Semantic Analysis

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Semantic Analysis

We need to check the following:

- Type checking
  - 1 + “1”
- Scopes
  - Undefined variables
- Other
  - Division by zero
  - Const variables
  - Visibility semantics in classes (public, private, …)

Symbol Table

- Maintain a stack of scopes
- Each scope maps identifiers to their **type information**
- Identifiers may be:
  - Variable names
  - Function names
  - Method names

Symbol Table

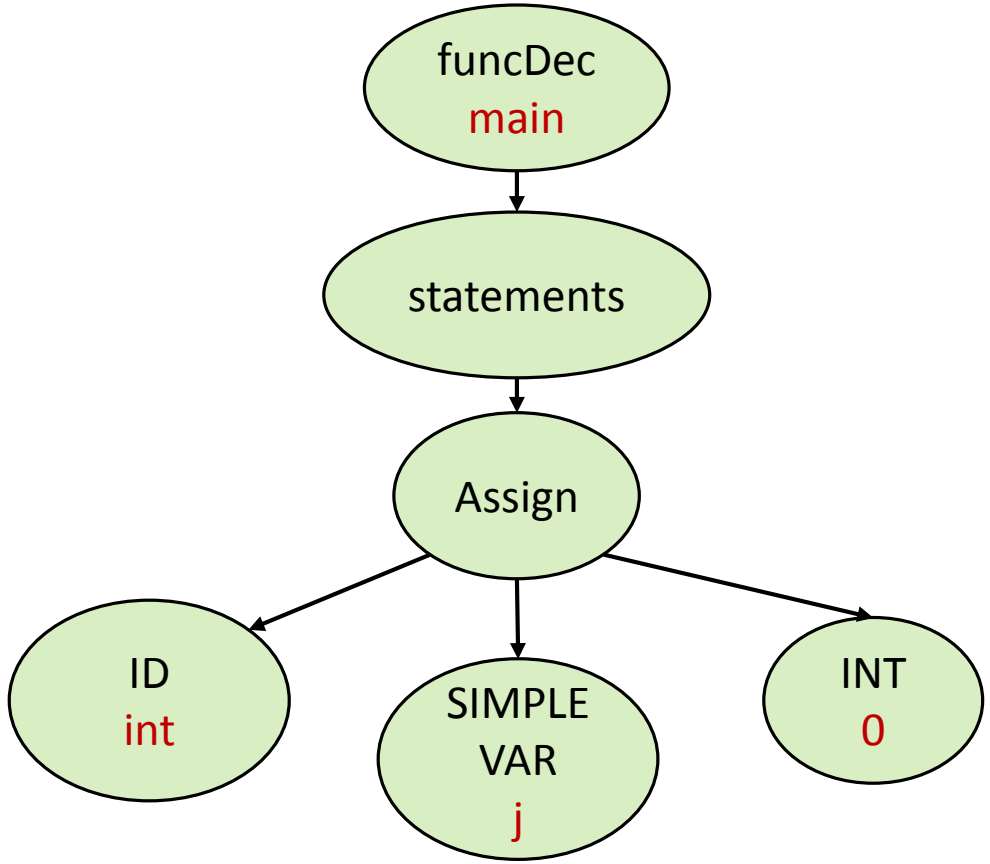
- When we reach a variable/function/… declaration
  - Update the map of the current scope (top of the stack)
- When we reach a new block, **push** a new scope
- When we leave a block, **pop** the top scope
- Begin with the global (initial scope)
  - Functions, global variables, …

Symbol Table

- When we need to resolve an identifier
  - Scan the scopes (starting from the top)
  - Stop at the first matching scope
  - If no scope was found, we have an error…

Assignments

```
void main() {
   int j = 0;
}
```



Assignments

```
void main() {
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}
```
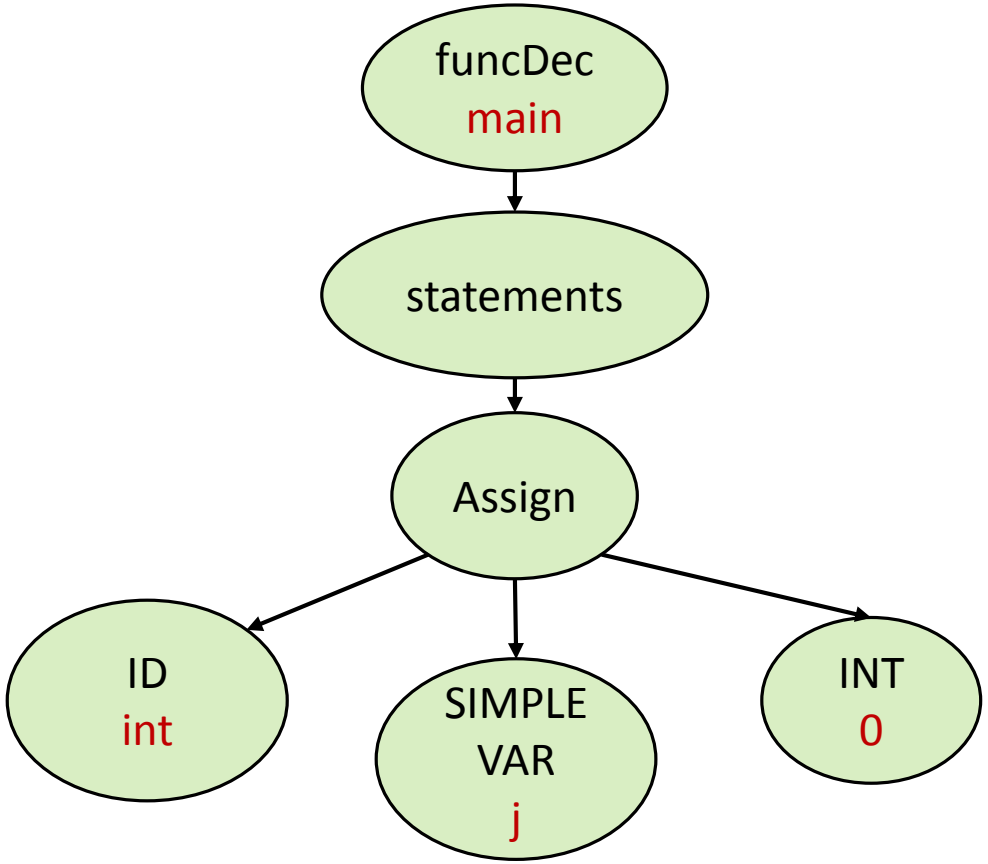

Valid



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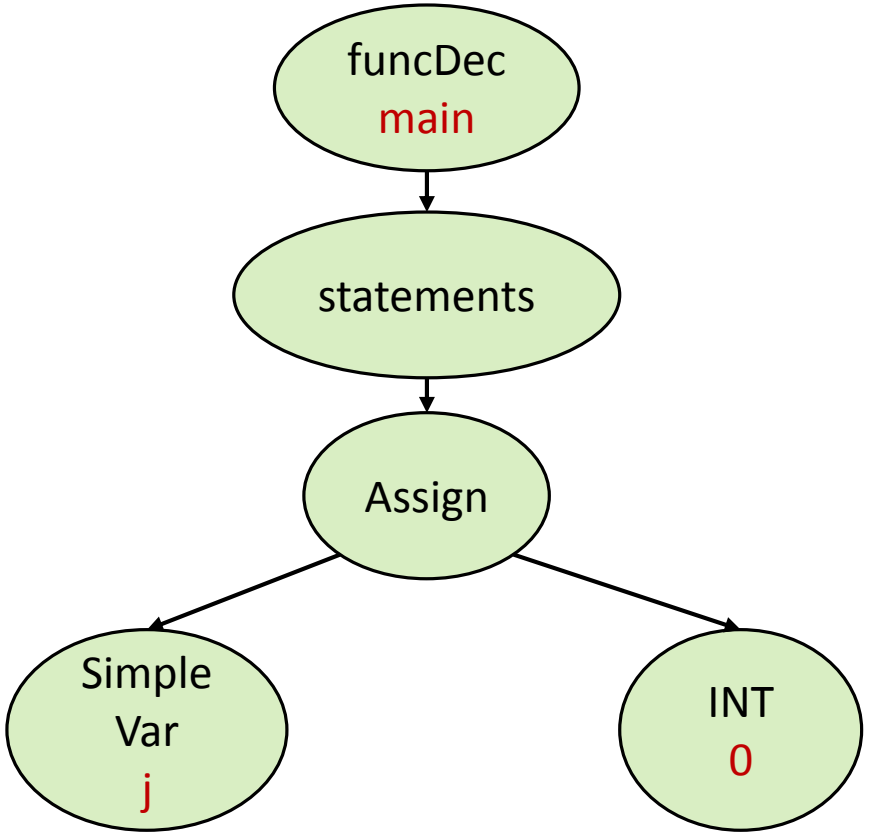

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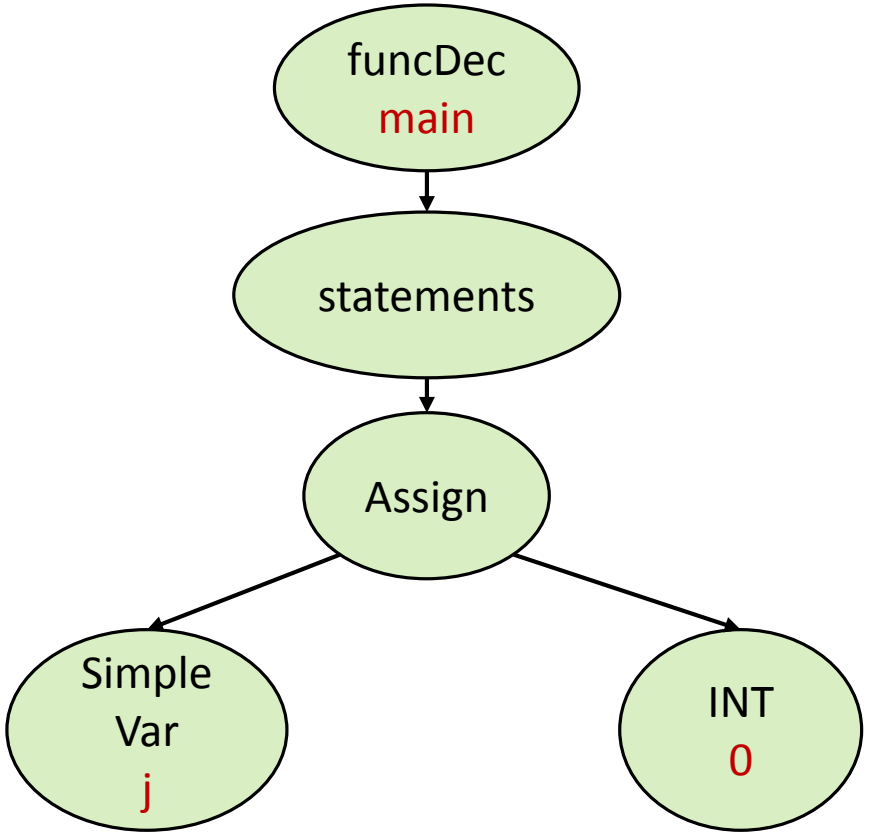
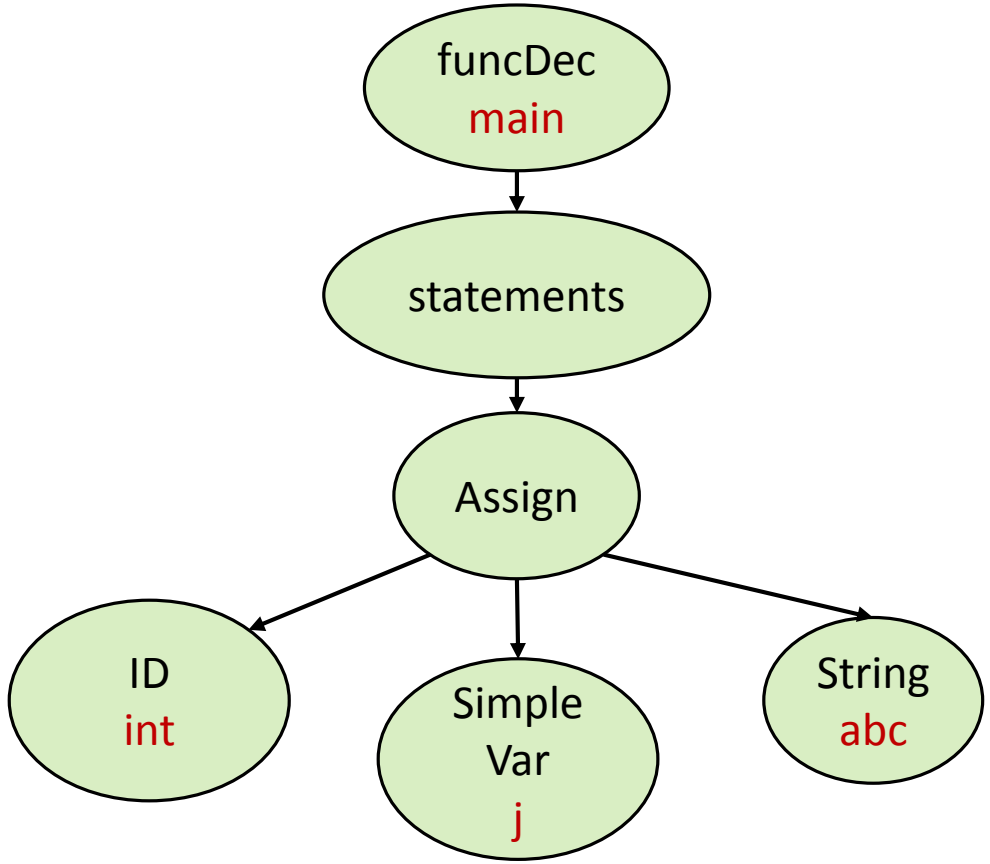


