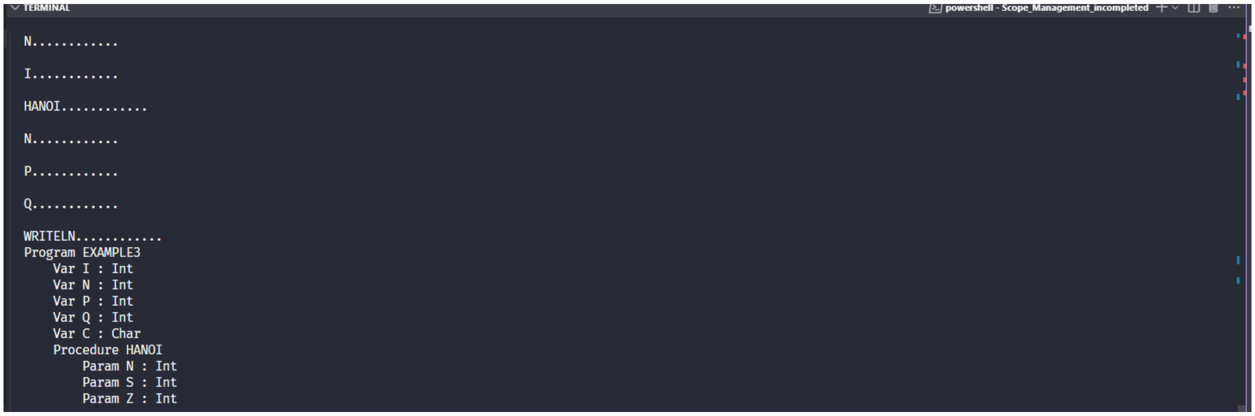
SCOPE MANAGEMENT REPORT

Full Name: Dinh Viet Quang

Student ID: 20215235

1. Results (a part of the screen) received when executing project with example3.kpl.

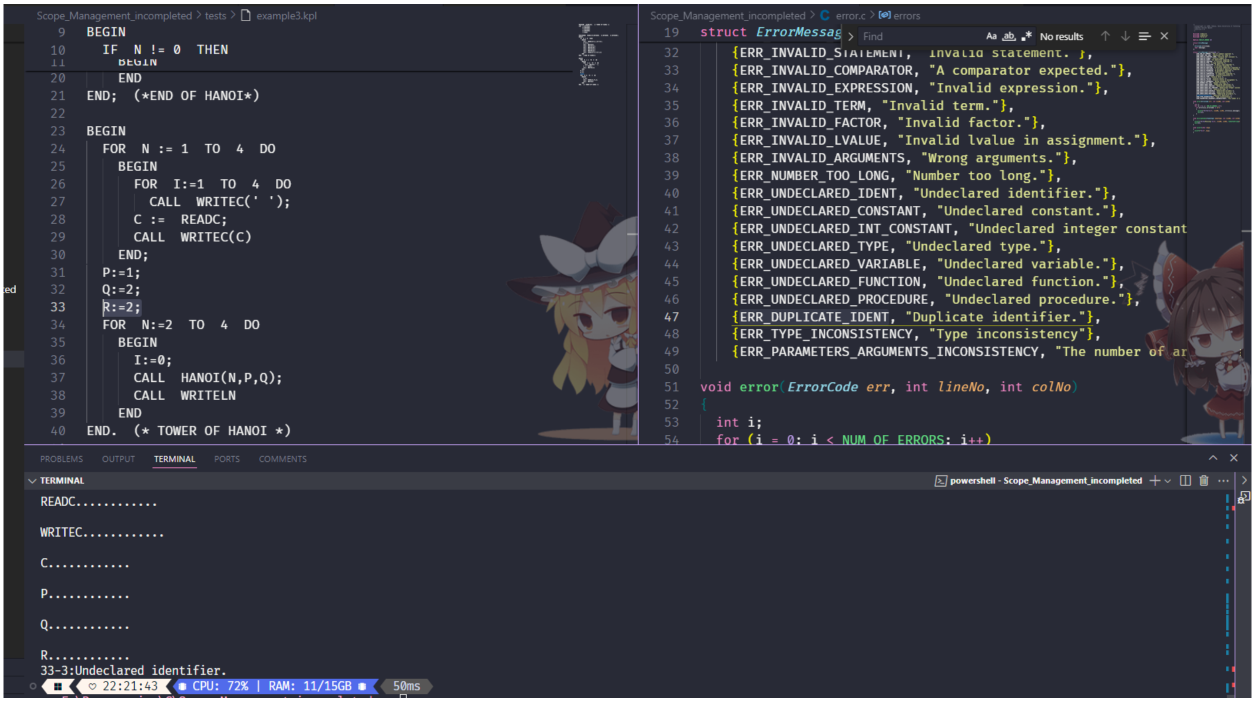


```
N...........

I...........

HANOI...........

N...........

P...........

Q...........

WRITELN...........
Program EXAMPLE3
    Var I : Int
    Var N : Int
    Var P : Int
    Var Q : Int
    Var C : Char
    Procedure HANOI
        Param N : Int
        Param S : Int
        Param Z : Int
```

