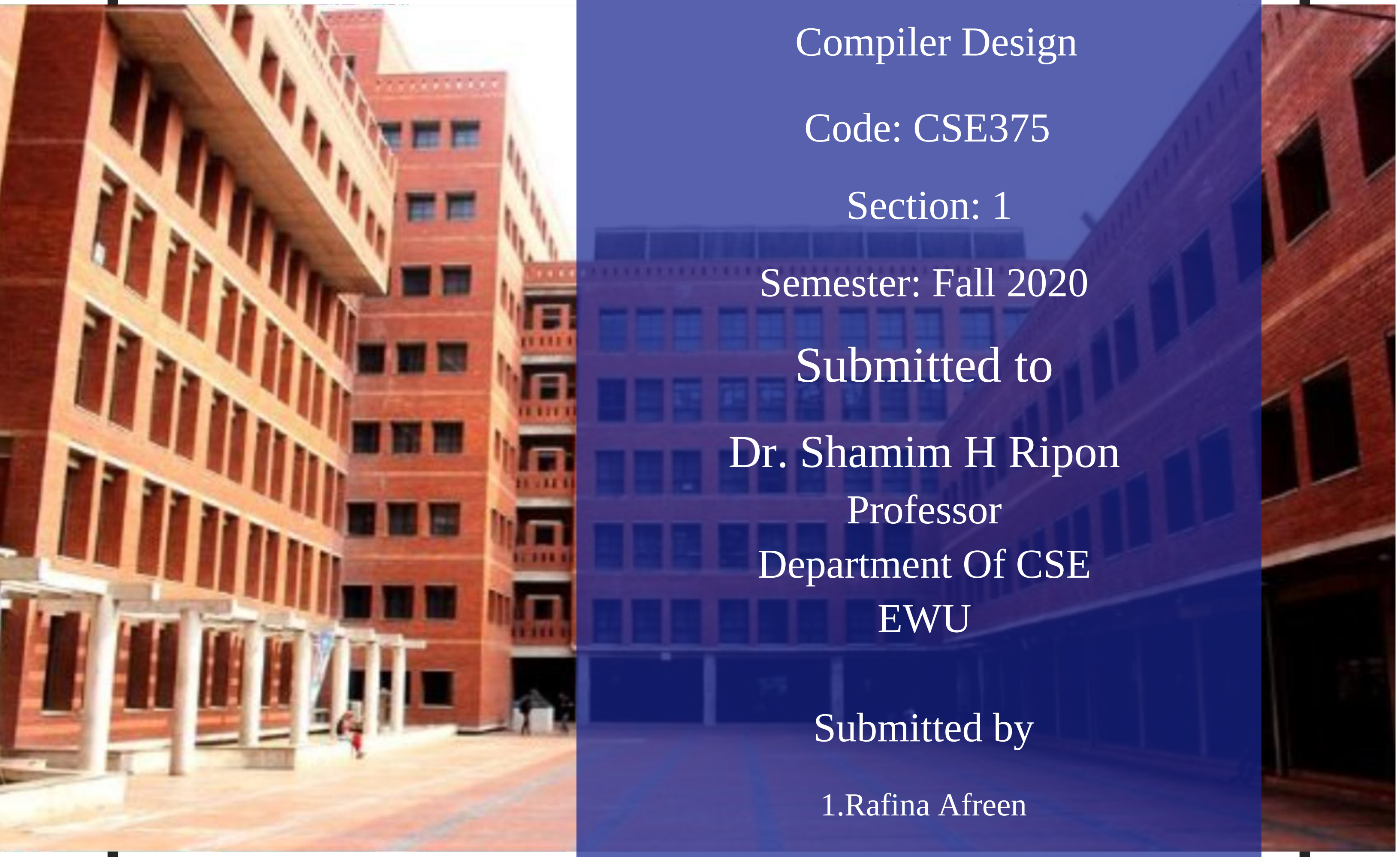

Project Report

Course title:

Compiler Design

Code: CSE375

Section: 1

Semester: Fall 2020

Submitted to

Dr. Shamim H Ripon
Professor
Department Of CSE
EWU

Submitted by

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Structure of the code:

Header Part:

^^include<stdio.h>

^^include<iostream>

^^define MAX_SIZE 1000

^^import<stdio.h>

^^import<iostream>

Function:

Type(‘integer’/’double’/’boolian’/’char’)

```
(ID/Type ID) function_name(Parameter1, parameter2,…)
^<
    Inner_part;
>^
```

Main Function:

```
Integer main()
^<
        Inner_part;
>^
```

Function Call:

Function_name(Parameter1, Parameter2,…);

Function_name();

Variable Declaration:

Type variable_name ;

Type: ('integer'/'double'/'boolian'/'char')

Variable Implementation:

Type variable_name = ID/LIT ;

Type: ('integer'/'double'/'boolian'/'char')

ID : (a-z,A-Z) ;

LIT : (0-9) ;

Variable assign:

Variable= ID/LIT;

ID : (a-z,A-Z) ;

LIT : (0-9) ;

Array :

Type array_name[ID/LIT];

Input:

scan ^< $Type : $Variable_name >^;

Output:

print ^<$%integer is a prime number : x>^

Conditional statement:

```
If: if^<any condition>^
^<
    Inner_part;
>^
Else: else
^<
        Inner_part;
  >^
```

Forloop:

```
for^<initialize ;condition; increment/decrement>^
^<
        Inner_part;
 >^
```

Binary_operations : ('$+' / '$-' / '$*' / '$/' / '$%')

Relational_operation: ('$=' / '$!=' / '$>' / '$>=' / '$<' / '$<='/'$==')

Variable_increment_decrement: ('$++'/ '$--')

Whileloop:

```
while^<conditiont>^
^<
        Inner_part;
 >^
```

Switch_case:

```
switch(argument)
^<
     case 0:
     ^<
            inner_part;
            break;
      >^
      case 1:
      ^<
            inner_part
            break;
      >^
```

>^

Grammar:

```
grammar pro1;

root: declaration function+ ;

declaration:('^^' declarationlist ('<' declarationtype '>'|declarationtype))+ ;

declarationlist : 'include' | 'define' | 'import' ;

declarationtype: term '.' term| expression+;


function :((ID|type ID) '(' ')' inner_part) |( (ID|type ID) '(' type variable ')' (';')?(inner_part)? )
|( (ID|type ID) '(' (type variable ',' type variable)+ ')' (';')? (inner_part)? ) ;

inner_part: '^<' information '>^';

information:

(

about_expr

| if_else

| return_

| iteration

| output

| breakset

| scan_

| functioncall

| switch_case

)+

;

about_expr: (type term+ ((','term+)+)?) ';'|(type)? term'$=' term('['term']')?(','(variable|term'$='
term))?';'|(type)? (term+ '[' term ('_'term)? ']'(',')?)+(','(variable|term'$='
term))?';'|term+'['term']' rel_op (term+'['term']'|symbol term symbol) ';'|term variable_inc_dec
';'|(type)? term+ rel_op functioncall ';'| (type)?term+ rel_op term bin_op term ';' ;

return_: 'return' expression ';' | 'return' term ';'| 'return' (expression+)? functioncall ';' ;
```

expression :symbol+|term+|expression bin_op expression |expression rel_op expression |expression logic_op expression|term (term',')+ term | expression rel_op term|term '['term']'rel_op term|term bin_op term rel_op term|term+('['term']')? rel_op (symbol)? term (symbol)?;

symbol: '*' | '@' | '!' |'-' |'_' |'~'| '/'|'?'|';'|''''| ','| '.'|':';

bin_op:'$+' | '$-' | '$*' | '$/' | '$%';

rel_op:'$=' | '$!=' | '$>' | '$>=' | '$<' | '$<='|'$==';

logic_op: '$||' | '$&&' ;

if_else: 'if' '^<' expression ((logic_op expression+)+)? '>^'inner_part | 'if' '^<' expression ((logic_op expression+)+)? '>^' inner_part 'else' inner_part| 'if' '^<' expression ((logic_op expression+)+)? '>^' inner_part 'else if' '^<' expression ((logic_op expression+)+)? '>^' inner_part | 'if' '^<' expression ((logic_op expression+)+)?'>^' inner_part 'else if' '^<'expression ((logic_op expression+)+)?'>^' inner_part 'else' inner_part ;

breakset: 'break'';' | 'continue' ';' ;

switch_case : 'switch' '(' expression+ ')' '^<' switchblock '>^' ;

switchblock : ('case' term ':' inner_part)+ ('default' ':' inner_part)?;

iteration: condition | loop;

condition: 'while' '^<' expression+'>^' inner_part;

loop: 'for' '^<' (type)? variable '$=' term ';' variable rel_op term ';' (variable variable_inc_dec|variable_inc_dec variable) '>^' inner_part;

output: 'print' '^<' expression ':' '>^' ';'| 'print' '^<' bin_op type (expression)? ':' variable('['variable']')? '>^' ';'|'print' '^<' expression+ '>^' ';'|'print' '^<' expression+ (rel_op)? bin_op type (expression+)? (rel_op)? (bin_op type)? ':' expression+ (functioncall)? '>^' ';' | 'print' '^<' (expression bin_op type)+ ':' expression '>^'';'|'print' '^<' expression bin_op type term+ bin_op type ':' expression functioncall '>^' ';'|'print' '^<'bin_op type expression+ ':' expression+ '>^'';';

scan_: 'scan' '^<' (bin_op type)+ ':' ('$'term+)+ ('['variable']')?'>^' ';'|'gets''^<'term+'>^'';';

functioncall: variable '(' ')'(';')?| variable '(' (expression+)? ')'(';')? ;

variable: ID;

variable_inc_dec:'$++'| '$--';

term:ID|LIT ;

type: 'integer'|'double'|'boolian'|'char';