Assignments

```
void main() {
   int j = "abc";
}
```



Assignments

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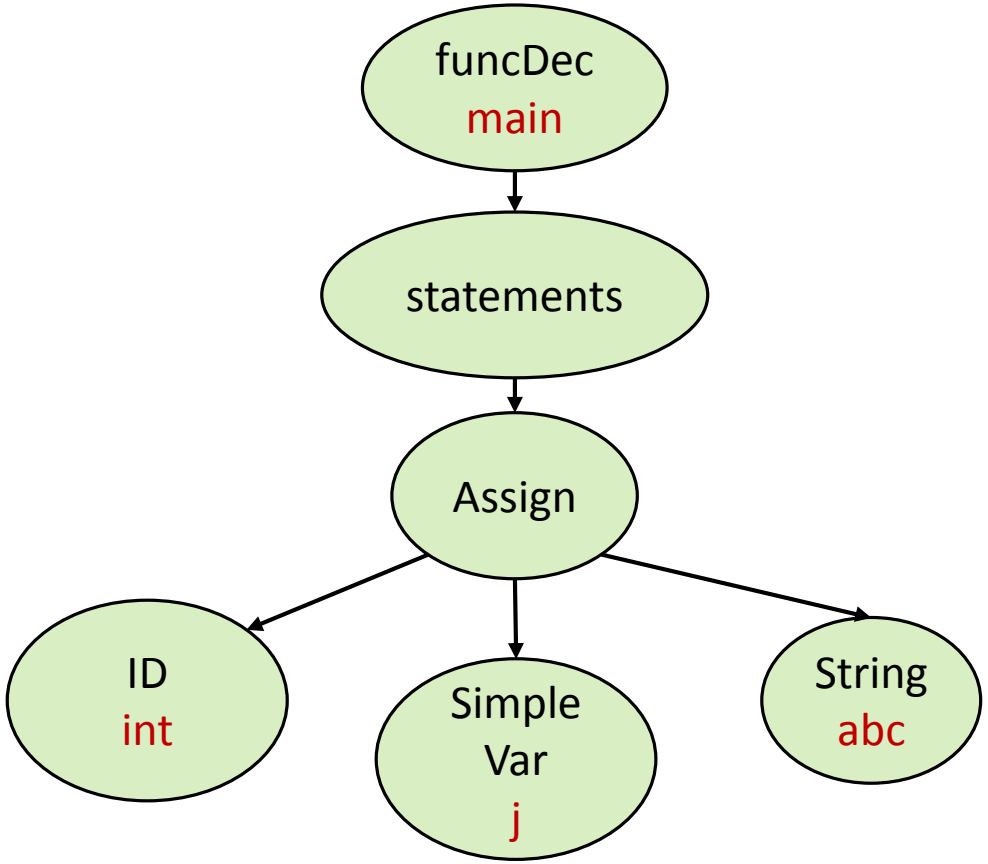
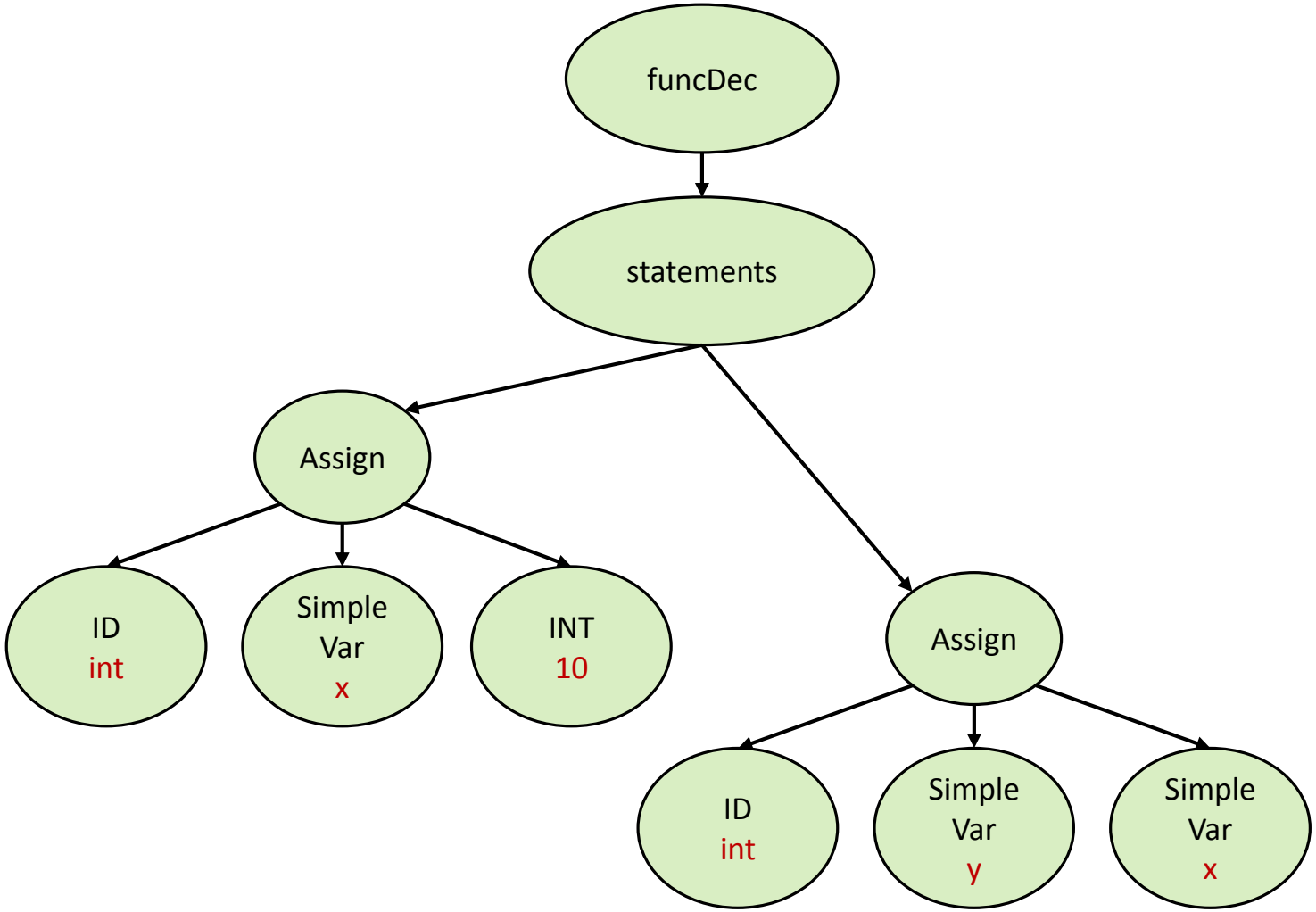
   int j = "abc";
}
```

Invalid



Assignments