2. All kinds of errors that can be found by the semantic analyzer, except ERR_UNDECLARED_INT_CONSTANT

2.1. ERR_UNDECLARED_IDENT

Error: R:=2;



Scope_Management_incompleted > tests > example3.kpl

```
BEGIN
  IF  N != 0  THEN
    BEGIN
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
    BEGIN
      FOR  I:=1  TO  4  DO
        CALL  WRITEC(' ');
      C :=  READC;
      CALL  WRITEC(C)
    END;
  P:=1;
  Q:=2;
  R:=2;
  FOR  N:=2  TO  4  DO
    BEGIN
      I:=0;
      CALL  HANOI(N,P,Q);
      CALL  WRITELN
    END
END.  (* TOWER OF HANOI *)
```

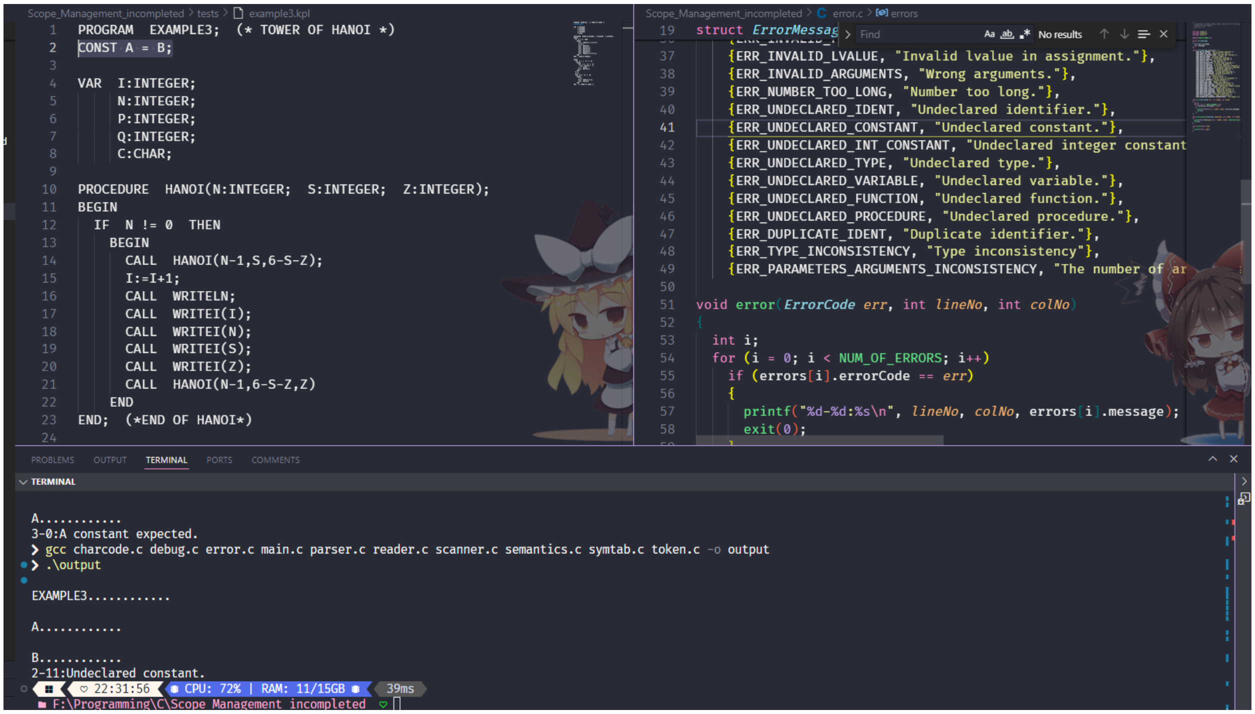
Scope_Management_incompleted > error.c > errors

```
struct ErrorMessag
    {ERR_INVALID_STATEMENT, "Invalid statement."},
    {ERR_INVALID_COMPARATOR, "A comparator expected."},
    {ERR_INVALID_EXPRESSION, "Invalid expression."},
    {ERR_INVALID_TERM, "Invalid term."},
    {ERR_INVALID_FACTOR, "Invalid factor."},
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
```

```
READC...........

WRITEC...........

C...........

P...........

Q...........

R...........
33-3:Undeclared identifier.
 22:21:43  CPU: 72% | RAM: 11/15GB  50ms
```