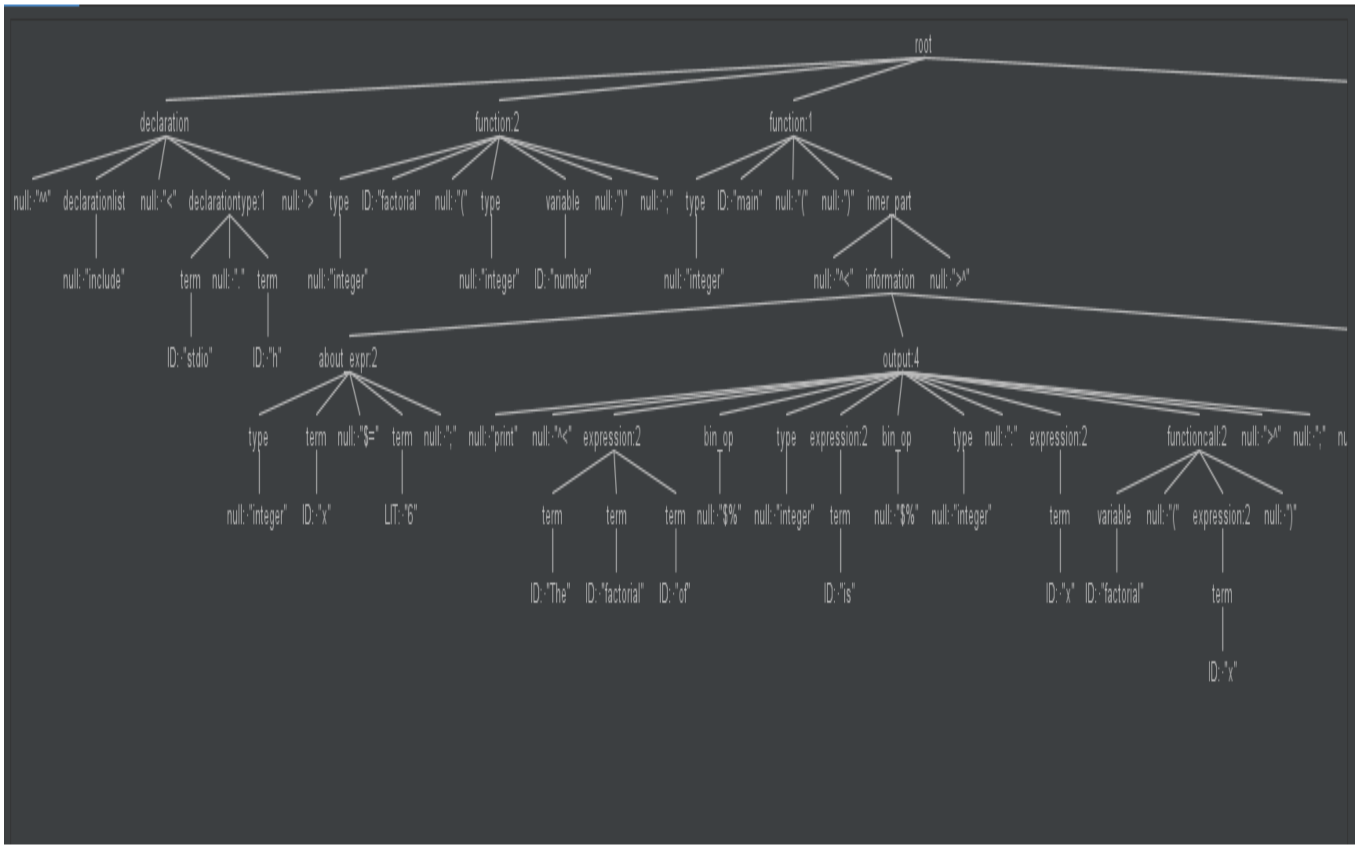
```
ID : [a-zA-Z]+ ;

LIT : [0-9]+ ;


WS : [ \t\r\n]+ ->skip;
```

Sample correct input:

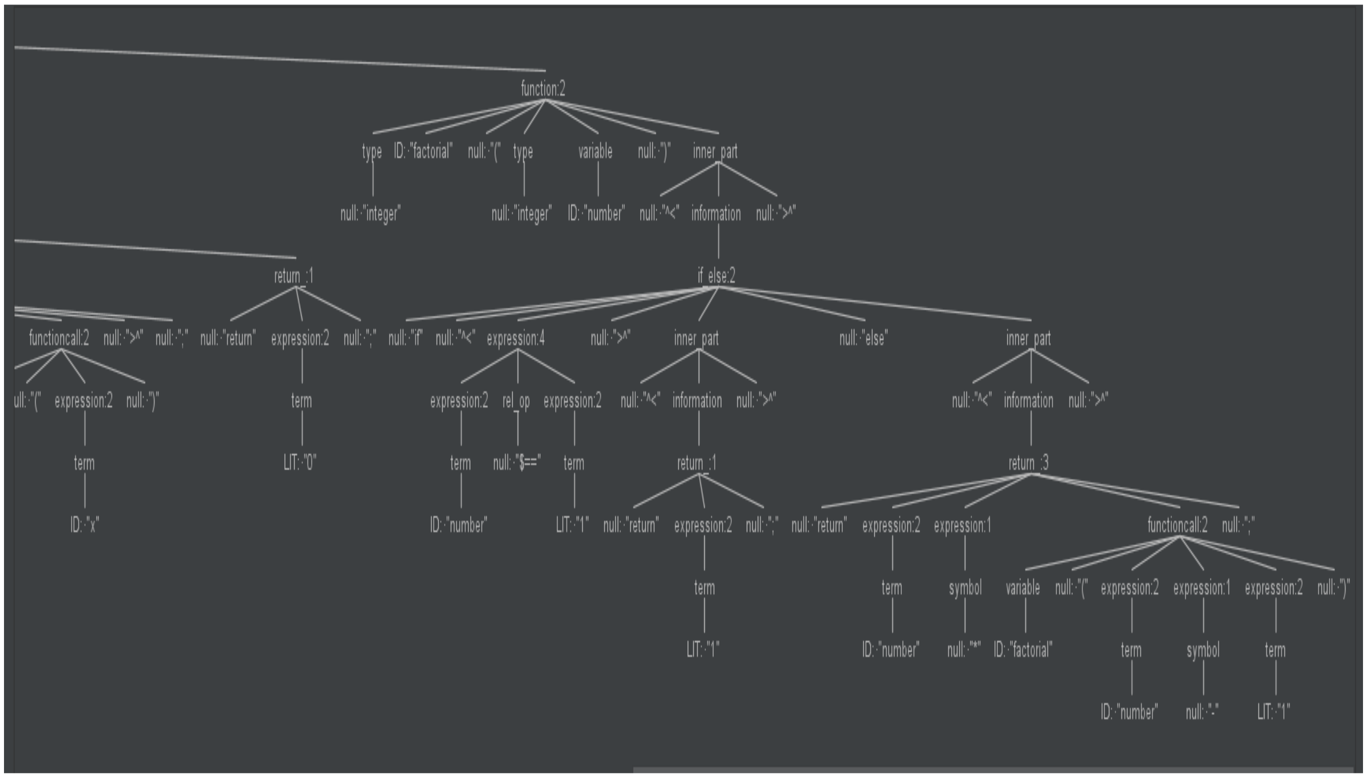
1.Function-recursion:

```
 ^^include <stdio.h>
integer factorial(integer number);
integer main()
^<
integer x $= 6;
print ^<The factorial of $%integer is $%integer: x factorial(x)>^;
return 0;
>^
integer factorial(integer number)
^<
if ^< number $== 1>^
^<
return 1;
>^
else
^<
return number * factorial(number - 1);
>^
>^
```

Tree:



root
declaration
function:2
function:1
null:"^^"
declarationlist
null:"<"
declarationtype:1
null:">"
type
ID:"factorial"
null:"("
type
variable
null:")"
null:";"
type
ID:"main"
null:"("
null:")"
inner_part
null:"include"
term
null:"."
term
null:"integer"
null:"integer"
ID:"number"
null:"integer"
null:"^<"
information
null:">^"
ID:"stdio"
ID:"h"
about_expr:2
output:4
type
term
null:"$="
term
null:";"
null:"print"
null:"^<"
expression:2
bin_op
type
expression:2
bin_op
type
null:":"
expression:2
functioncall:2
null:">^"
null:";"
null:"integer"
ID:"x"
LIT:"6"
term
term
term
null:"$%"
null:"integer"
term
null:"$%"
null:"integer"
term
variable
null:"("
expression:2
null:")"
ID:"The"
ID:"factorial"
ID:"of"
ID:"is"
ID:"x"
ID:"factorial"
term
ID:"x"