```
void main() {
   int x = 10;
   int y = x;
}
```



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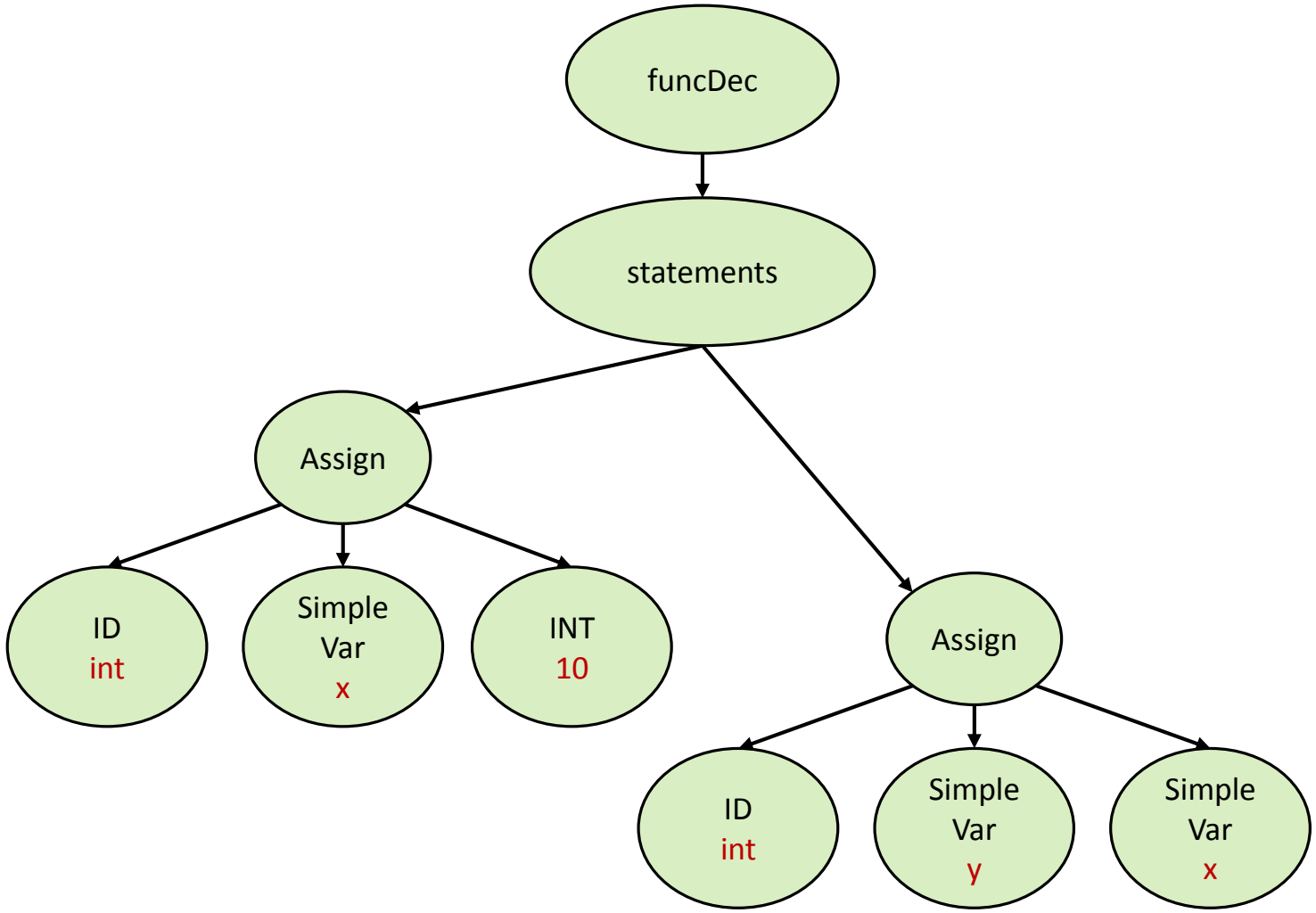

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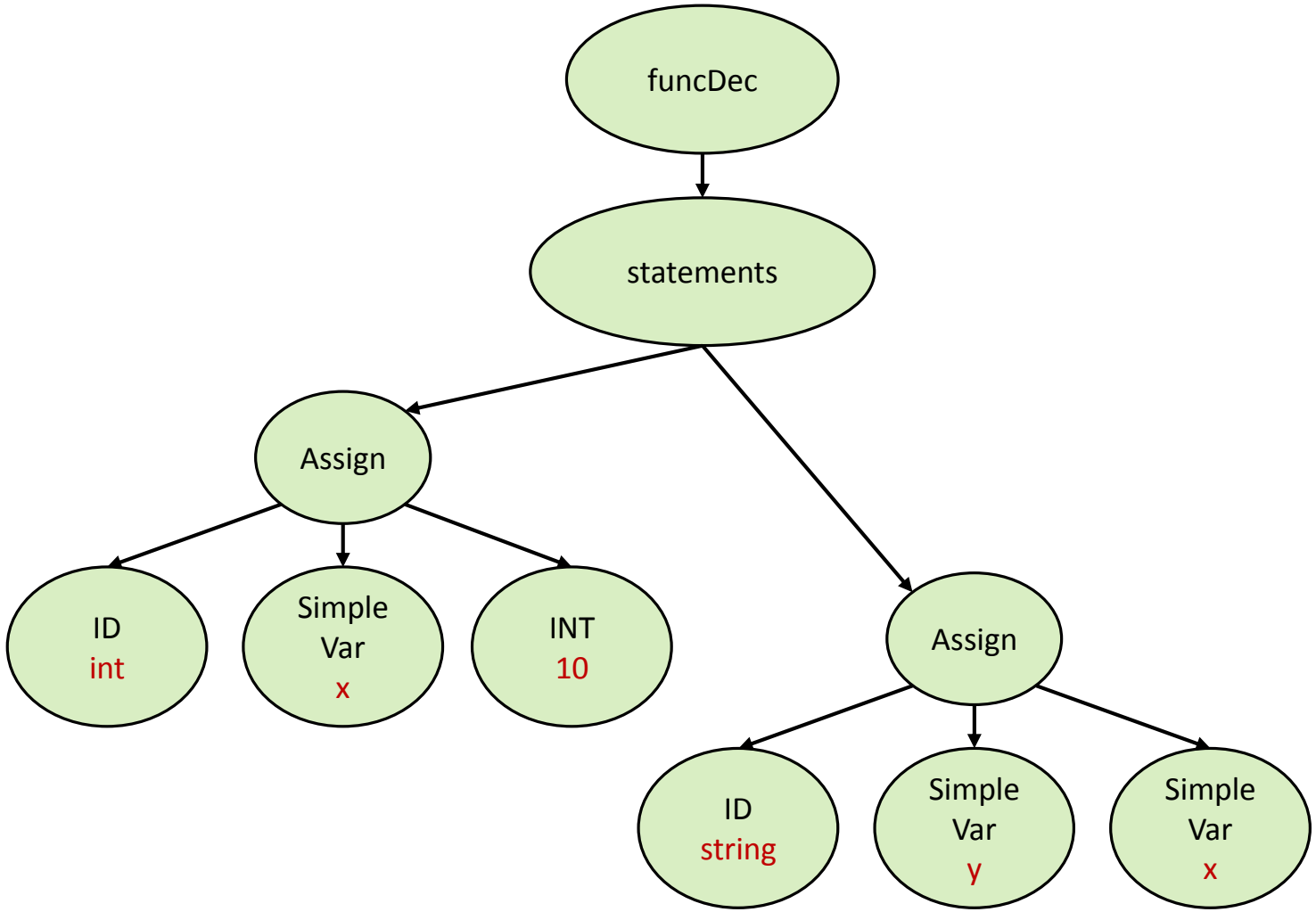

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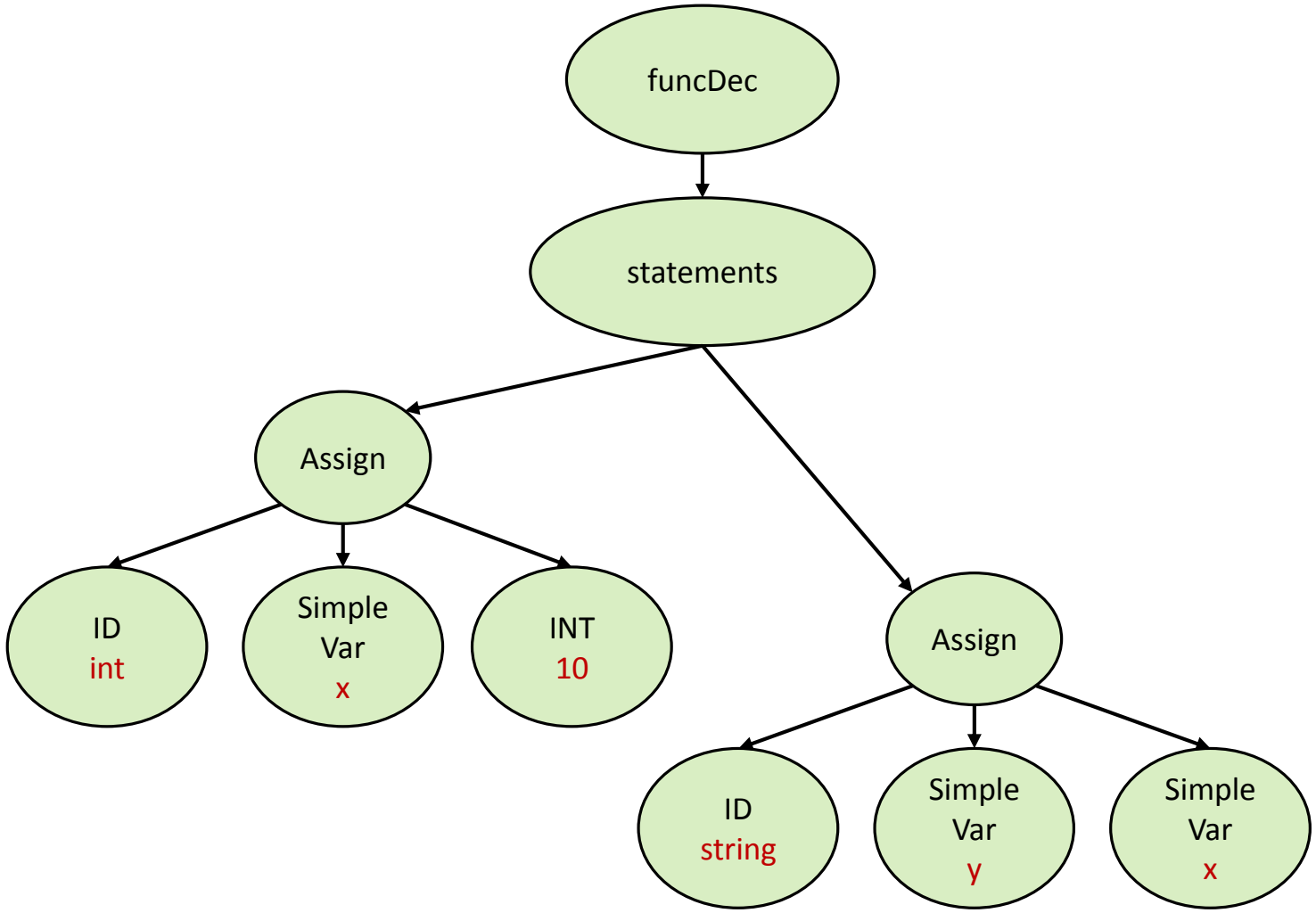
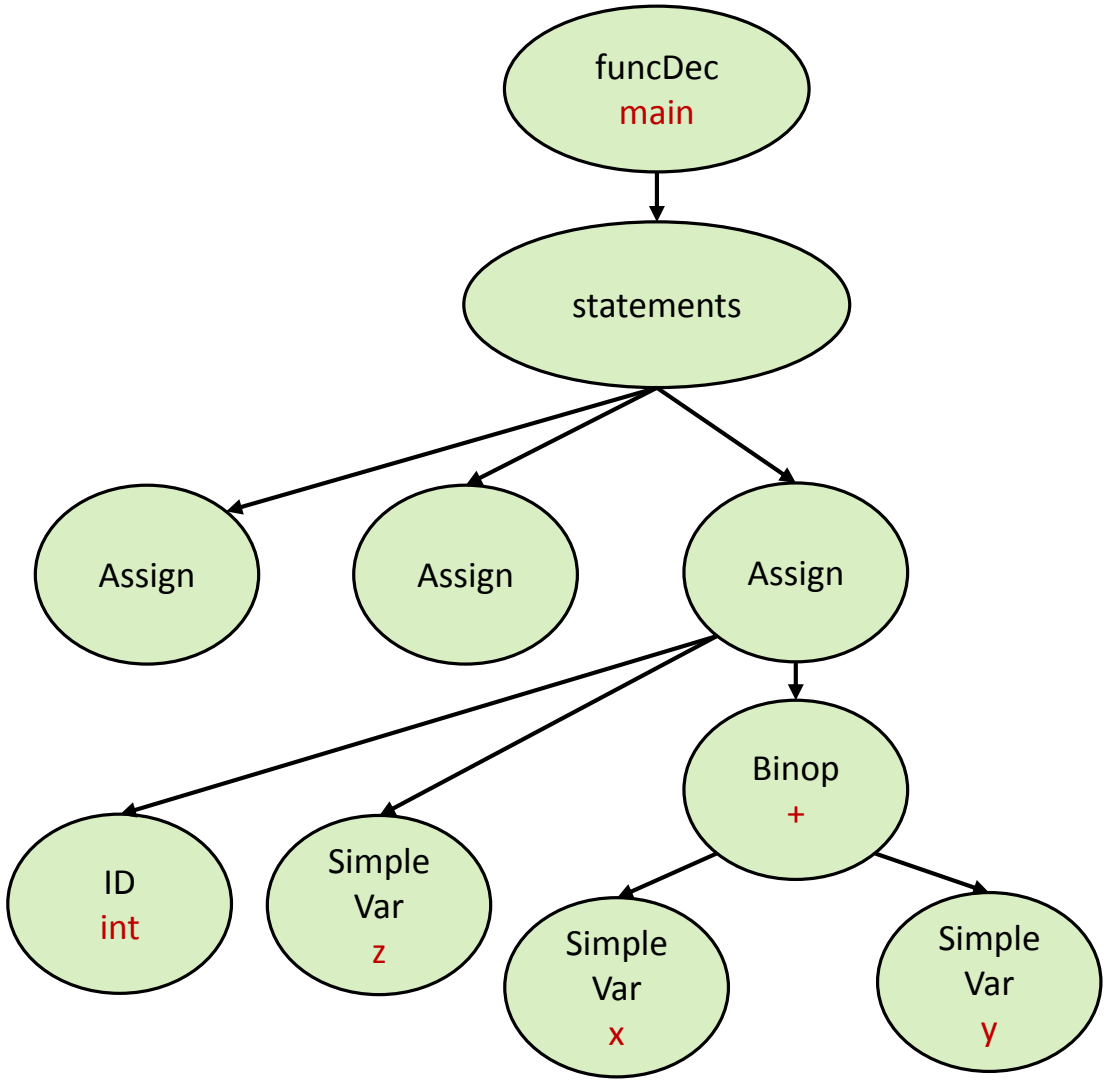


Binary Operations

```
void main() {
   int x = 1;
   int y = 2;
   int z = x + y;
}
```



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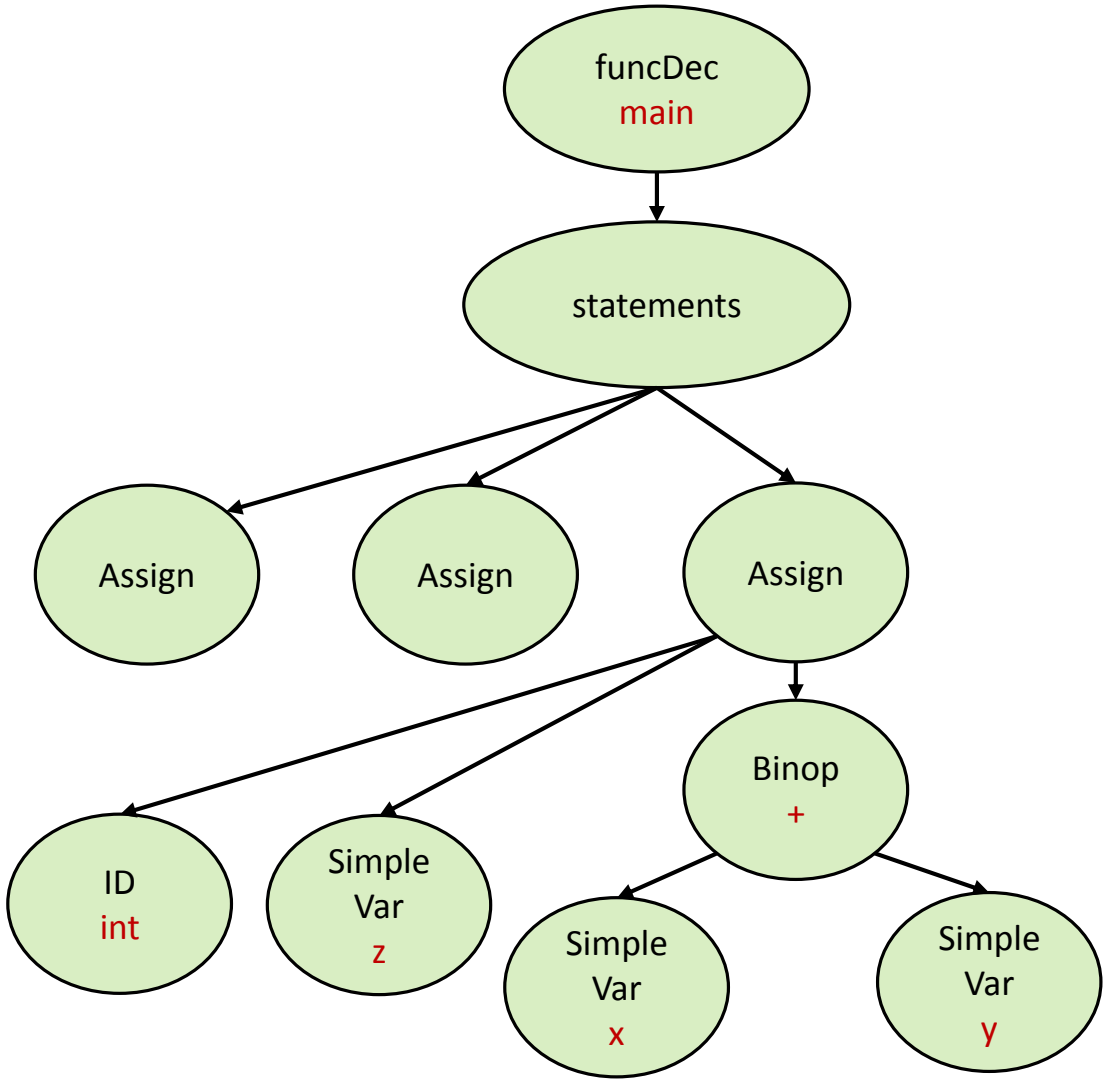

Binary Operations

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void main() {
   int x = 1;
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   int z = x < y;
}
```