2.2. ERR_UNDECLARED_CONSTANT

Error: CONST A = B;


Scope_Management_incompleted > tests > example3.kpl
Scope_Management_incompleted > error.c > errors
Find
No results
PROBLEMS
OUTPUT
TERMINAL
PORTS
COMMENTS
TERMINAL

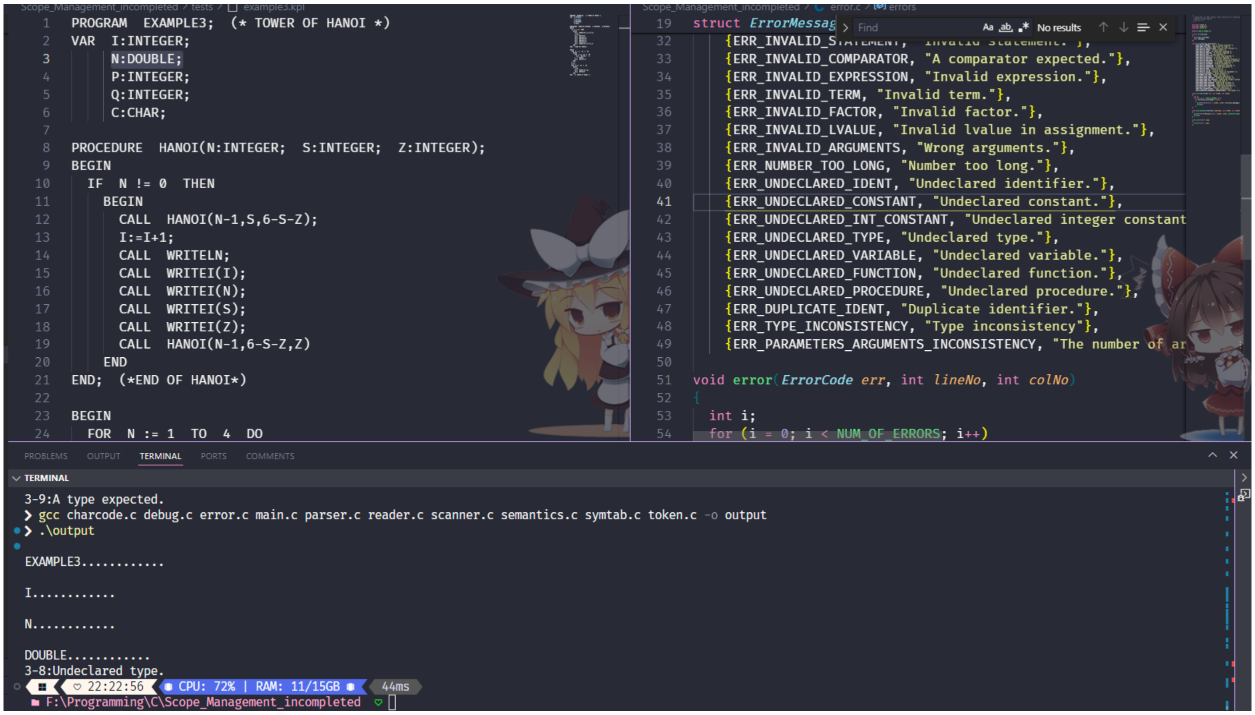
```
PROGRAM  EXAMPLE3;  (* TOWER OF HANOI *)
CONST A = B;

VAR  I:INTEGER;
     N:INTEGER;
     P:INTEGER;
     Q:INTEGER;
     C:CHAR;

PROCEDURE  HANOI(N:INTEGER;  S:INTEGER;  Z:INTEGER);
BEGIN
  IF  N != 0  THEN
    BEGIN
      CALL  HANOI(N-1,S,6-S-Z);
      I:=I+1;
      CALL  WRITELN;
      CALL  WRITEI(I);
      CALL  WRITEI(N);
      CALL  WRITEI(S);
      CALL  WRITEI(Z);
      CALL  HANOI(N-1,6-S-Z,Z)
    END
END;  (*END OF HANOI*)
```

```
struct ErrorMessag
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
    if (errors[i].errorCode == err)
    {
      printf("%d-%d:%s\n", lineNo, colNo, errors[i].message);
      exit(0);
```

```
A...........
3-0:A constant expected.
> gcc charcode.c debug.c error.c main.c parser.c reader.c scanner.c semantics.c symtab.c token.c -o output
> .\output

EXAMPLE3...........

A...........

B...........
2-11:Undeclared constant.
○  ♡ 22:31:56  CPU: 72% | RAM: 11/15GB  39ms
 F:\Programming\C\Scope_Management_incompleted ♡
```