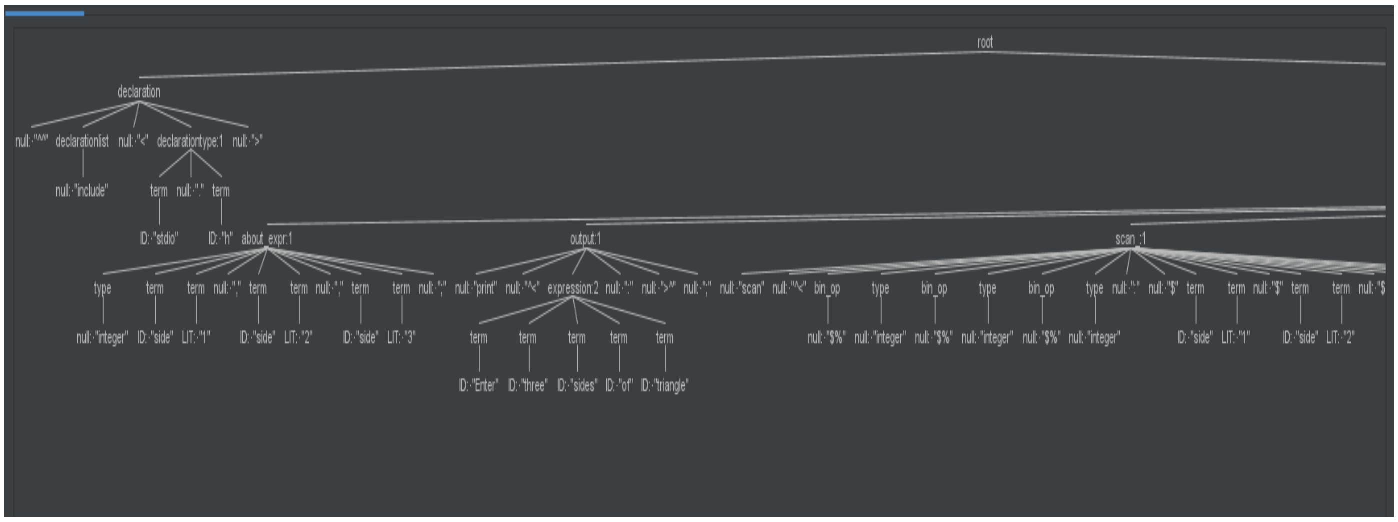


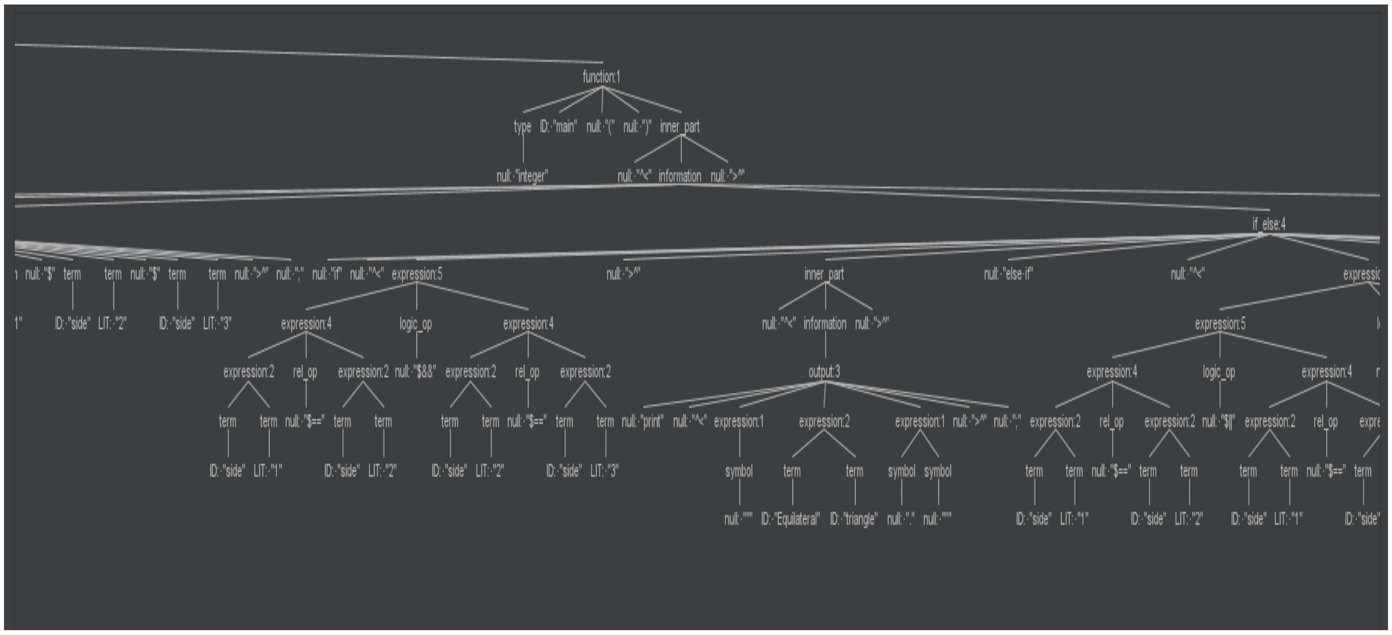
function:2
type
ID:"factorial"
null:"("
type
variable
null:")"
inner_part
null:"integer"
null:"integer"
ID:"number"
null:"^<"
information
null:">^"
return_:1
if_else:2
functioncall:2
null:">^"
null:";"
null:"return"
expression:2
null:";"
null:"if"
null:"^<"
expression:4
null:">^"
inner_part
null:"else"
inner_part
null:"("
expression:2
null:")"
term
expression:2
rel_op
expression:2
null:"^<"
information
null:">^"
null:"^<"
information
null:">^"
term
LIT:"0"
term
null:"$=="
term
return_:1
return_:3
ID:"x"
ID:"number"
LIT:"1"
null:"return"
expression:2
null:";"
null:"return"
expression:2
expression:1
functioncall:2
null:";"
term
term
symbol
variable
null:"("
expression:2
expression:1
expression:2
null:")"
LIT:"1"
ID:"number"
null:"*"
ID:"factorial"
term
symbol
term
ID:"number"
null:"-"
LIT:"1"

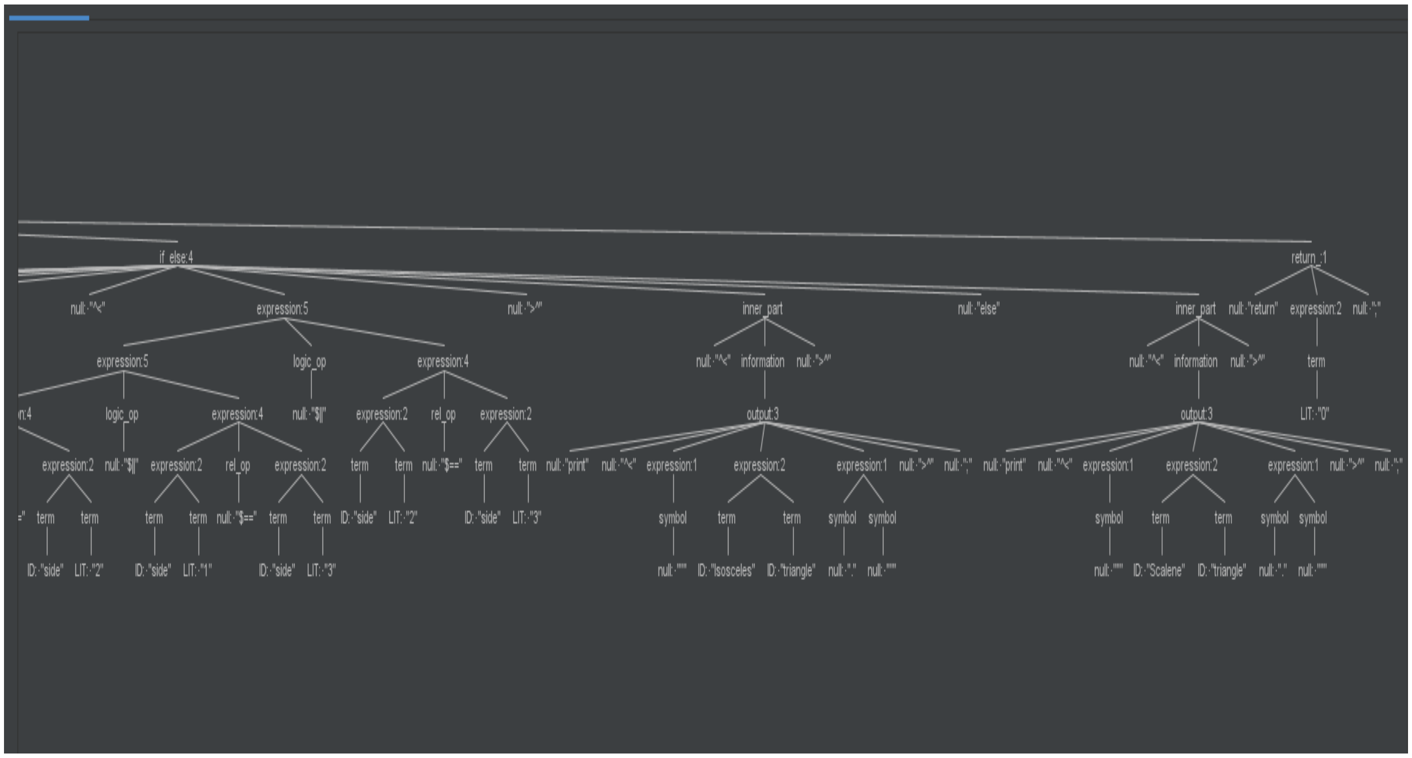
2. if-else:

```
 ^^include <stdio.h>
integer main()
^<
integer side1, side2, side3;
print^<Enter three sides of triangle: >^;
scan^<$%integer$%integer$%integer: $side1 $side2 $side3>^;
if^<side1 $== side2 $&& side2 $== side3>^
^<
print^<"Equilateral triangle.">^;
>^
else if^<side1$==side2 $|| side1$==side3 $|| side2$==side3>^
^<
print^<"Isosceles triangle.">^;
>^
else
^<
print^<"Scalene triangle.">^;
>^
return 0;
>^
```

Tree:


root
declaration
null:·"^^" declarationlist null:·"<" declarationtype:1 null:·">"
null:·"include"
term null:·"." term
ID:·"stdio" ID:·"h"
about_expr:1
type term term null:·"," term term null:·"," term term null:·";"
null:·"integer" ID:·"side" LIT:·"1" ID:·"side" LIT:·"2" ID:·"side" LIT:·"3"
output:1
null:·"print" null:·"^<" expression:2 null:·":" null:·">^" null:·";"
term term term term term
ID:·"Enter" ID:·"three" ID:·"sides" ID:·"of" ID:·"triangle"
scan_:1
null:·"scan" null:·"^<" bin_op type bin_op type bin_op type null:·":" null:·"$" term term null:·"$" term term null:·"$
null:·"$%" null:·"integer" null:·"$%" null:·"integer" null:·"$%" null:·"integer" ID:·"side" LIT:·"1" ID:·"side" LIT:·"2"