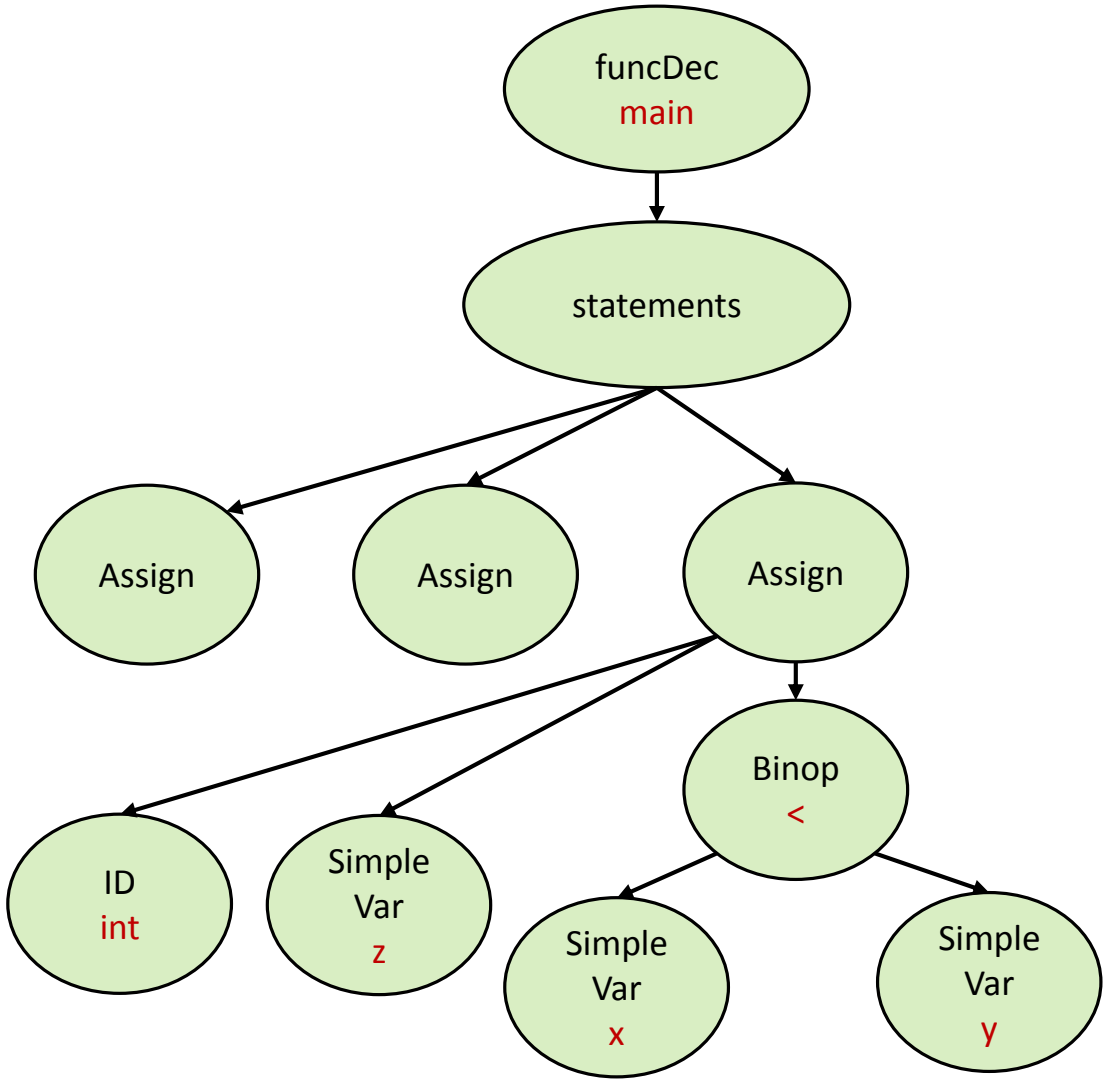

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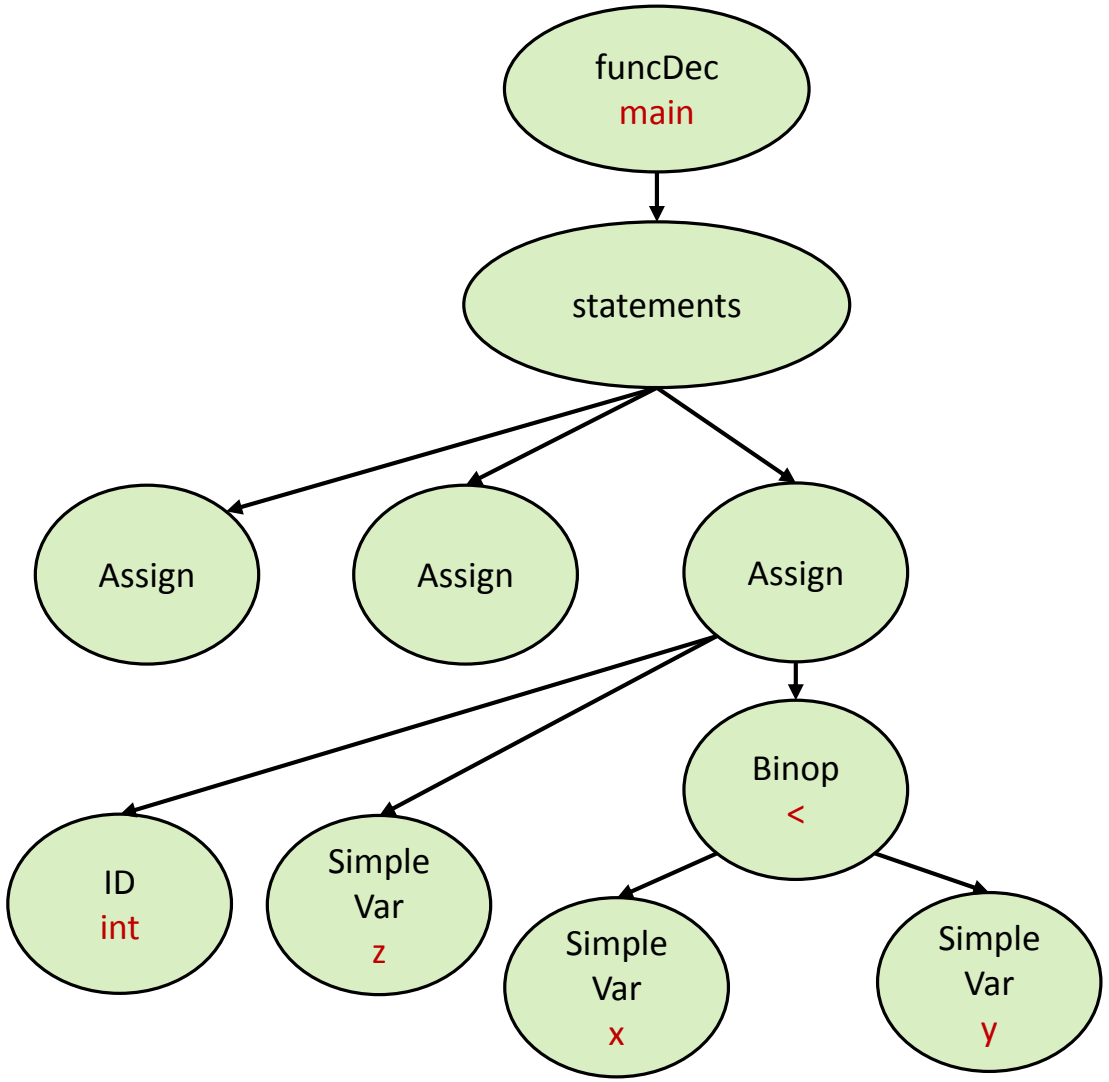

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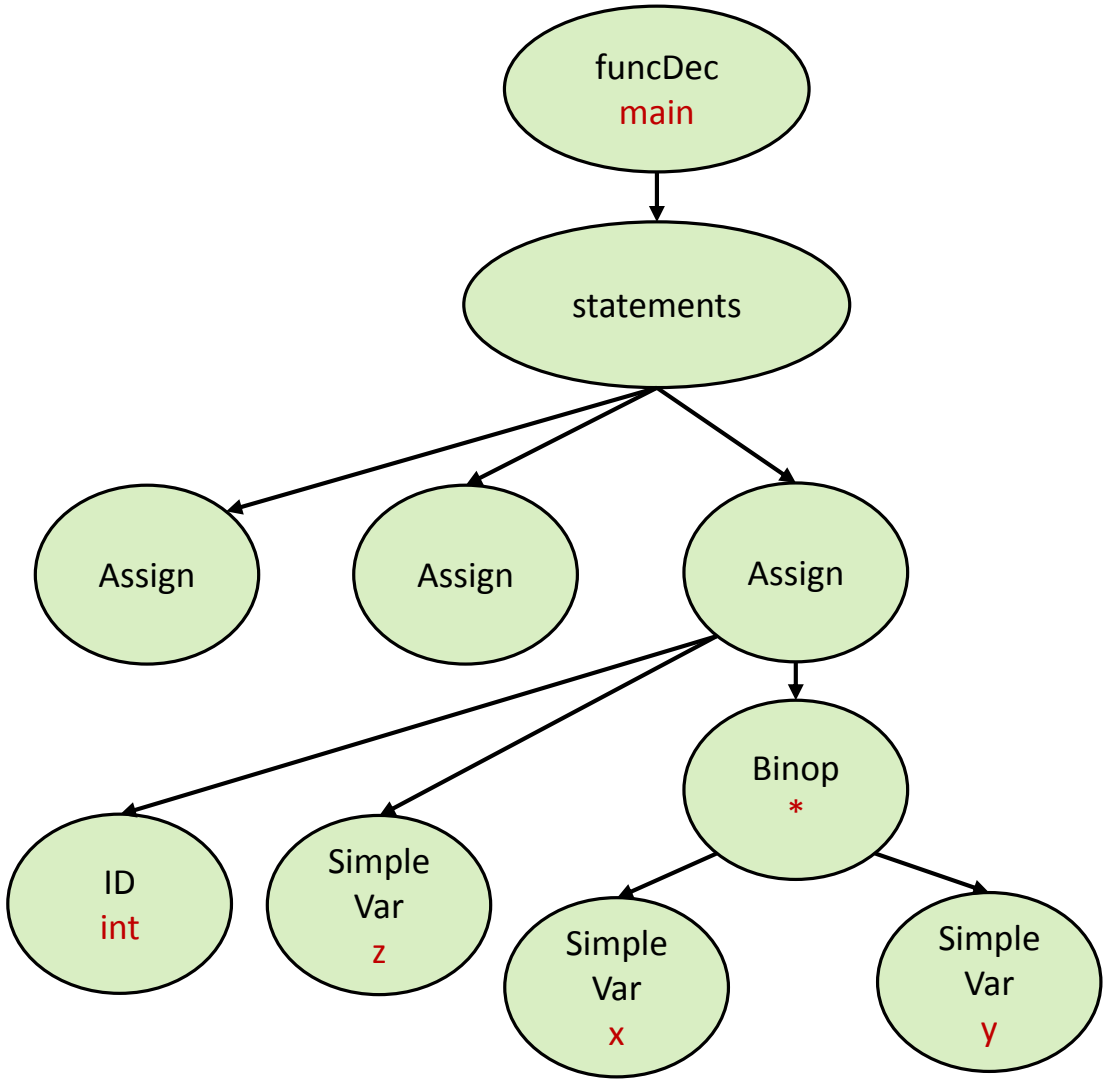