2.3. ERR_UNDECLARED_TYPE

Error: N:DOUBLE;


Scope_Management_incompleted > tests > example3.kpl
Scope_Management_incompleted > error.c > errors
Find
No results
PROBLEMS
OUTPUT
TERMINAL
PORTS
COMMENTS
TERMINAL

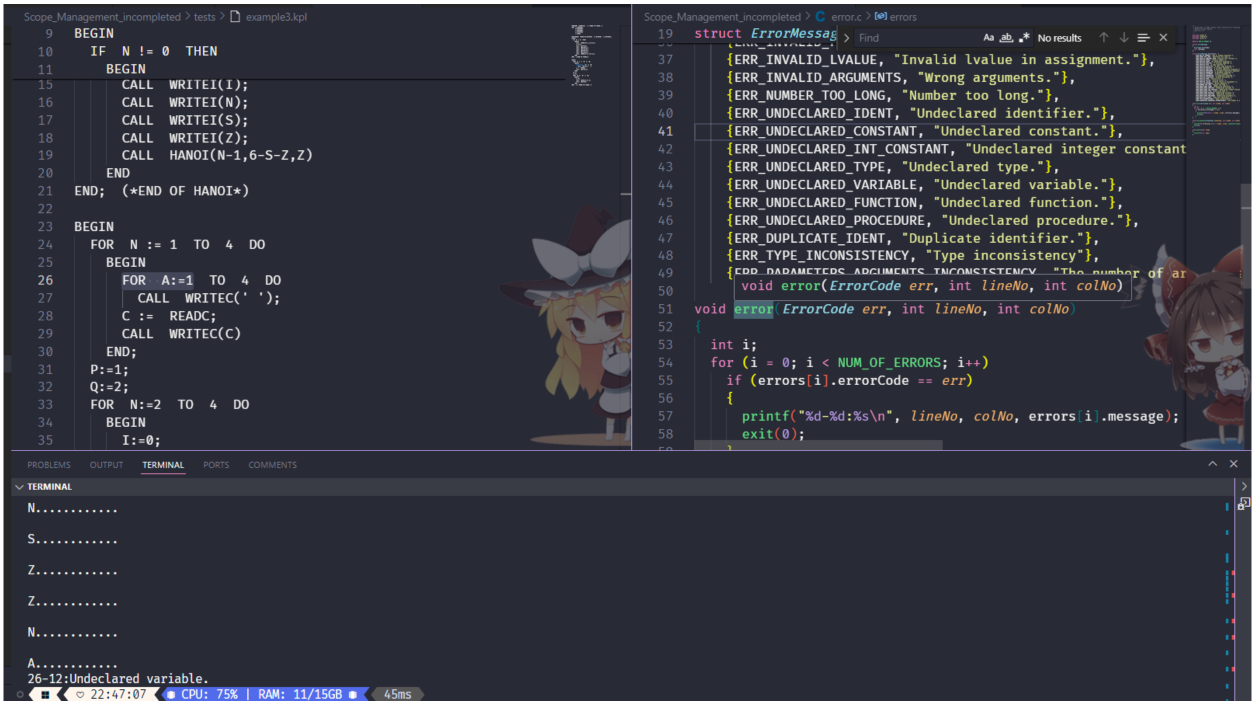
```
PROGRAM  EXAMPLE3;  (* TOWER OF HANOI *)
VAR  I:INTEGER;
     N:DOUBLE;
     P:INTEGER;
     Q:INTEGER;
     C:CHAR;

PROCEDURE  HANOI(N:INTEGER;  S:INTEGER;  Z:INTEGER);
BEGIN
  IF  N != 0  THEN
    BEGIN
      CALL  HANOI(N-1,S,6-S-Z);
      I:=I+1;
      CALL  WRITELN;
      CALL  WRITEI(I);
      CALL  WRITEI(N);
      CALL  WRITEI(S);
      CALL  WRITEI(Z);
      CALL  HANOI(N-1,6-S-Z,Z)
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
```

```
struct ErrorMessag
    {ERR_INVALID_STATEMENT, "Invalid statement."},
    {ERR_INVALID_COMPARATOR, "A comparator expected."},
    {ERR_INVALID_EXPRESSION, "Invalid expression."},
    {ERR_INVALID_TERM, "Invalid term."},
    {ERR_INVALID_FACTOR, "Invalid factor."},
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
```

```
3-9:A type expected.
> gcc charcode.c debug.c error.c main.c parser.c reader.c scanner.c semantics.c symtab.c token.c -o output
> .\output

EXAMPLE3...........

I...........

N...........

DOUBLE...........
3-8:Undeclared type.
○  ♡ 22:22:56  CPU: 72% | RAM: 11/15GB  44ms
 F:\Programming\C\Scope_Management_incompleted ♡
```