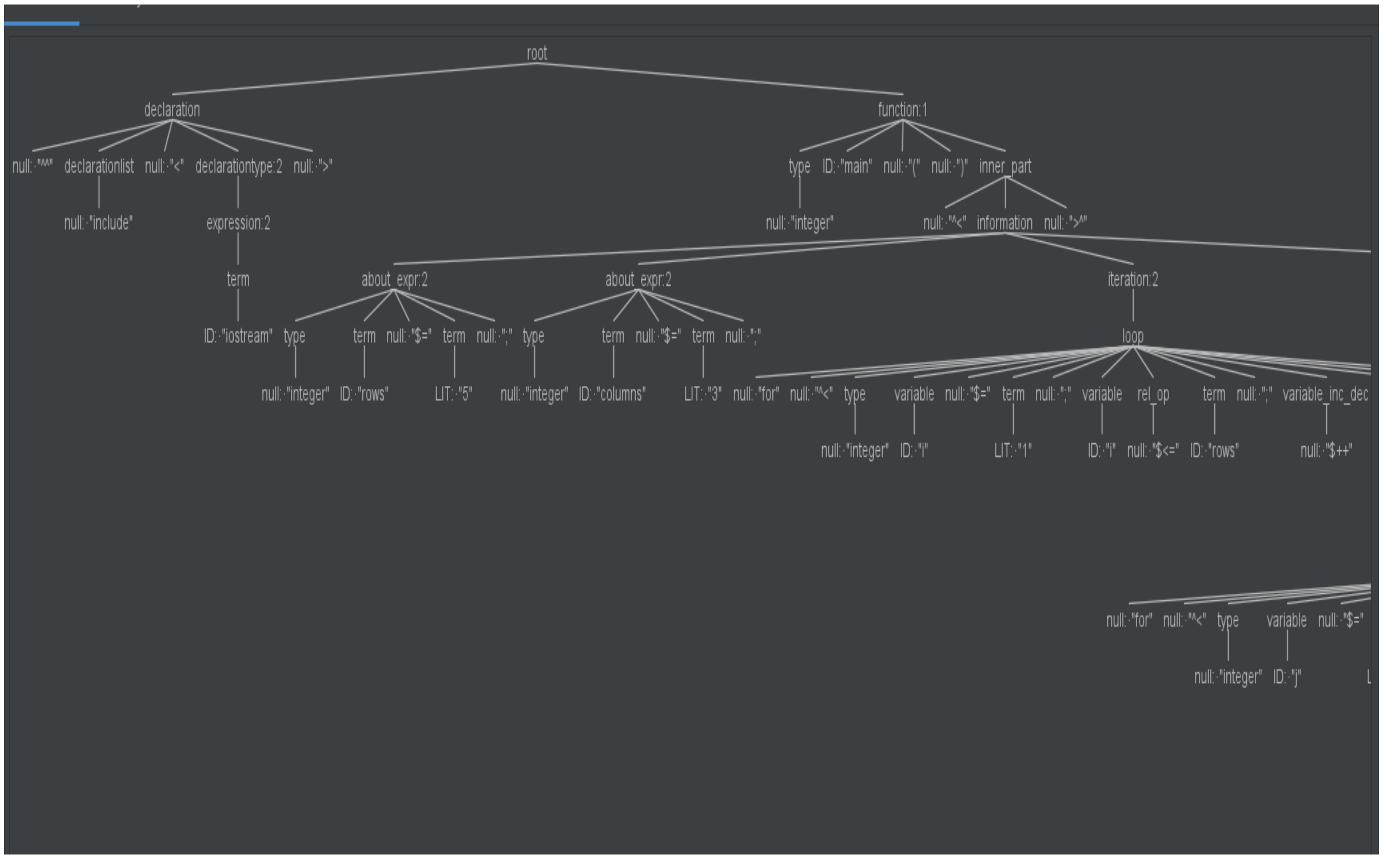


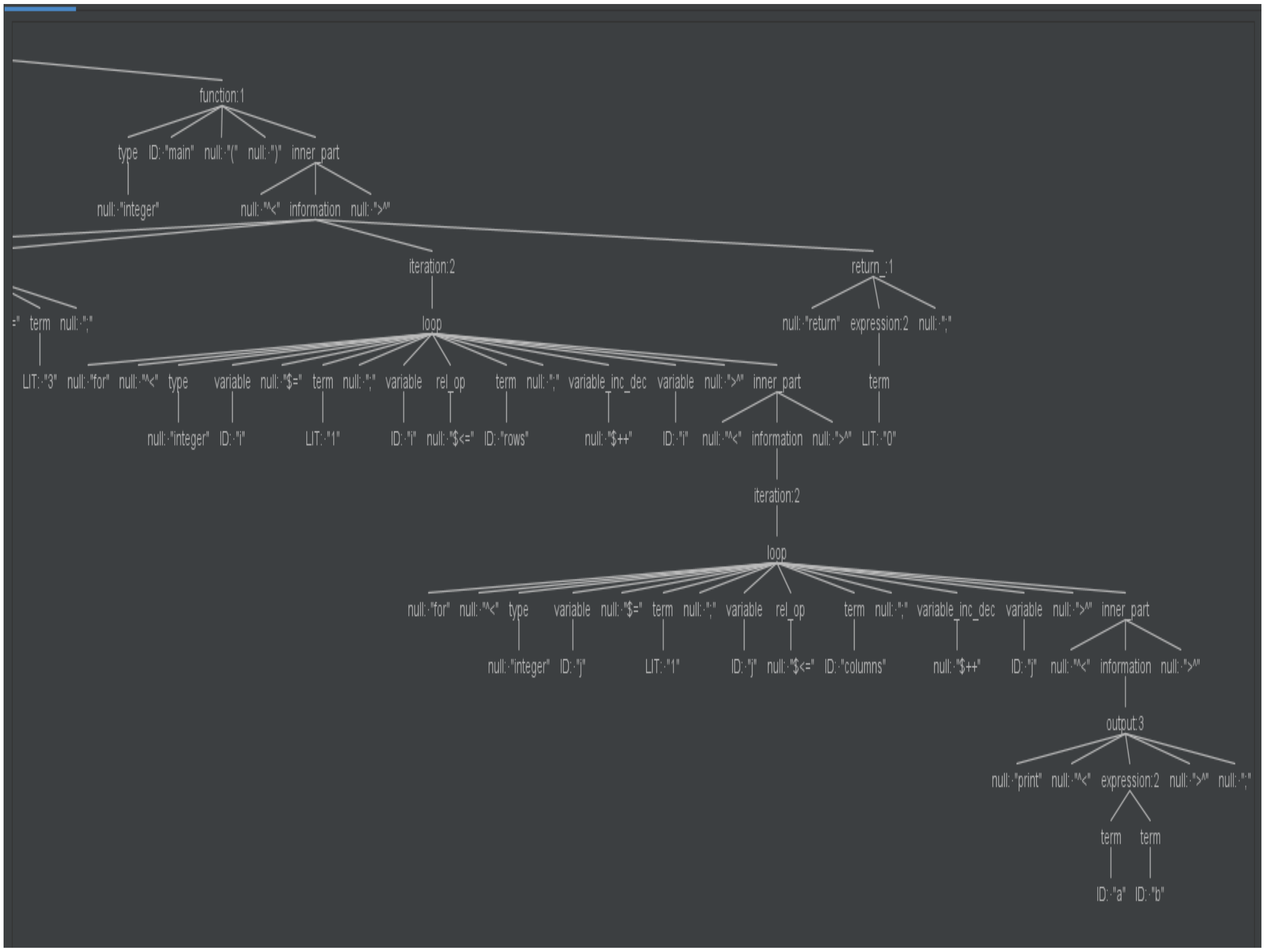
3.Nested-forloop:

```
 ^^include <iostream>
integer main ()
^<
integer rows $= 5;
integer columns $= 3;
```

```
for ^<integer i $= 1; i $<= rows; $++i >^
^<
for ^<integer j $= 1; j $<= columns; $++j>^
^<
print ^<a b>^;
>^
>^
return 0;
>^
```

Tree:



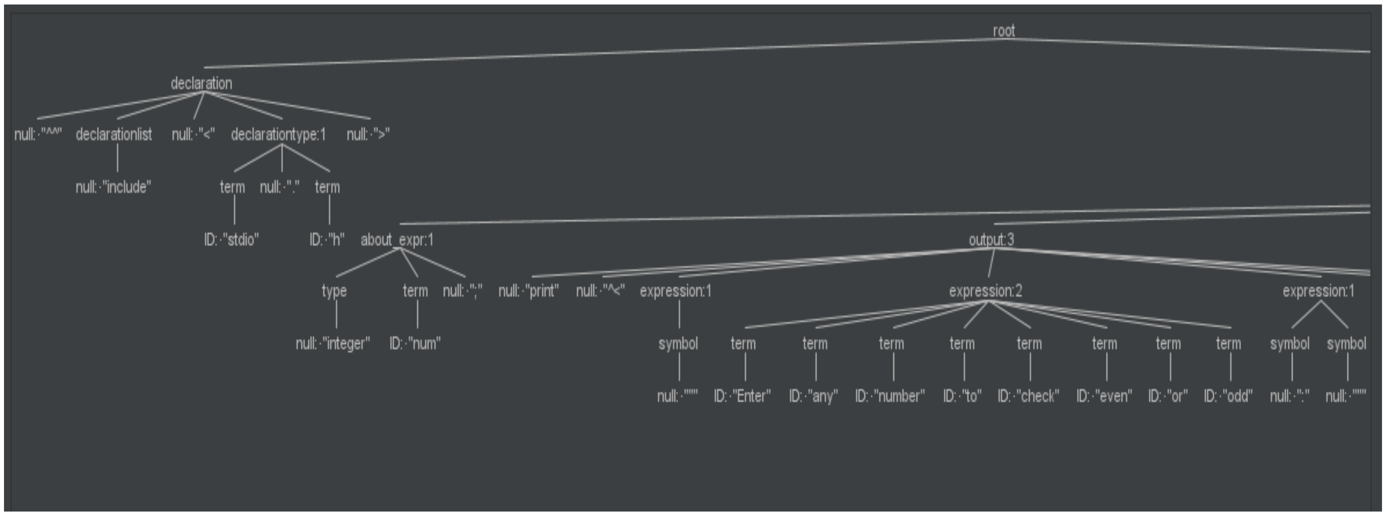


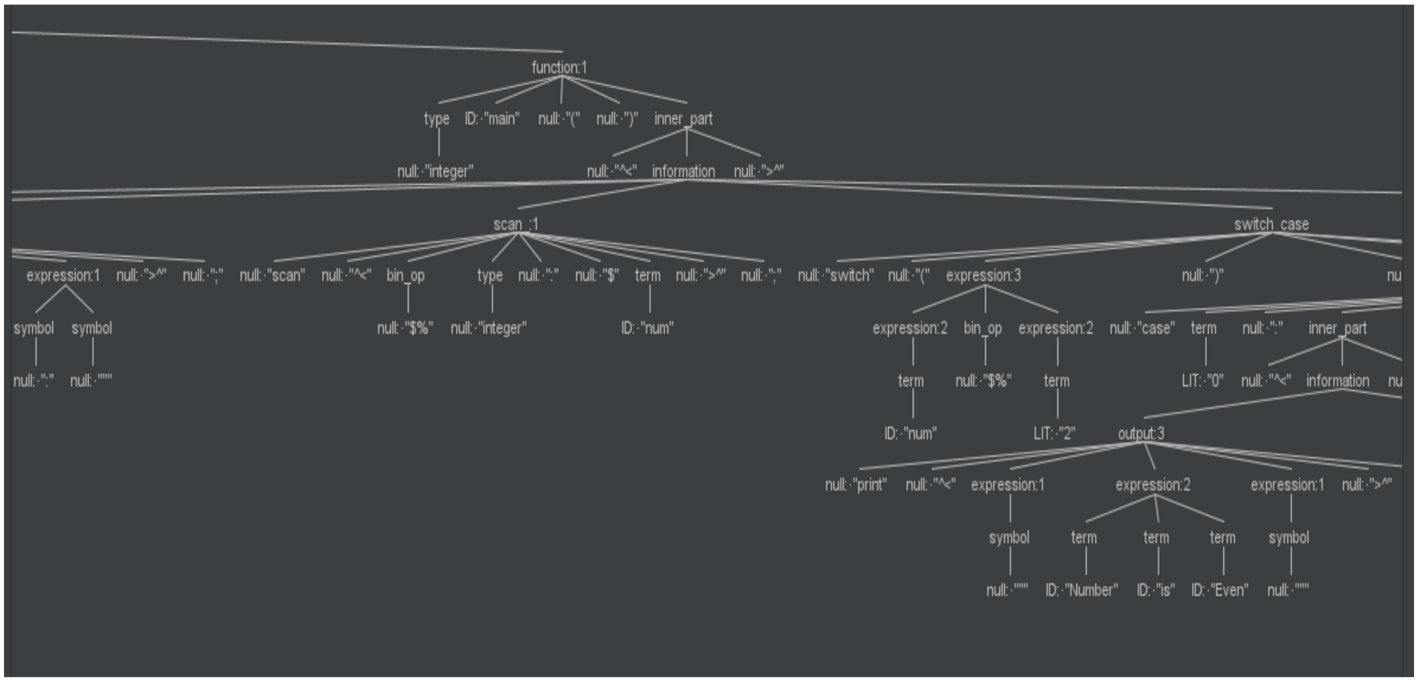
4.Switch-case:

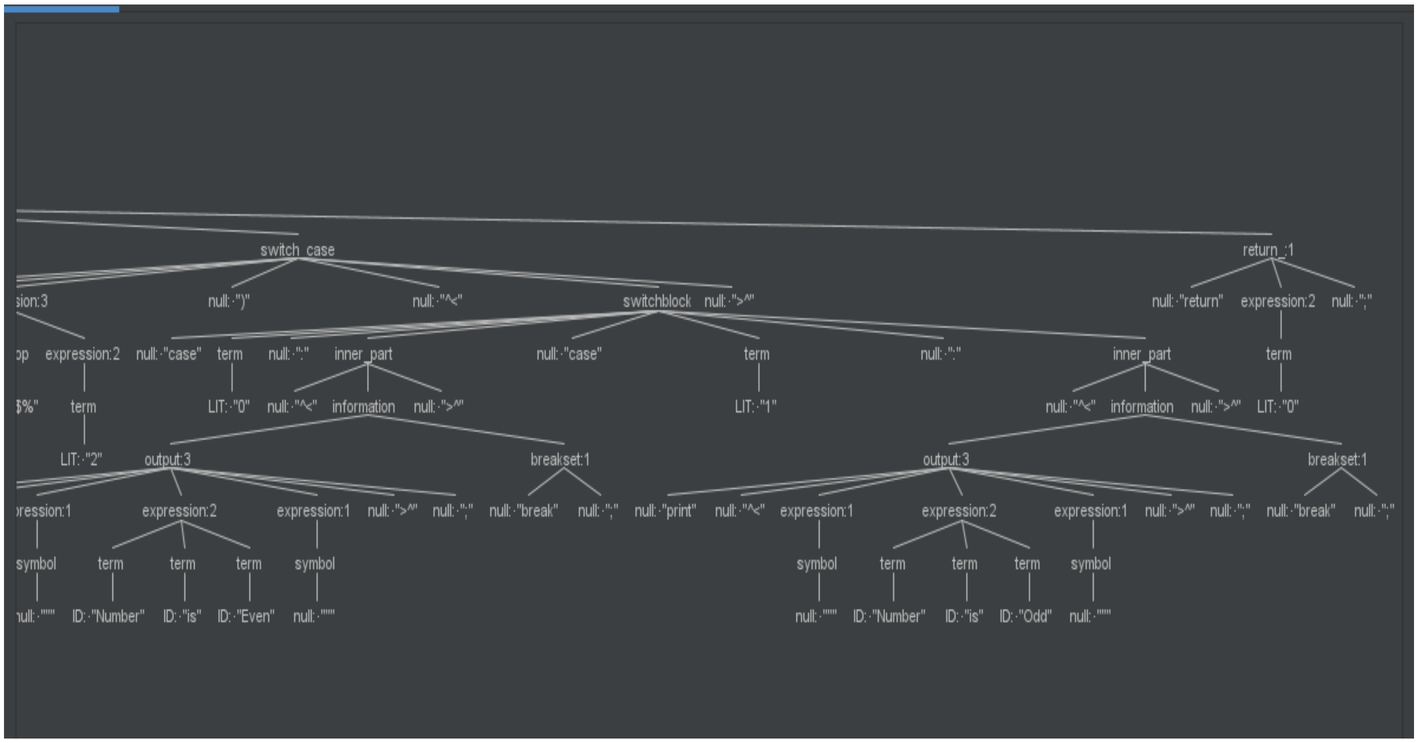
```
^^include <stdio.h>
integer main()
^<
integer num;
print^<"Enter any number to check even or odd: ">^;
scan^<$%integer: $num>^;
switch(num $% 2)
^<
case 0:
^<
print^<"Number is Even">^;
break;
>^
case 1:
^<
```

```
printf("Number is Odd");
break;
>^
>^
return 0;
>^
```

Tree:





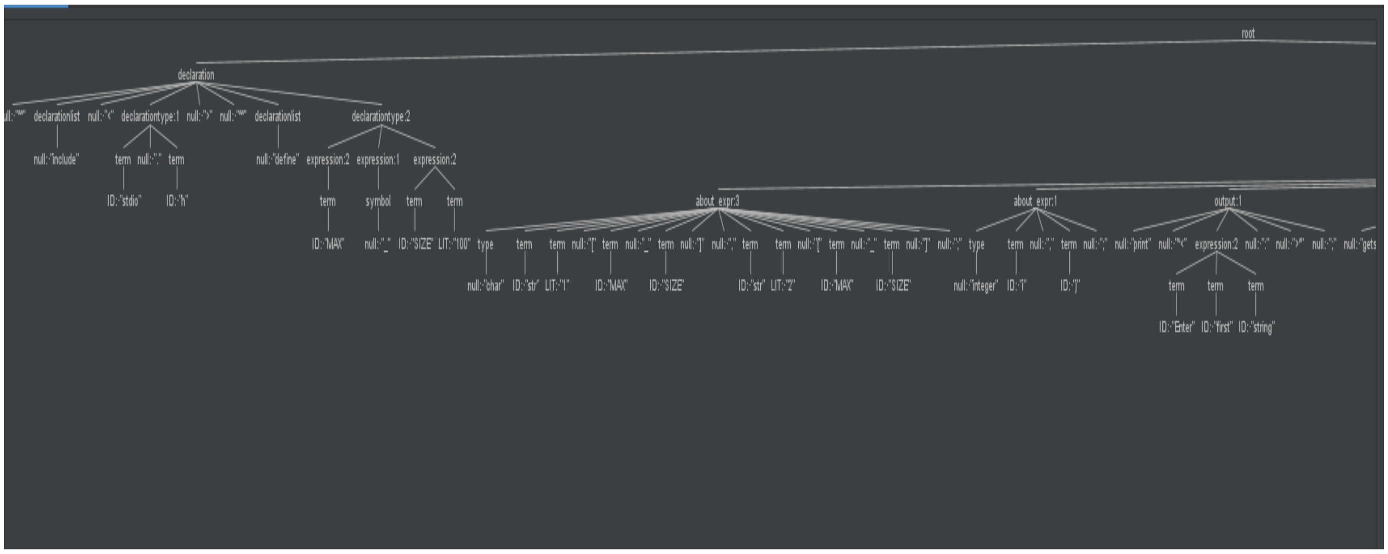


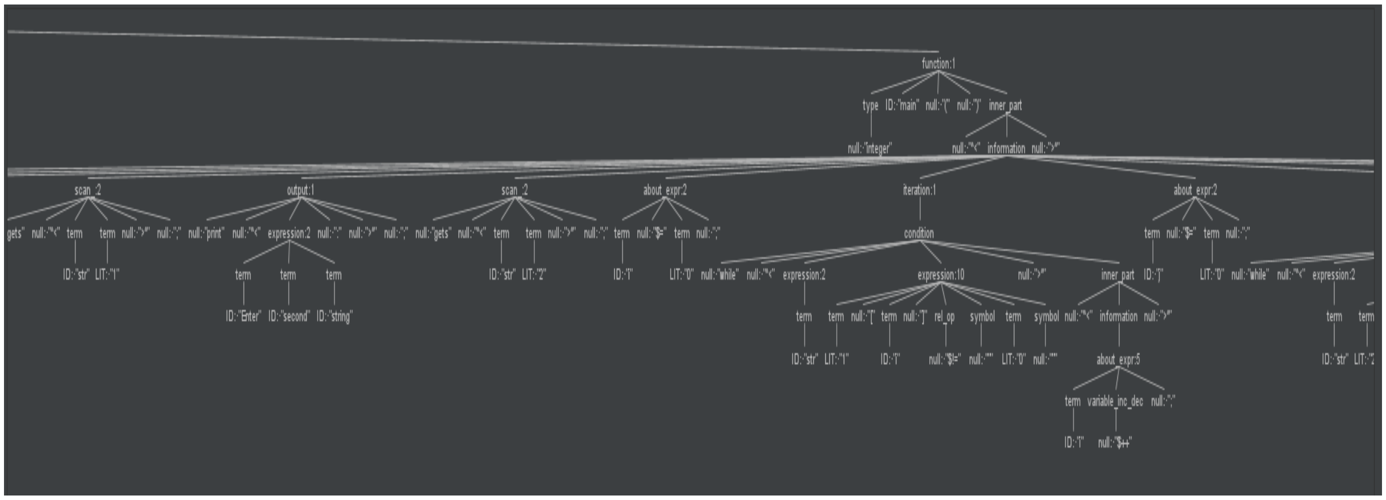
5.Whileloop and array:

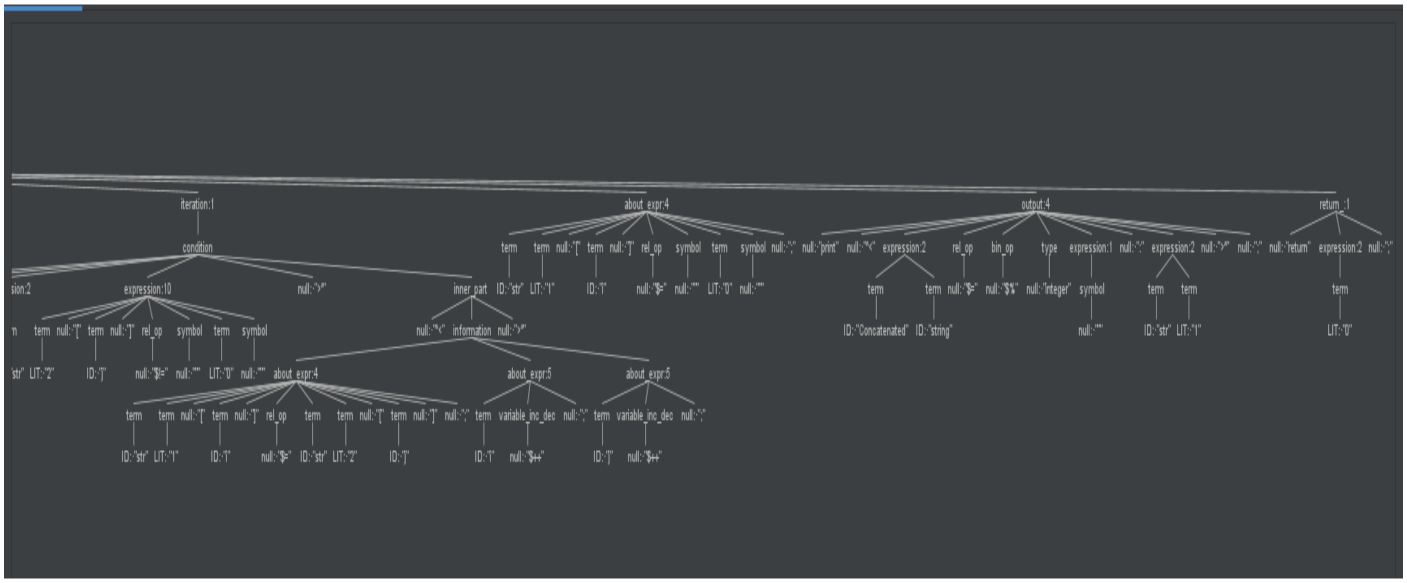
```
 ^^include <stdio.h>
^^define MAX_SIZE 100
integer main()
^<
char str1[MAX_SIZE], str2[MAX_SIZE];
integer i, j;
print^<Enter first string: >^;
gets^<str1>^;
print^<Enter second string: >^;
gets^<str2>^;
i$=0;
while^<str1[i] $!= "0">^
^<
i$++;
>^
j $= 0;
while^<str2[j] $!= "0">^
^<
str1[i] $= str2[j];
i$++;
j$++;
>^
str1[i] $= "0";
print^<Concatenated string $= $%integer": str1>^;
```

```
return 0;
>^
```

Tree:





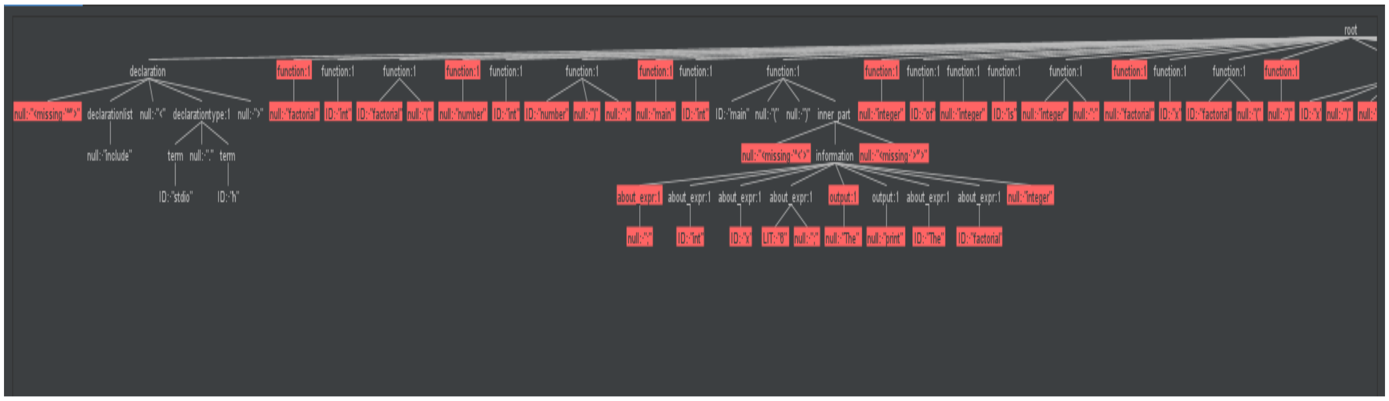


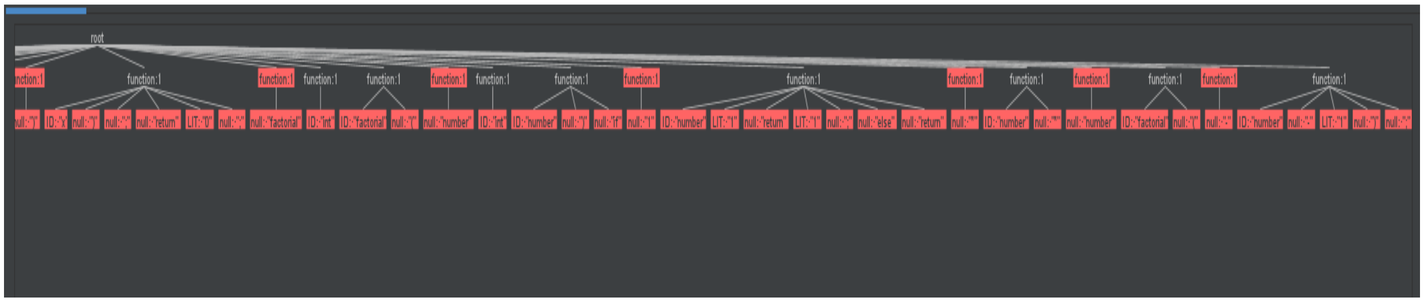
Incorrect sample input:

1.Function-recursion:

```
 ##include <stdio.h>
int factorial(int number);
int main()
{
int x = 6;
print {The factorial of %integer is %integer: x factorial(x)};
return 0;
}
int factorial(int number)
{
if { number == 1}
{
return 1;
}
else
{
return number * factorial(number - 1);
}
}
```