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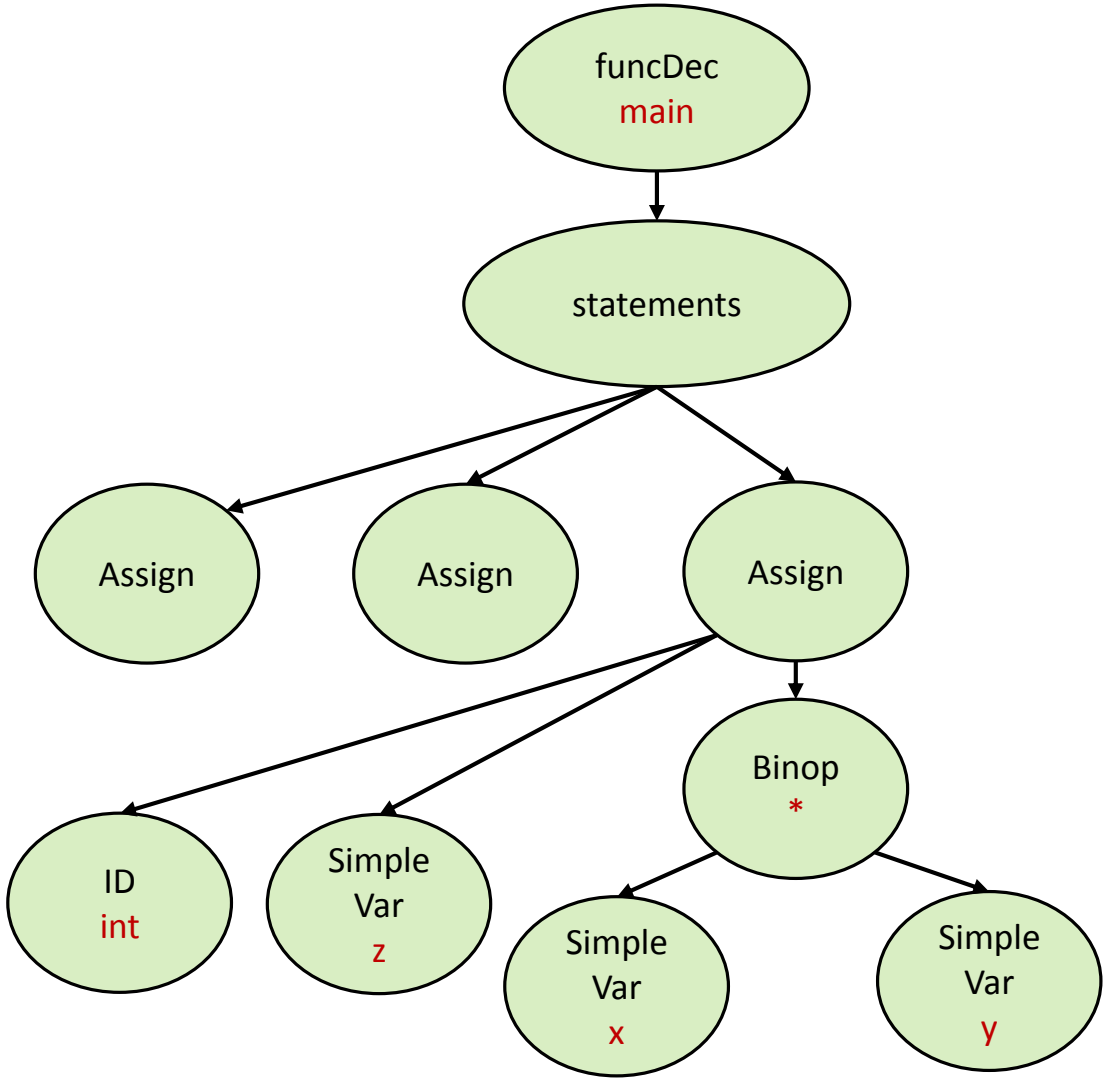
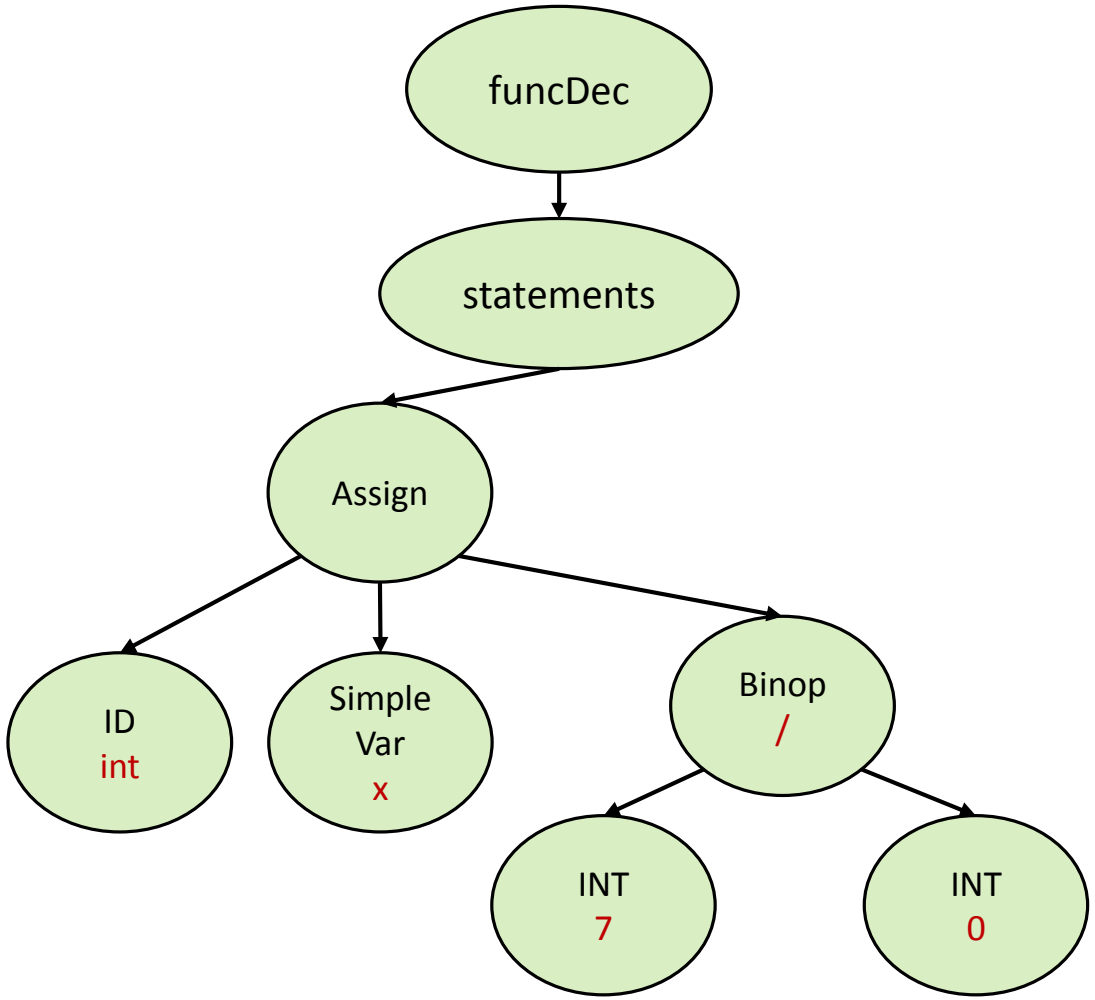


Binary Operations

```
void main() {
   int x = 7 / 0;
}
```



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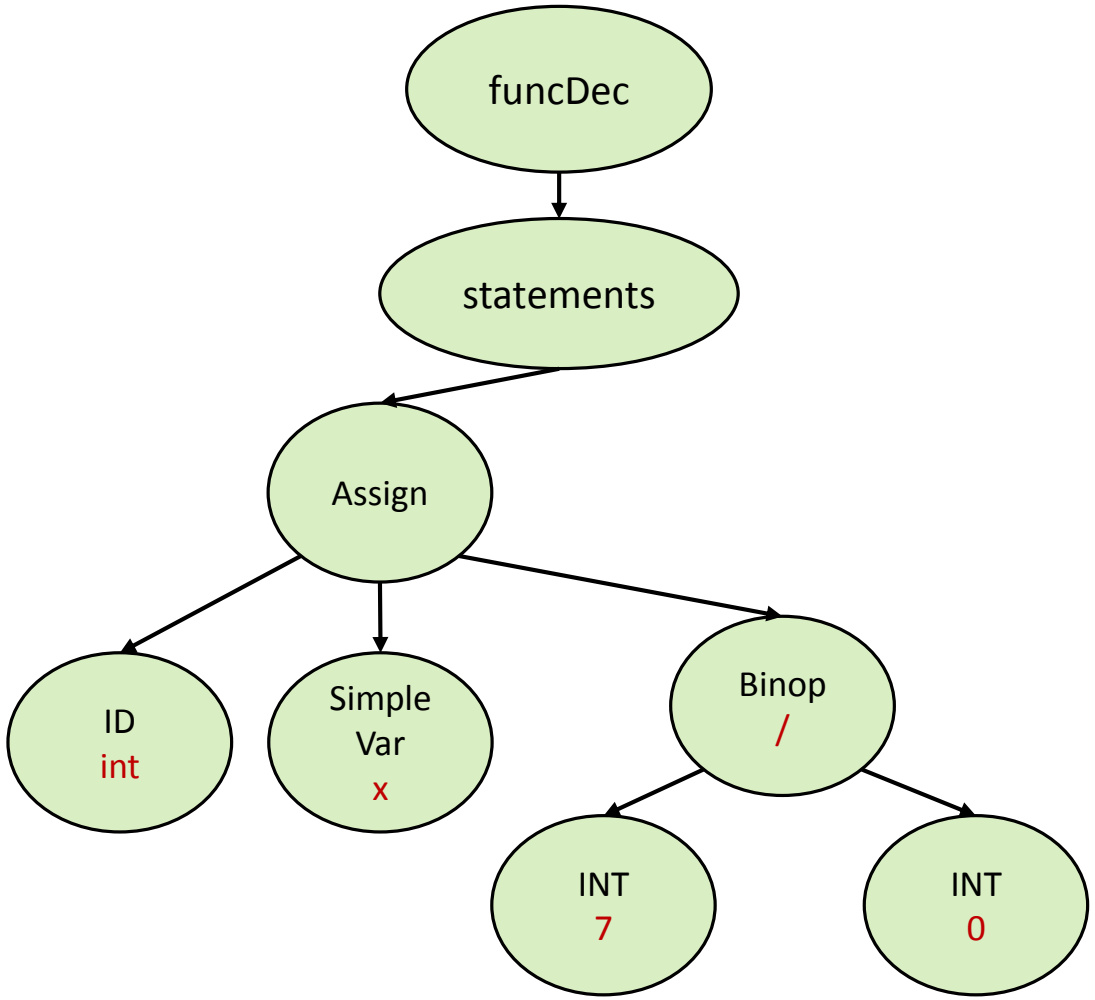
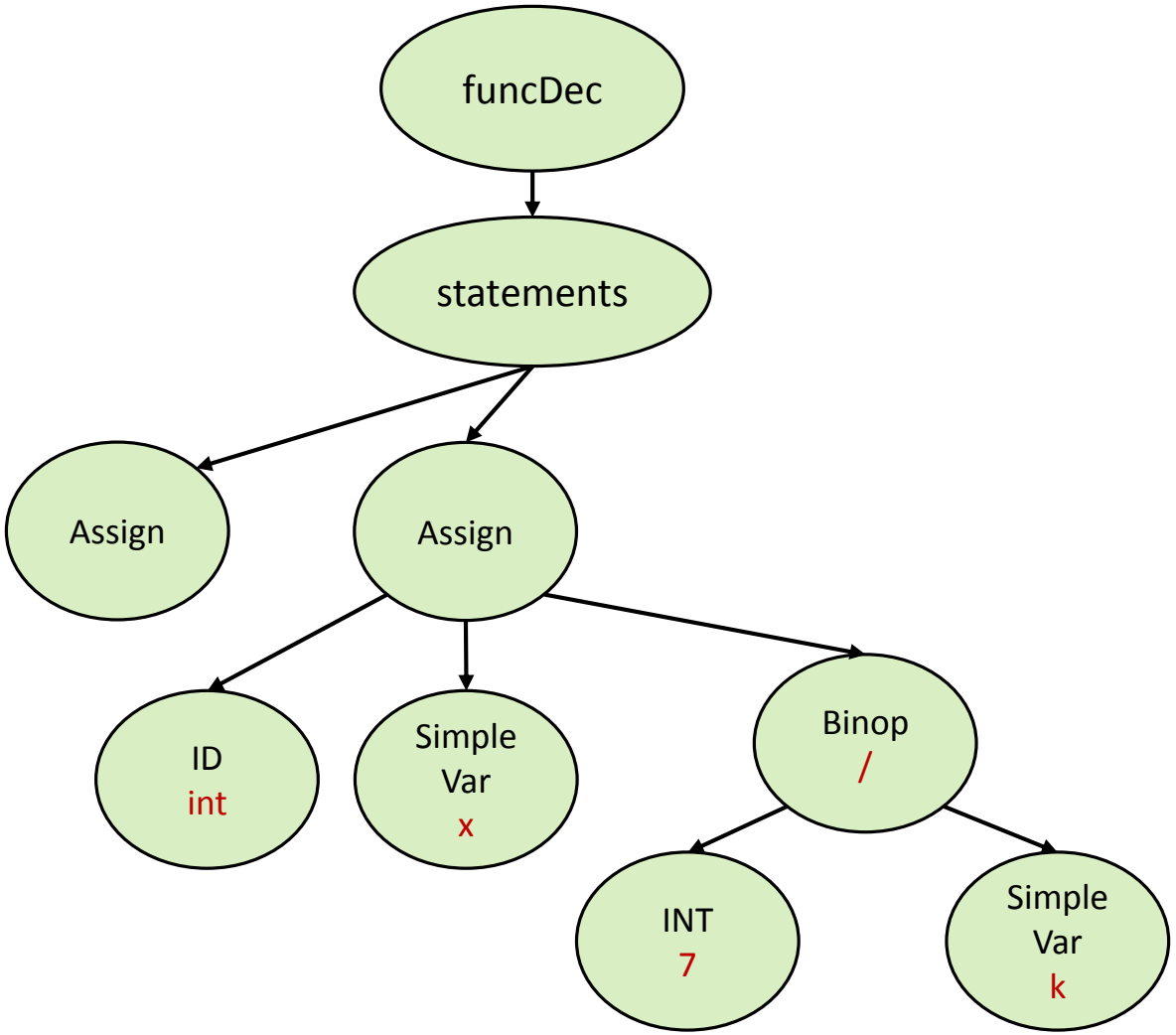