2.4. ERR_UNDECLARED_VARIABLE

Error: FOR A:=1


Scope_Management_incompleted > tests > example3.kpl
Scope_Management_incompleted > error.c > errors
Find
No results
PROBLEMS
OUTPUT
TERMINAL
PORTS
COMMENTS
22:47:07
CPU: 75% | RAM: 11/15GB
45ms

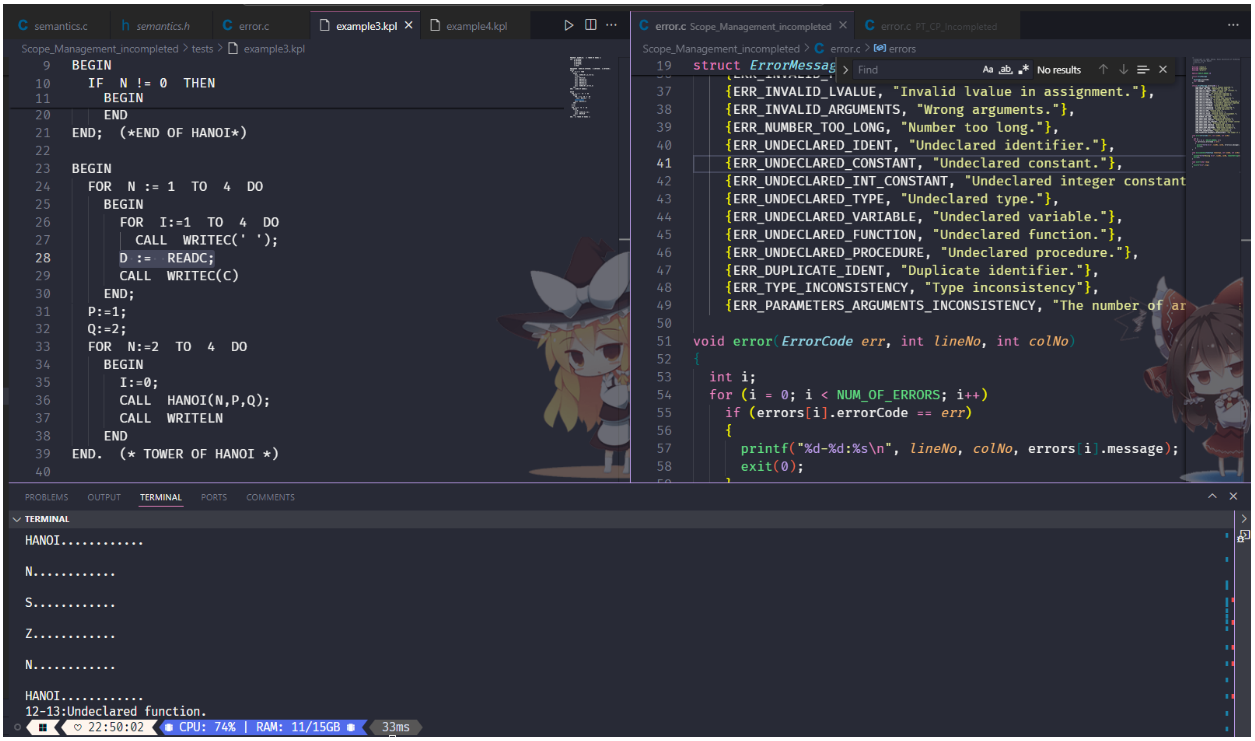
```
BEGIN
  IF  N != 0  THEN
    BEGIN
      CALL  WRITEI(I);
      CALL  WRITEI(N);
      CALL  WRITEI(S);
      CALL  WRITEI(Z);
      CALL  HANOI(N-1,6-S-Z,Z)
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
    BEGIN
      FOR  A:=1  TO  4  DO
        CALL  WRITEC(' ');
      C :=  READC;
      CALL  WRITEC(C)
    END;
  P:=1;
  Q:=2;
  FOR  N:=2  TO  4  DO
    BEGIN
      I:=0;
```

```
struct ErrorMessag
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar
      void error(ErrorCode err, int lineNo, int colNo)

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
    if (errors[i].errorCode == err)
    {
      printf("%d-%d:%s\n", lineNo, colNo, errors[i].message);
      exit(0);
```

```
N...........

S...........

Z...........

Z...........

N...........

A...........
26-12:Undeclared variable.
```