Tree:

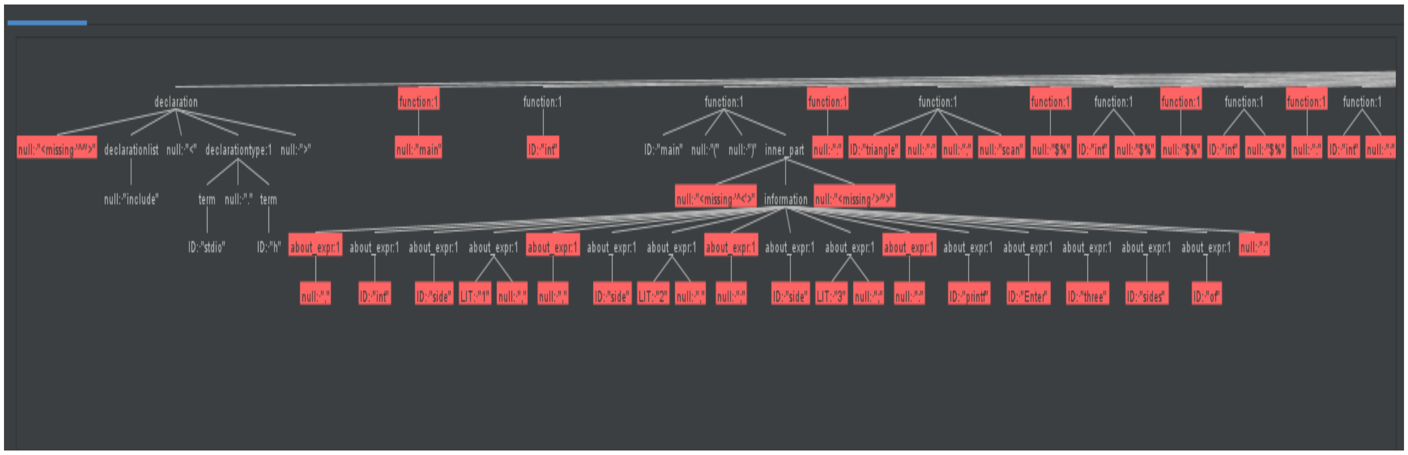


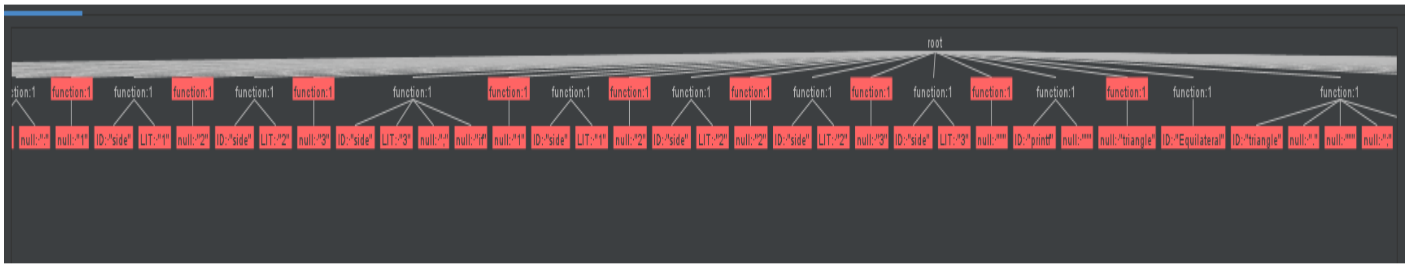


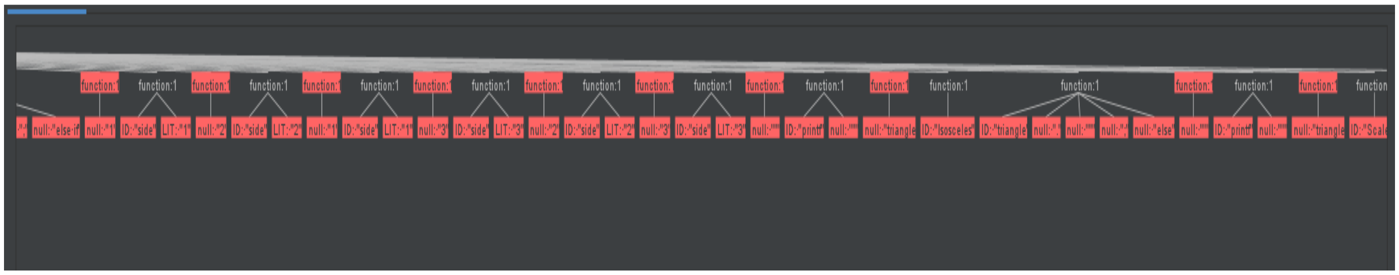
2.if else:

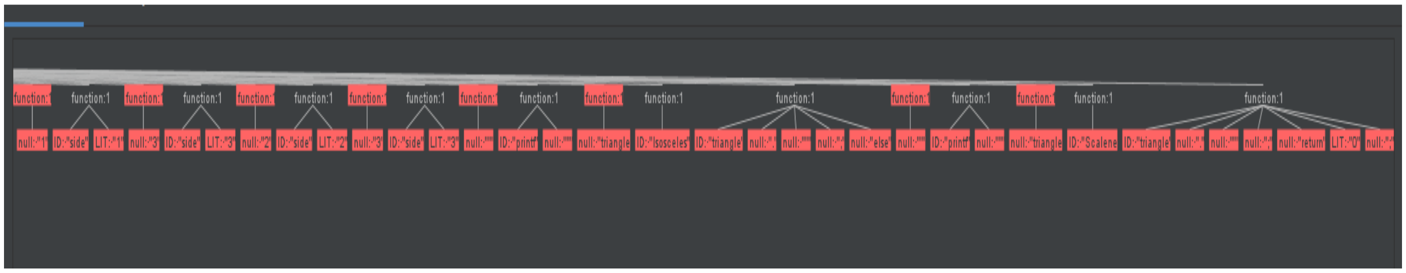
```
##include <stdio.h>
int main()
{
int side1, side2, side3;
printf{Enter three sides of triangle: };
scan{%int$%int$%int: side1 side2 side3};
if{side1 == side2 && side2 == side3}
{
printf{"Equilateral triangle."};
}
else if{side1==side2 || side1==side3 || side2==side3}
{
printf{"Isosceles triangle."};
}
else
{
printf{"Scalene triangle."};
}
return 0;
}
```

Tree:





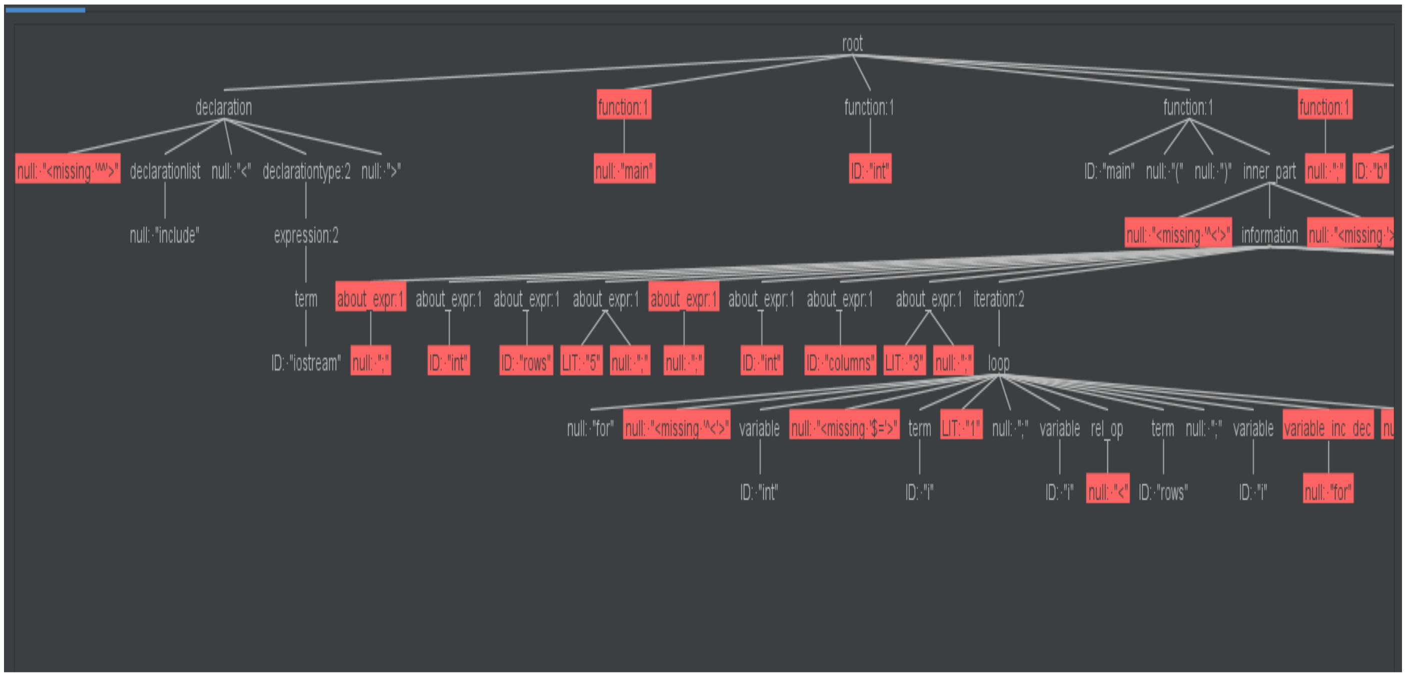


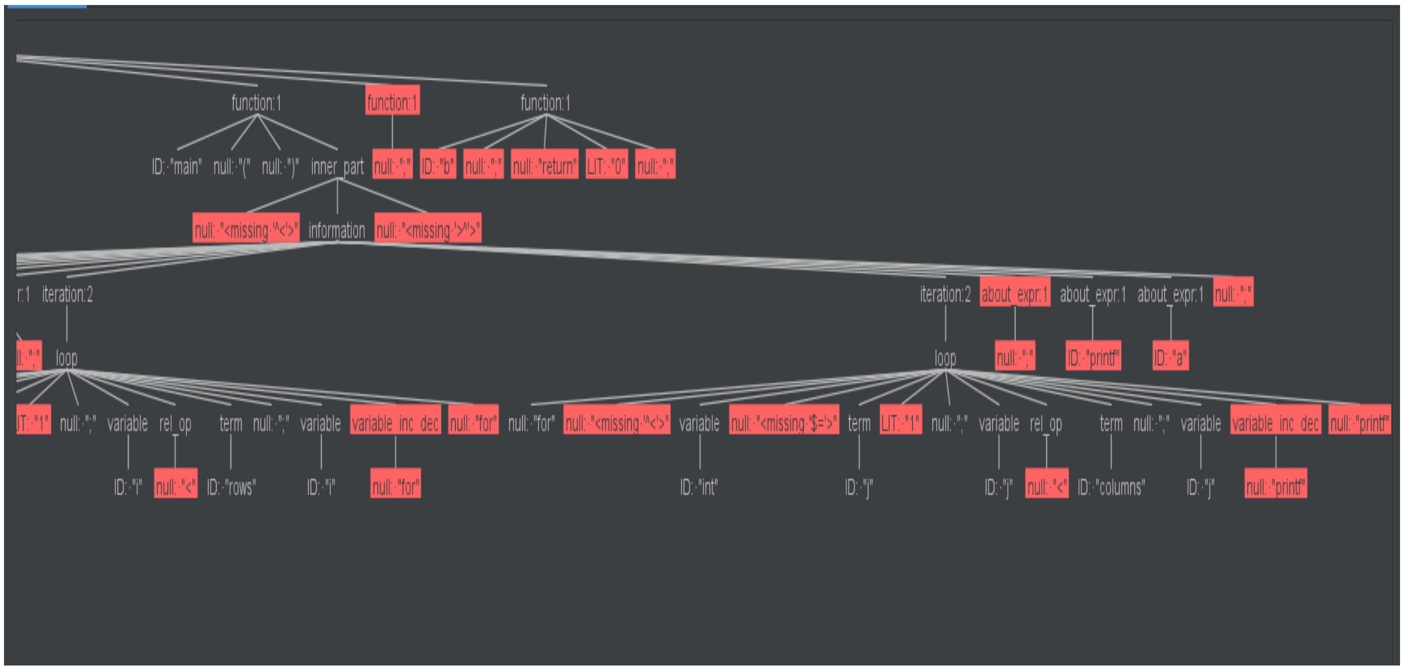


3. Nested-loop:

```
##include <iostream>
int main ()
{
int rows = 5;
int columns = 3;
for {int i = 1; i <= rows; ++i }
{
for {int j = 1; j <= columns; ++j}
{
printf{a b};
}
}
return 0;
}
```

Tree:

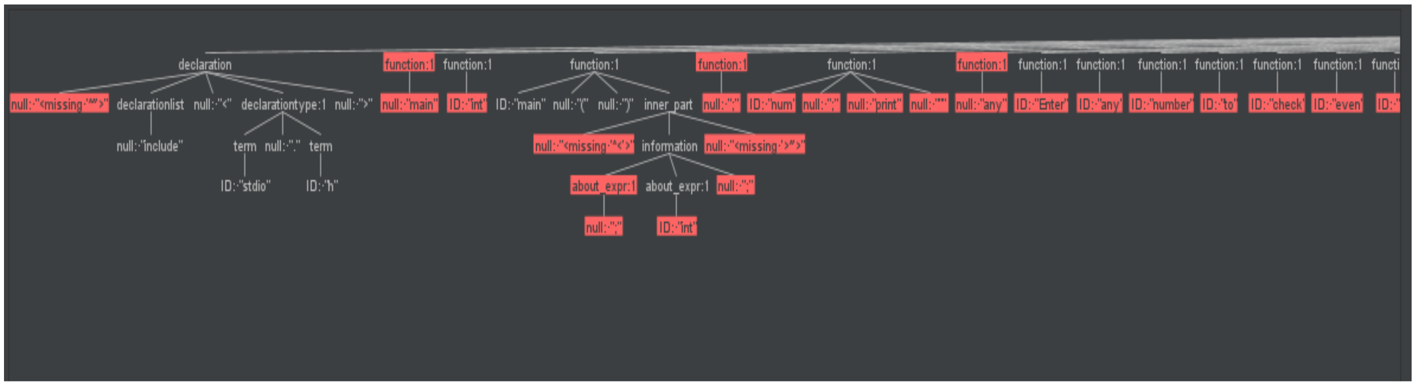


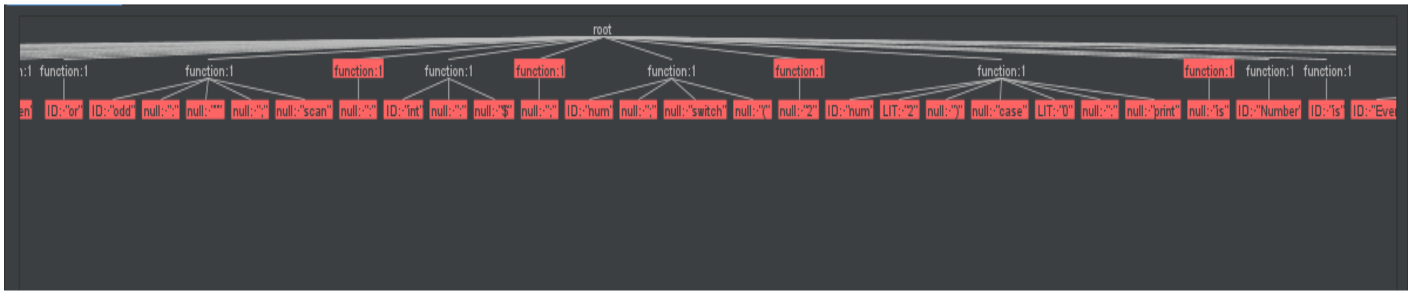


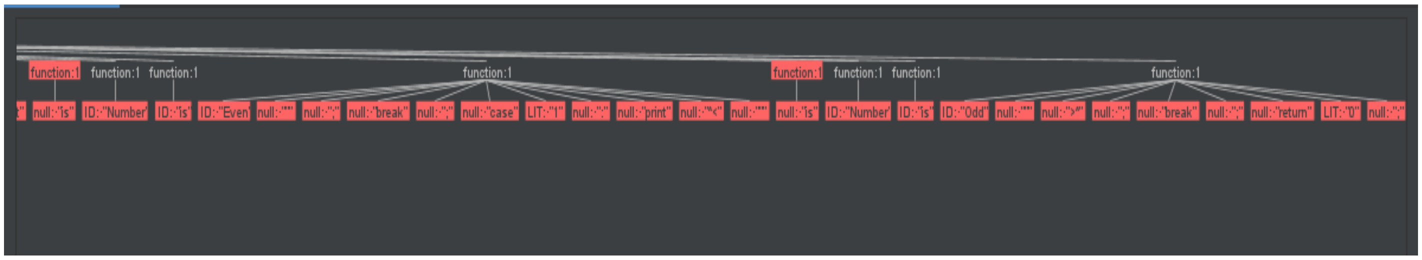
4. Switch case:

```
 ##include <stdio.h>
int main()
{
int num;
print{"Enter any number to check even or odd: "};
scan{%int: $num};
switch(num % 2)
{
case 0:
{
print{Number is Even"};
break;
}
case 1:
{
print^<"Number is Odd">^;
break;
}
}
return 0;
}
```

Tree:



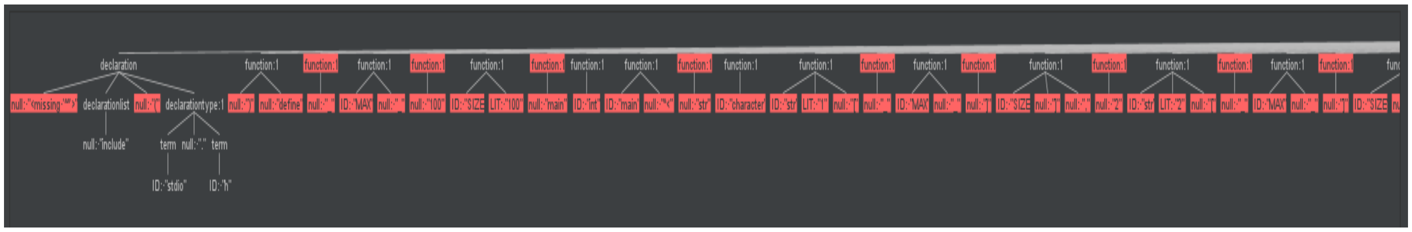




5.While loop and array:

```
 ##include (stdio.h)
##define MAX_SIZE 100
int main{}
^<
character str1[MAX_SIZE], str2[MAX_SIZE];
int i, j;
print{Enter first string: };
gets{str1};
print{Enter second string: };
gets{str2};
i=0;
while{str1[i] != "0"}
{
i++;
}
j = 0;
while{str2[j] != "0"}
{
str1[i] = str2[j];
i++;
j++;
}
str1[i] = "0";
print{Concatenated string = %int": str1};
return 0;
}
```

Tree:


declaration
declarationlist
declarationtype:1
null:"include"
term
term
ID:"stdio"
ID:"h"
function:1