Binary Operations

```
void main() {
   int k = 0;
   int x = 7 / k;
}
```



Binary Operations

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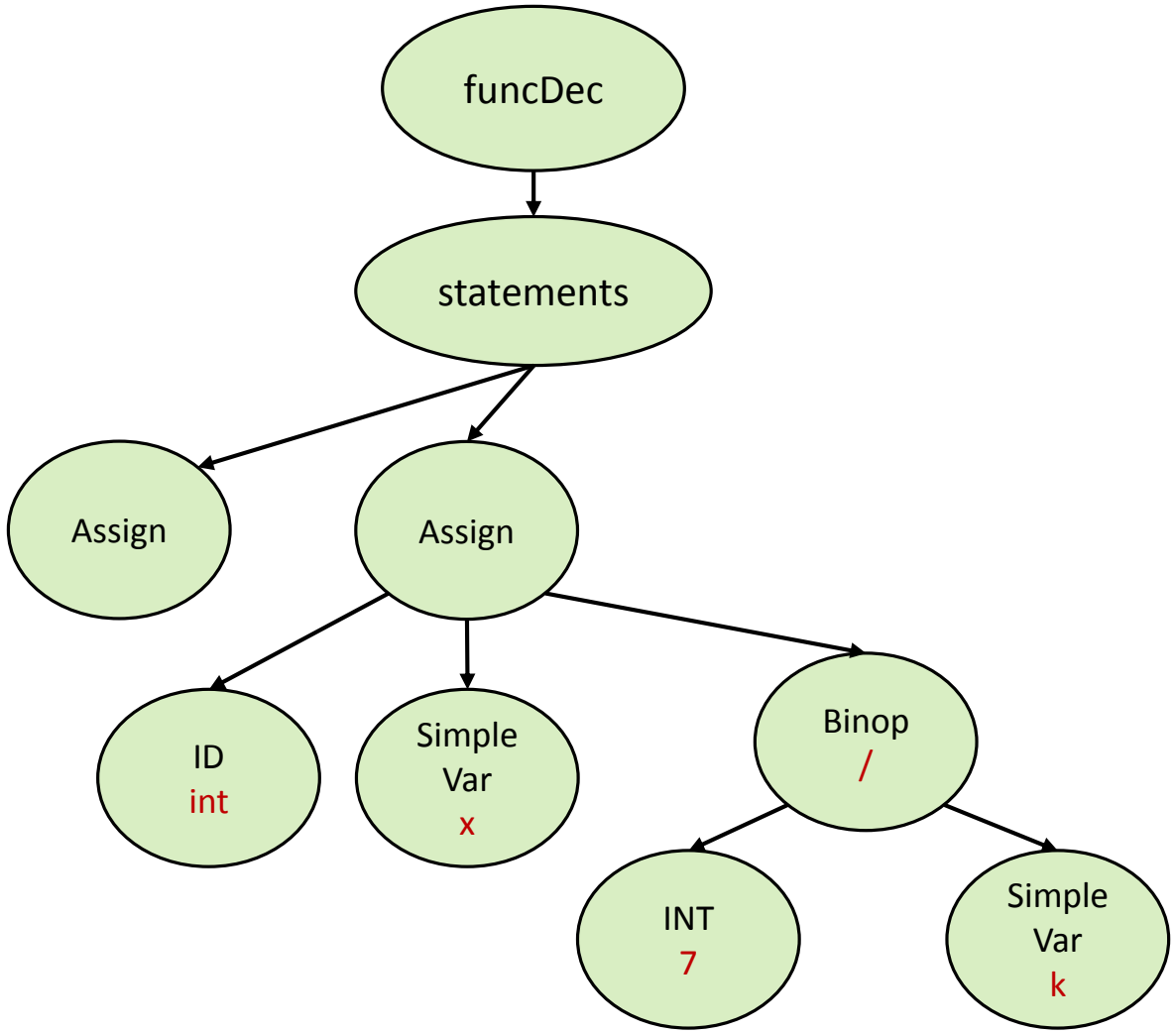
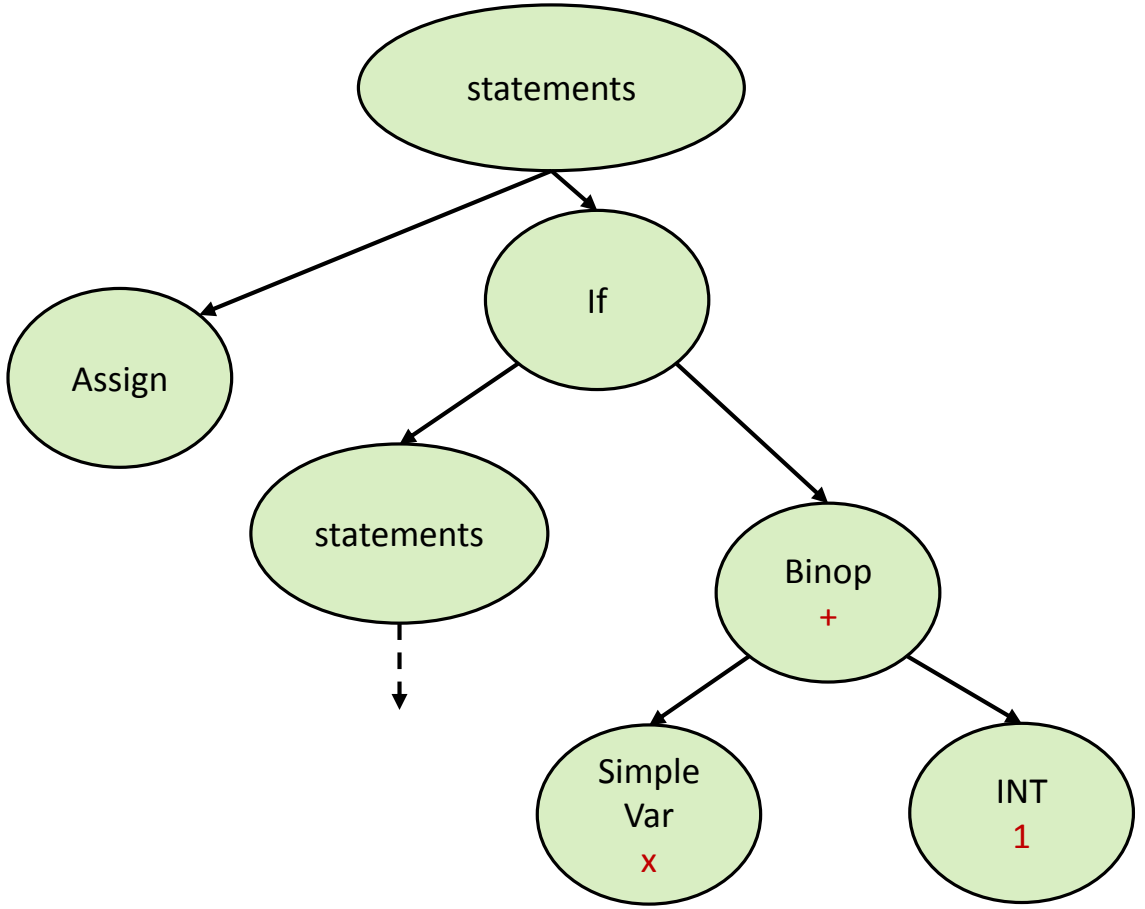
Depends



If, While, …

```
void main() {
   int x = 1;
   if (x + 1) {
      int z = 2;
   }
}
```



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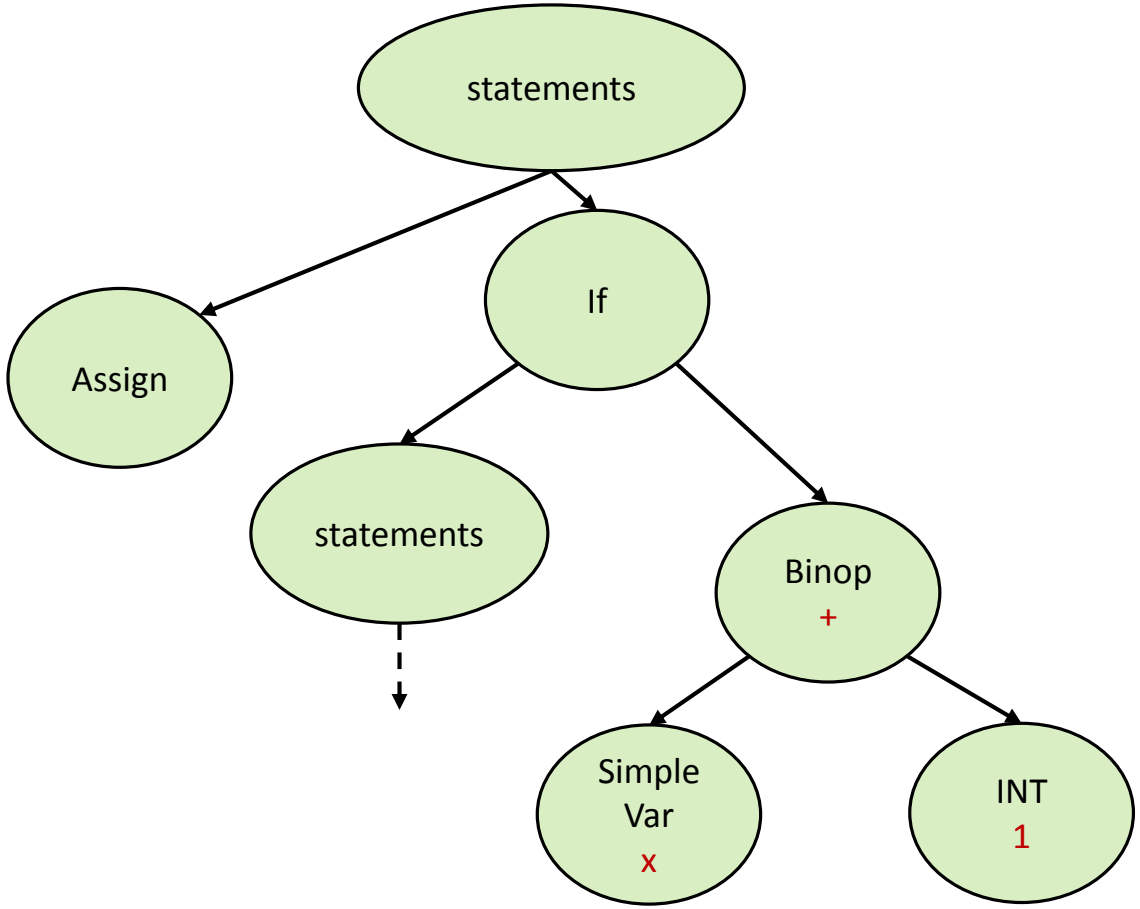
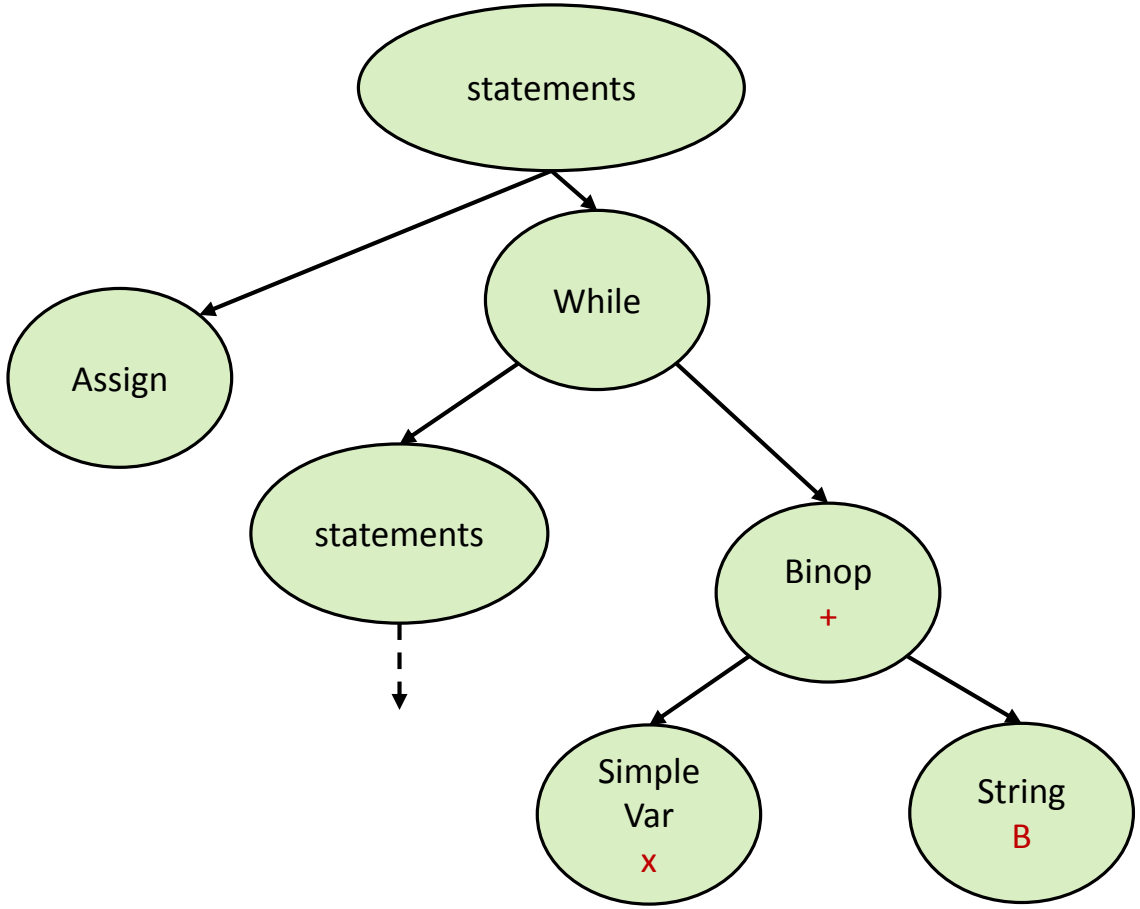