2.5. ERR_UNDECLARED_FUCNTION

Error: D := READC;


semantics.c
semantics.h
error.c
example3.kpl
example4.kpl
error.c Scope_Management_incompleted
error.c PT_CP_Incompleted
Scope_Management_incompleted > tests > example3.kpl
Scope_Management_incompleted > error.c > errors
Find
No results
PROBLEMS
OUTPUT
TERMINAL
PORTS
COMMENTS
22:50:02
CPU: 74% | RAM: 11/15GB
33ms

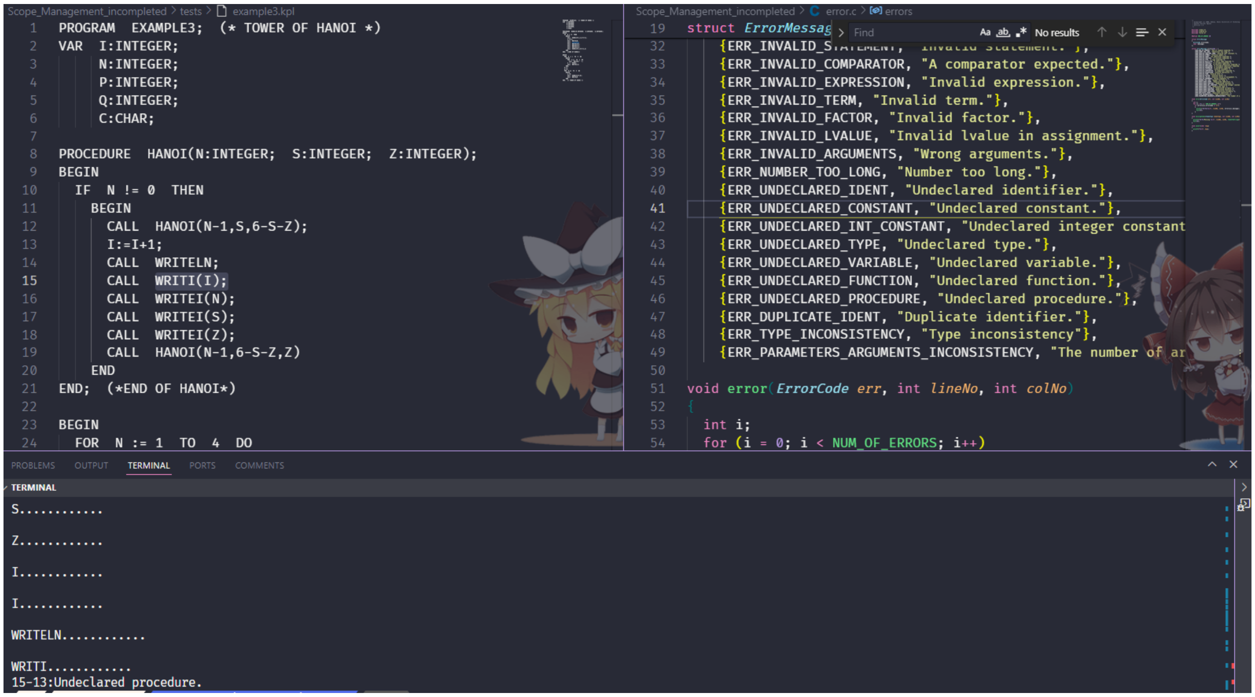
```
BEGIN
  IF  N != 0  THEN
    BEGIN
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
    BEGIN
      FOR  I:=1  TO  4  DO
        CALL  WRITEC(' ');
      D :=  READC;
      CALL  WRITEC(C)
    END;
  P:=1;
  Q:=2;
  FOR  N:=2  TO  4  DO
    BEGIN
      I:=0;
      CALL  HANOI(N,P,Q);
      CALL  WRITELN
    END
END.  (* TOWER OF HANOI *)
```

```
struct ErrorMessag
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
    if (errors[i].errorCode == err)
    {
      printf("%d-%d:%s\n", lineNo, colNo, errors[i].message);
      exit(0);
```

```
HANOI...........

N...........

S...........

Z...........

N...........

HANOI...........
12-13:Undeclared function.
```

