# Operator Precedence and Associativity

#### Postfix 1

```
%%
                                                   { };
                StmtSeq
Prog
StmtSeq
                 Stmt StmtSeq
                                                   { };
StmtSeq
                Id '=' Expr ';'
                                                   {printf("%s = %s\n", $1, $3);};
Stmt
                Expr '+' Term
                                                   {asprintf(&$$, "%s %s +", $1, $3);};
Expr
                Term
                                                   \{\$\$ = \$1;\};
Expr
                Term '*' Factor
                                                   {asprintf(&$$, "%s %s *", $1, $3);};
Term
                                                   \{\$\$ = \$1;\};
                Factor
Term
            : '-' Factor
                                                   {asprintf(&$$, "%s !", $2);};
Factor
                '(' Expr ')'
Factor
                                                   \{\$\$ = \$2;\};
                                                   \{\$\$ = \$1;\};
Factor
                Id
                                                   { $$ = strdup(yytext);};
\operatorname{Id}
             : Ident
%%
```

### Postfix 2

```
%%
                                                   { };
Prog
                 StmtSeq
StmtSeq
                Stmt StmtSeq
                                                   { };
                                                   { };
StmtSeq
                Id '=' RExpr ';'
                                                    {printf("%s = %s\n", $1, $3);};
Stmt
                 Expr '<' Expr
                                                   {asprintf(&$$, "%s %s <", $1, $3);};
RExpr
RExpr
                 Expr
                                                   \{\$\$ = \$1;\};
                 Expr '+' Term
                                                   {asprintf(&$$, "%s %s +", $1, $3);};
Expr
                 Term
                                                   \{\$\$ = \$1;\};
Expr
                 Term '*' Factor
                                                   {asprintf(&$$, "%s %s *", $1, $3);};
Term
Term
                Factor
                                                   \{\$\$ = \$1;\};
                 Expo '^' Factor
                                                   {asprintf(&$$, "%s %s ^", $1, $3);};
Factor
                                                   \{\$\$ = \$1;\};
Factor
                 Expo
                 '-' Expo
                                                   {asprintf(&$$, "%s !", $2);};
Expo
                 '(' Expr ')'
Expo
                                                   \{\$\$ = \$2;\};
                                                   \{\$\$ = \$1;\};
                 Ιd
Expo
                Ident
                                                   { $$ = strdup(yytext);};
Id
```

%%

### Postfix 3

```
%%
                                                   { };
                 StmtSeq
Prog
                                                   { };
StmtSeq
                 Stmt StmtSeq
StmtSeq
                                                    { };
                Id '=' BExpr ';'
                                                   {printf("%s = %s\n", $1, $3);};
Stmt
                                                   {asprintf(&$$, "%s %s &", $1, $3);};
BExpr
                 BExpr '&' RExpr
BExpr
                 RExpr
                                                    \{\$\$ = \$1;\};
                                                   {asprintf(&$$, "%s %s <", $1, $3);};
                 Expr '<' Expr
RExpr
                 Expr
RExpr
                                                    \{\$\$ = \$1;\};
                 Expr '+' Term
                                                   {asprintf(&$$, "%s %s +", $1, $3);};
Expr
Expr
                 Term
                                                    \{\$\$ = \$1;\};
                 Term '*' Factor
                                                   {asprintf(&$$, "%s %s *", $1, $3);};
Term
                                                   \{\$\$ = \$1;\};
Term
                 Factor
                 Expo '^' Factor
                                                   {asprintf(&$$, "%s %s ^", $1, $3);};
Factor
Factor
                 Expo
                                                    \{\$\$ = \$1;\};
                 '-' Expo
                                                   {asprintf(&$$, "%s !", $2);};
Expo
                 '(' Expr ')'
                                                    \{\$\$ = \$2;\};
Expo
                 Ιd
                                                   \{\$\$ = \$1;\};
Expo
                                                   { $$ = strdup(yytext);};
Id
                Ident
```

%%

## Postfix 3 Example Execution

```
$ cat in3
x = a < b;
y = a + b < c * d;
z = w ^ r ^ t;
e = -f ^ g * h ^ -(i + j);
$ ./a.out < in3
x = a b <
y = a b + c d * <
z = w r t ^ ^
e = f ! g ^ h i j + ! ^ *</pre>
```

## Postfix 3 Example Execution

```
$ cat in5
x = a < b & -c < d;
y = e + f < g * - h * i ^ j & k * (l * (m + n)) ^ o+p < w + x * z;
$ ./a.out < in5
x = a b < c ! d < &
y = e f + g h ! * i j ^ * < k l m n + * o ^ * p + w x z * + < &</pre>
```