If, While, …

```
void main() {
   string x = "A";
   while (x + "B") {
      int z = 2;
   }
}
```



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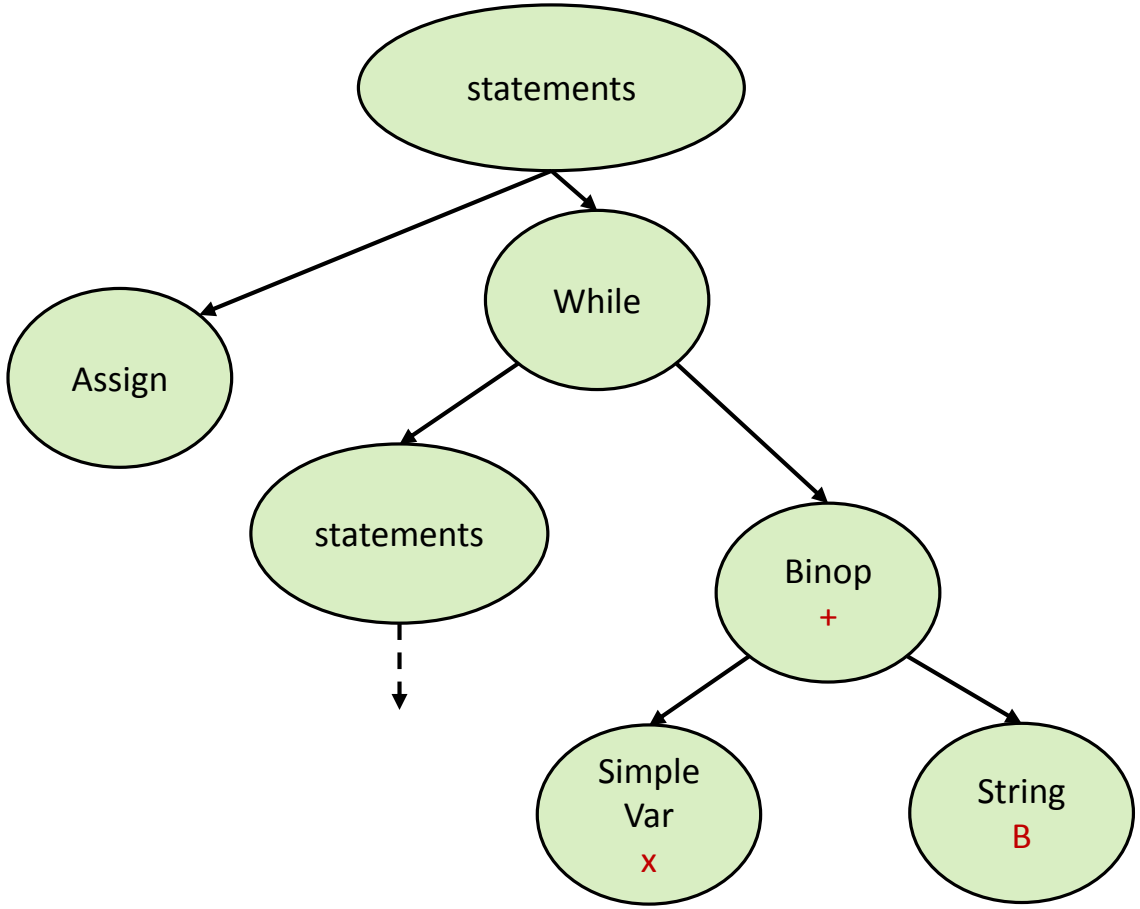
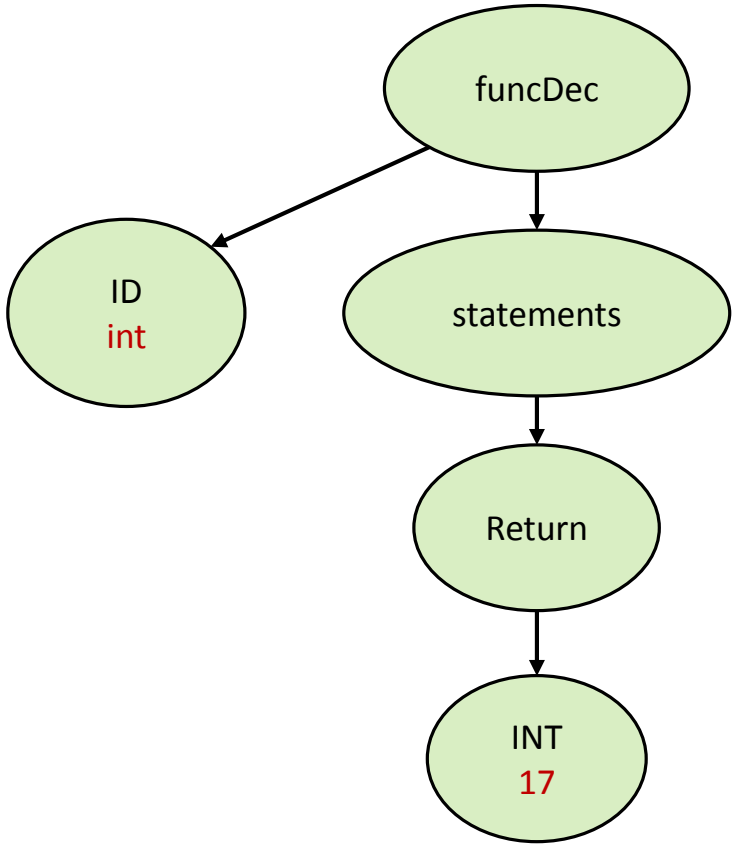


Return Statement

```
int main() {
   return 17;
}
```



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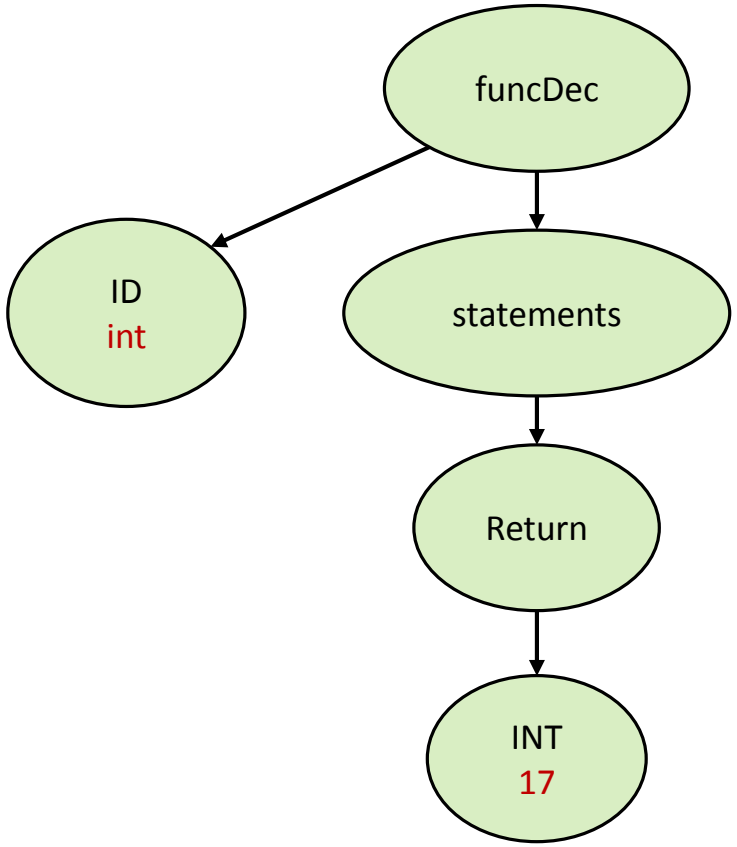
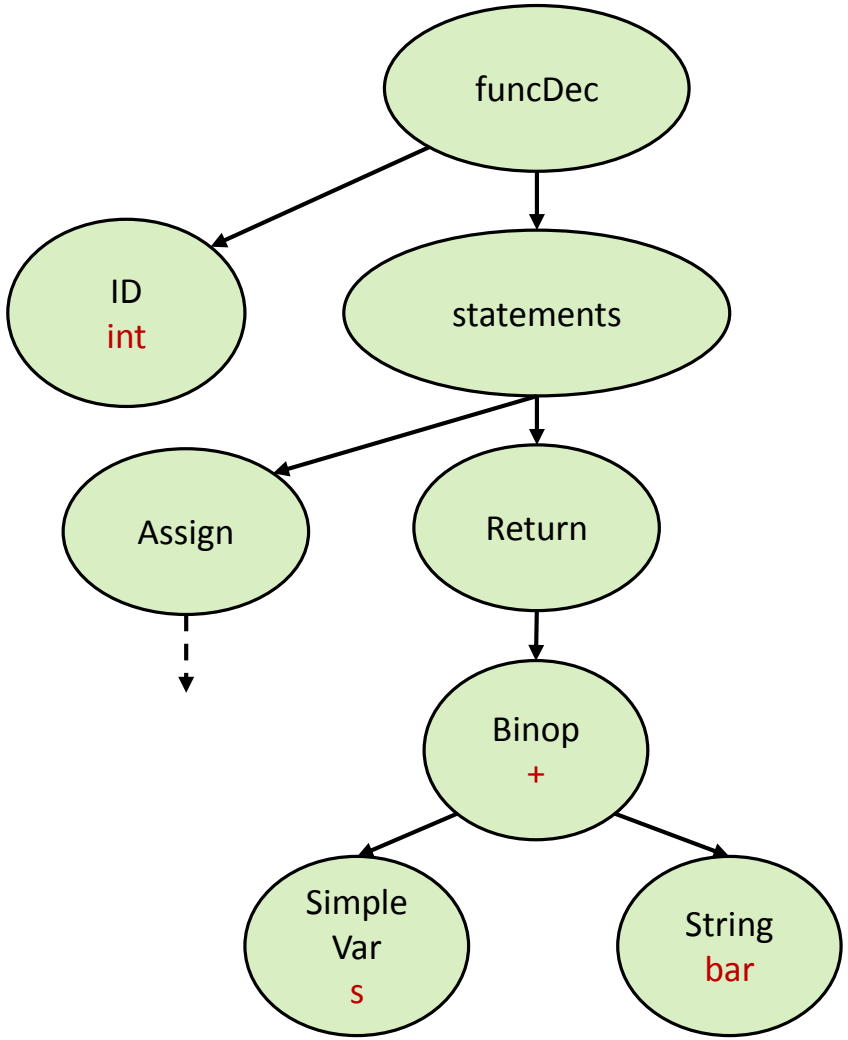