2.6. ERR_UNDECLARED_PROCEDURE

Error: WRITI(I)



Scope_Management_incompleted > tests > example3.kpl

```
PROGRAM  EXAMPLE3;  (* TOWER OF HANOI *)
VAR  I:INTEGER;
     N:INTEGER;
     P:INTEGER;
     Q:INTEGER;
     C:CHAR;

PROCEDURE  HANOI(N:INTEGER;  S:INTEGER;  Z:INTEGER);
BEGIN
  IF  N != 0  THEN
    BEGIN
      CALL  HANOI(N-1,S,6-S-Z);
      I:=I+1;
      CALL  WRITELN;
      CALL  WRITI(I);
      CALL  WRITEI(N);
      CALL  WRITEI(S);
      CALL  WRITEI(Z);
      CALL  HANOI(N-1,6-S-Z,Z)
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
```

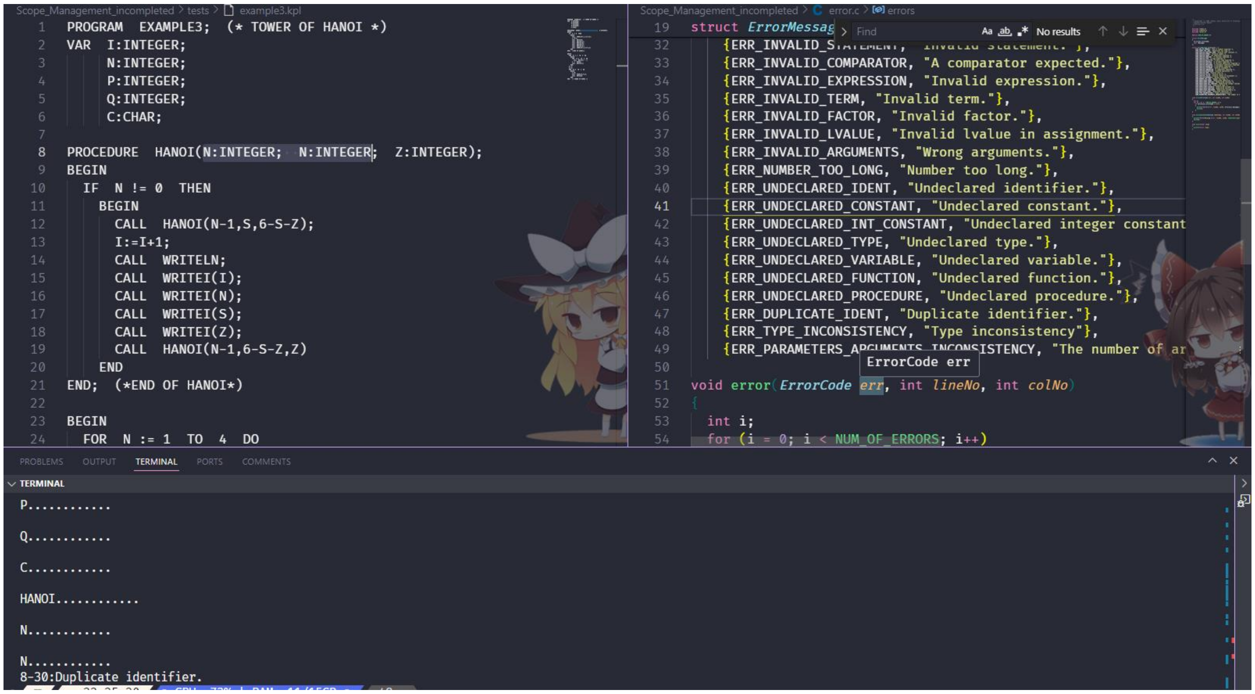
Scope_Management_incompleted > error.c > errors
Find
No results

```
struct ErrorMessag
    {ERR_INVALID_STATEMENT, "Invalid statement."},
    {ERR_INVALID_COMPARATOR, "A comparator expected."},
    {ERR_INVALID_EXPRESSION, "Invalid expression."},
    {ERR_INVALID_TERM, "Invalid term."},
    {ERR_INVALID_FACTOR, "Invalid factor."},
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar

void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
```

```
S...........

Z...........

I...........

I...........

WRITELN...........

WRITI...........
15-13:Undeclared procedure.
```

