;i<n;i++)
{
printf("\n%c",ter[i]);
for(j=0;j<n;j++)
{
printf("\t%c",opt[i][j][0]);
}
}
stack[top]='$';
printf("\nEnter the input string: ");
scanf("%s",ip);
i=0;
printf("\nSTACK\t\t\tINPUT STRING\t\t\tACTION\n");
printf("\n%s\t\t\t%s\t\t\t",stack,ip);
while(i<=strlen(ip))
{
for(k=0;k<n;k++)
{
if(stack[top]==ter[k])
col=k;
```

```
if(ip[i]==ter[k])
row=k;
}
if((stack[top]=='$')&&(ip[i]=='$'))
{
printf("\nString is accepted\n");
break;
}
else if((opt[col][row][0]=='<') ||(opt[col][row][0]=='='))
{
stack[++top]=opt[col][row][0];
stack[++top]=ip[i];
printf("Shift %c",ip[i]);
i++;
}
else
{
if(opt[col][row][0]=='>')
{
while(stack[top]!='<'){--top;}
top=top-1;
printf("Reduce");
}
else
{
printf("\nString is not accepted");
break;
}
}
printf("\n");
for(k=0;k<=top;k++)
{
printf("%c",stack[k]);
}
printf("\t\t\t");
for(k=i;k<strlen(ip);k++)
{
printf("%c",ip[k]);
}
printf("\t\t\t");
```

```
 }
}
```

Output:





Conclusion : In this practical we learnt how operator precedence parser works for parsing operator precedence grammar.