2.7. ERR_DUPLICATE_IDENT

Error: N:INTEGER; N:INTEGER



Scope_Management_incompleted > tests > example3.kpl

```
PROGRAM  EXAMPLE3;  (* TOWER OF HANOI *)
VAR  I:INTEGER;
     N:INTEGER;
     P:INTEGER;
     Q:INTEGER;
     C:CHAR;

PROCEDURE  HANOI(N:INTEGER;  N:INTEGER;  Z:INTEGER);
BEGIN
  IF  N != 0  THEN
    BEGIN
      CALL  HANOI(N-1,S,6-S-Z);
      I:=I+1;
      CALL  WRITELN;
      CALL  WRITEI(I);
      CALL  WRITEI(N);
      CALL  WRITEI(S);
      CALL  WRITEI(Z);
      CALL  HANOI(N-1,6-S-Z,Z)
    END
END;  (*END OF HANOI*)

BEGIN
  FOR  N := 1  TO  4  DO
```

Scope_Management_incompleted > error.c > errors
Find
No results

```
struct ErrorMessag
    {ERR_INVALID_STATEMENT, "Invalid statement."},
    {ERR_INVALID_COMPARATOR, "A comparator expected."},
    {ERR_INVALID_EXPRESSION, "Invalid expression."},
    {ERR_INVALID_TERM, "Invalid term."},
    {ERR_INVALID_FACTOR, "Invalid factor."},
    {ERR_INVALID_LVALUE, "Invalid lvalue in assignment."},
    {ERR_INVALID_ARGUMENTS, "Wrong arguments."},
    {ERR_NUMBER_TOO_LONG, "Number too long."},
    {ERR_UNDECLARED_IDENT, "Undeclared identifier."},
    {ERR_UNDECLARED_CONSTANT, "Undeclared constant."},
    {ERR_UNDECLARED_INT_CONSTANT, "Undeclared integer constant
    {ERR_UNDECLARED_TYPE, "Undeclared type."},
    {ERR_UNDECLARED_VARIABLE, "Undeclared variable."},
    {ERR_UNDECLARED_FUNCTION, "Undeclared function."},
    {ERR_UNDECLARED_PROCEDURE, "Undeclared procedure."},
    {ERR_DUPLICATE_IDENT, "Duplicate identifier."},
    {ERR_TYPE_INCONSISTENCY, "Type inconsistency"},
    {ERR_PARAMETERS_ARGUMENTS_INCONSISTENCY, "The number of ar
                                    ErrorCode err
void error(ErrorCode err, int lineNo, int colNo)
{
  int i;
  for (i = 0; i < NUM_OF_ERRORS; i++)
```

```
P...........

Q...........

C...........

HANOI...........

N...........

N...........
8-30:Duplicate identifier.
```