Return Statement

```
int main() {
   string s = "foo"
   return s + "bar";
}
```



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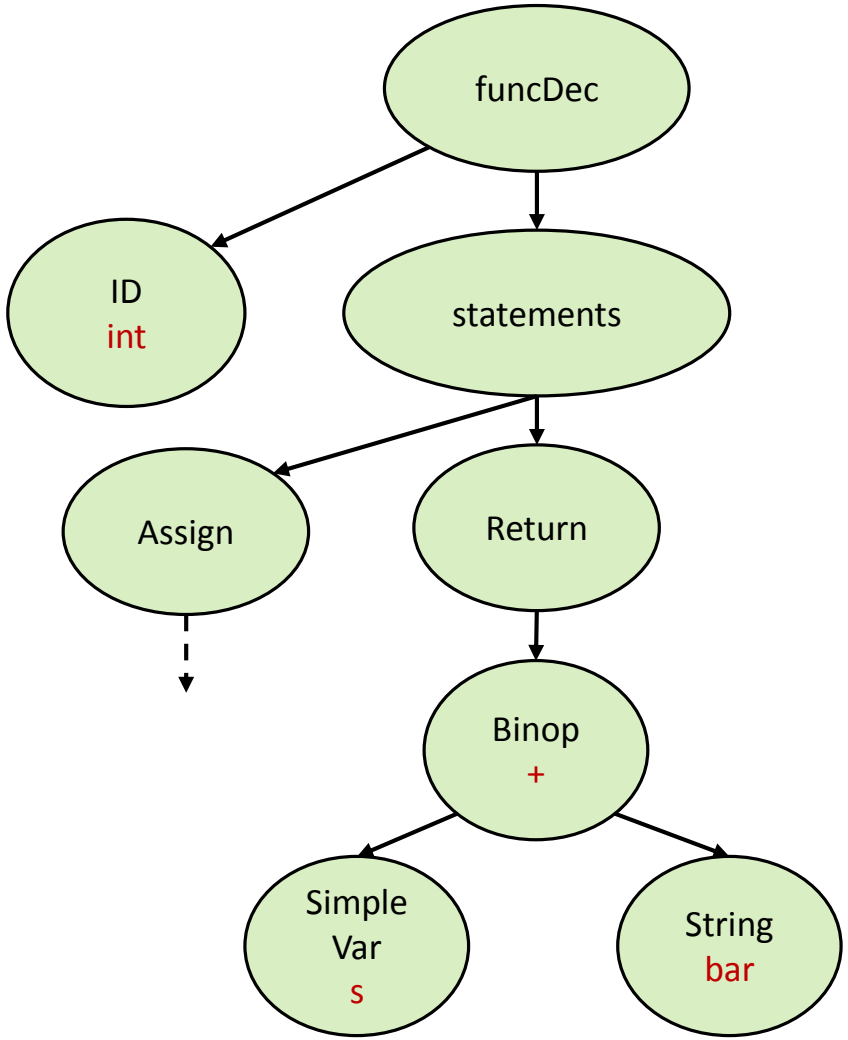
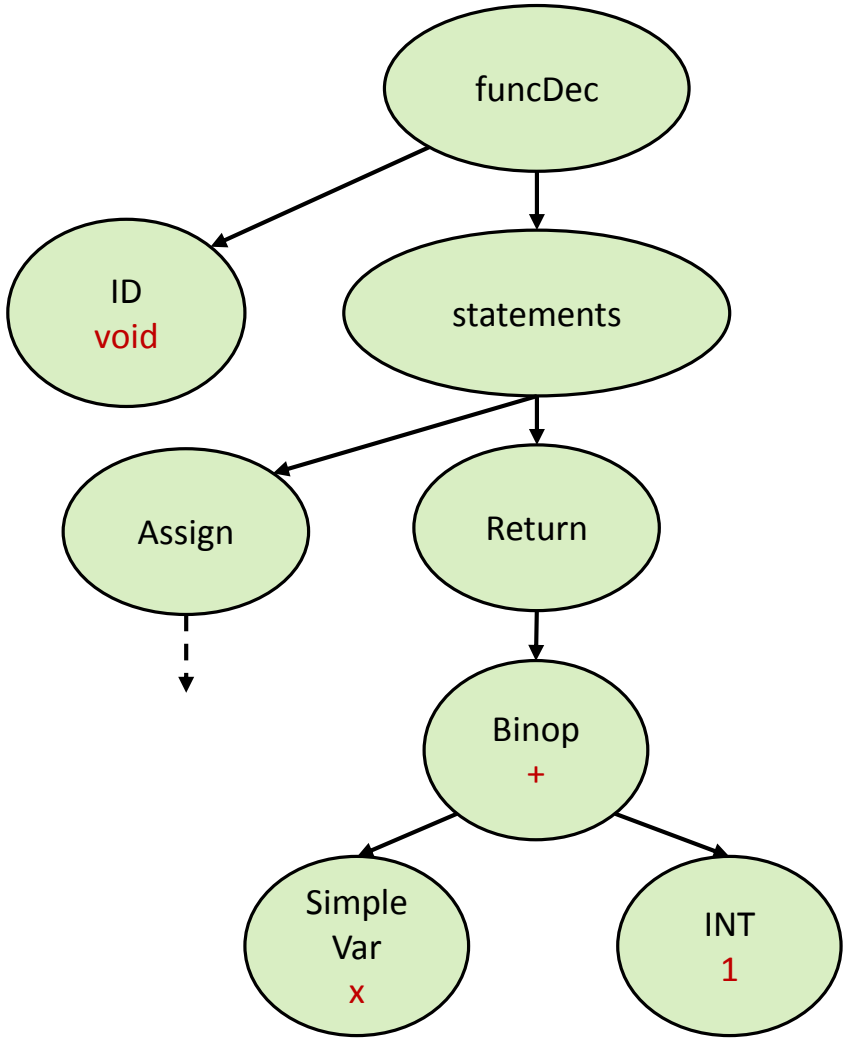


Return Statement

```
void main() {
   int x = 1;
   return x + 1;
}
```



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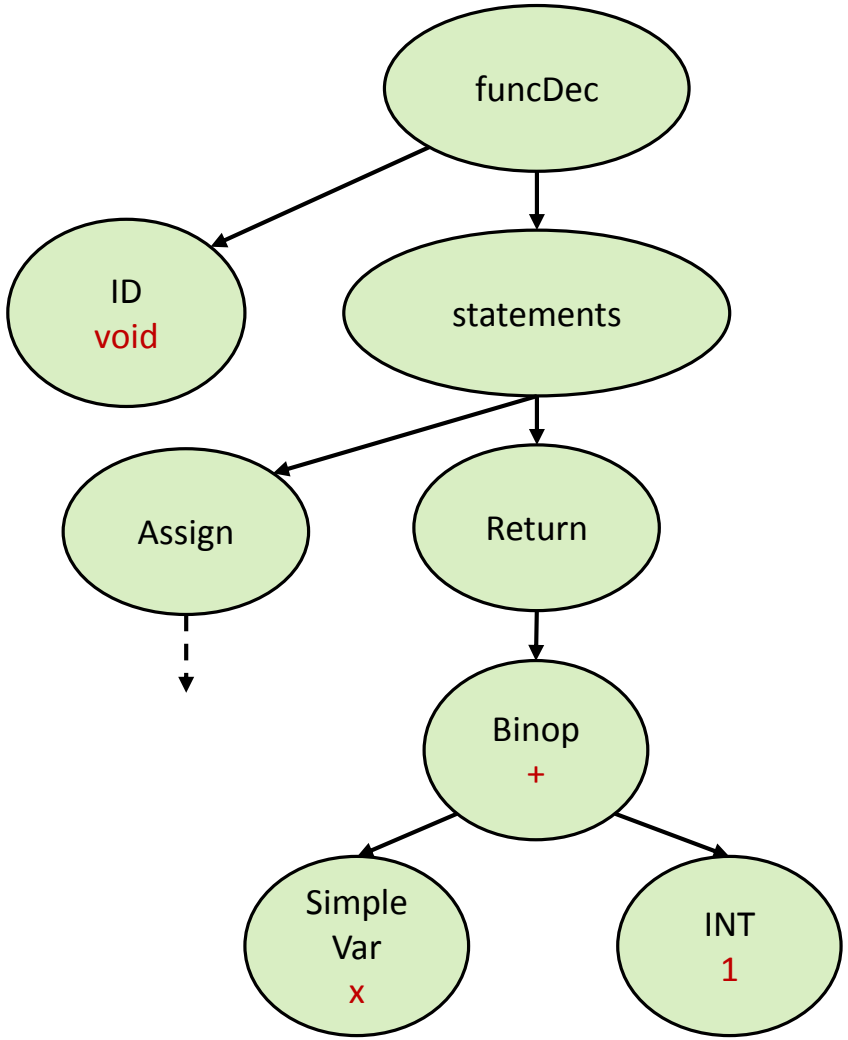
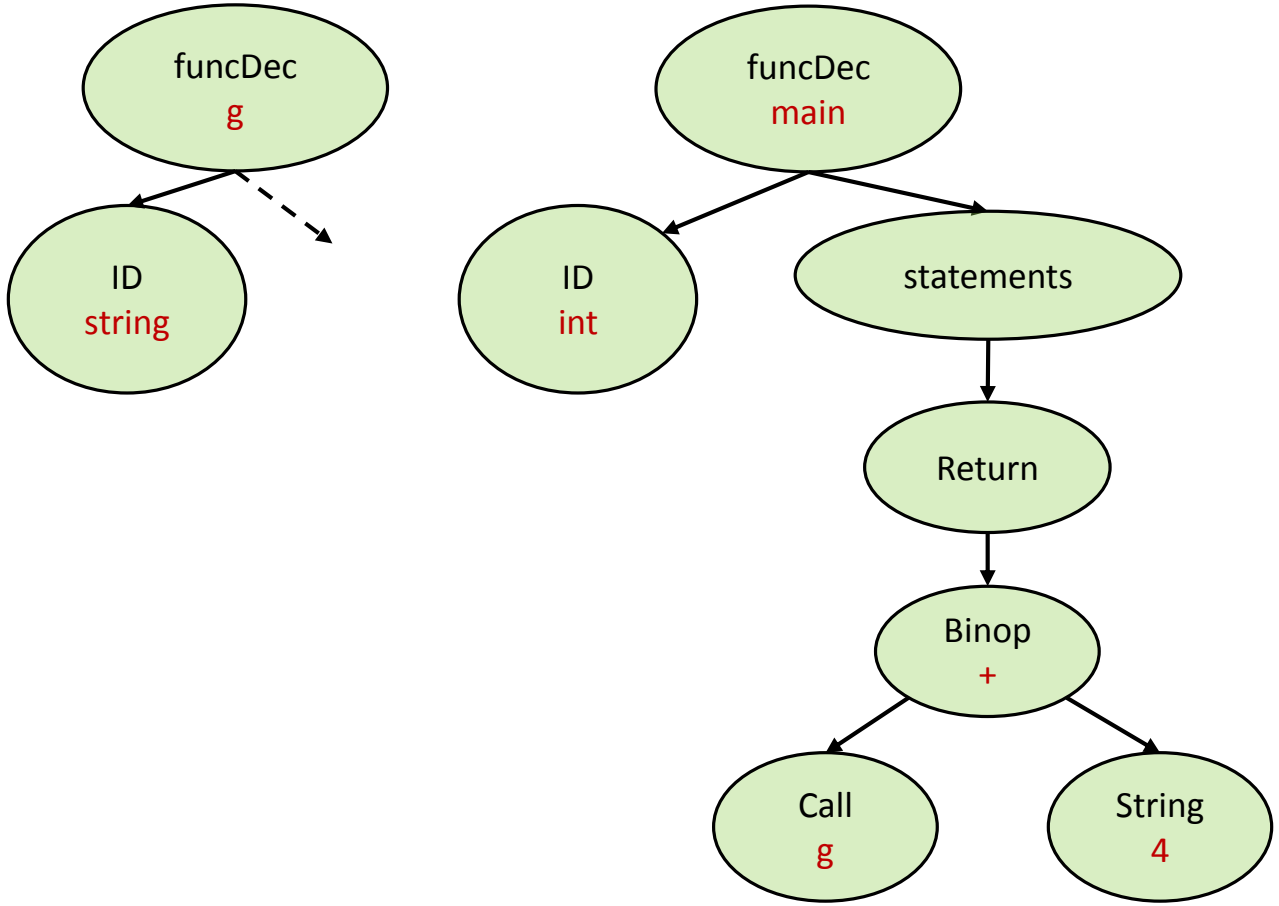


Return Statement

```
string g() {
  return "123";
}
int main() {
  return g() + "4";
}
```



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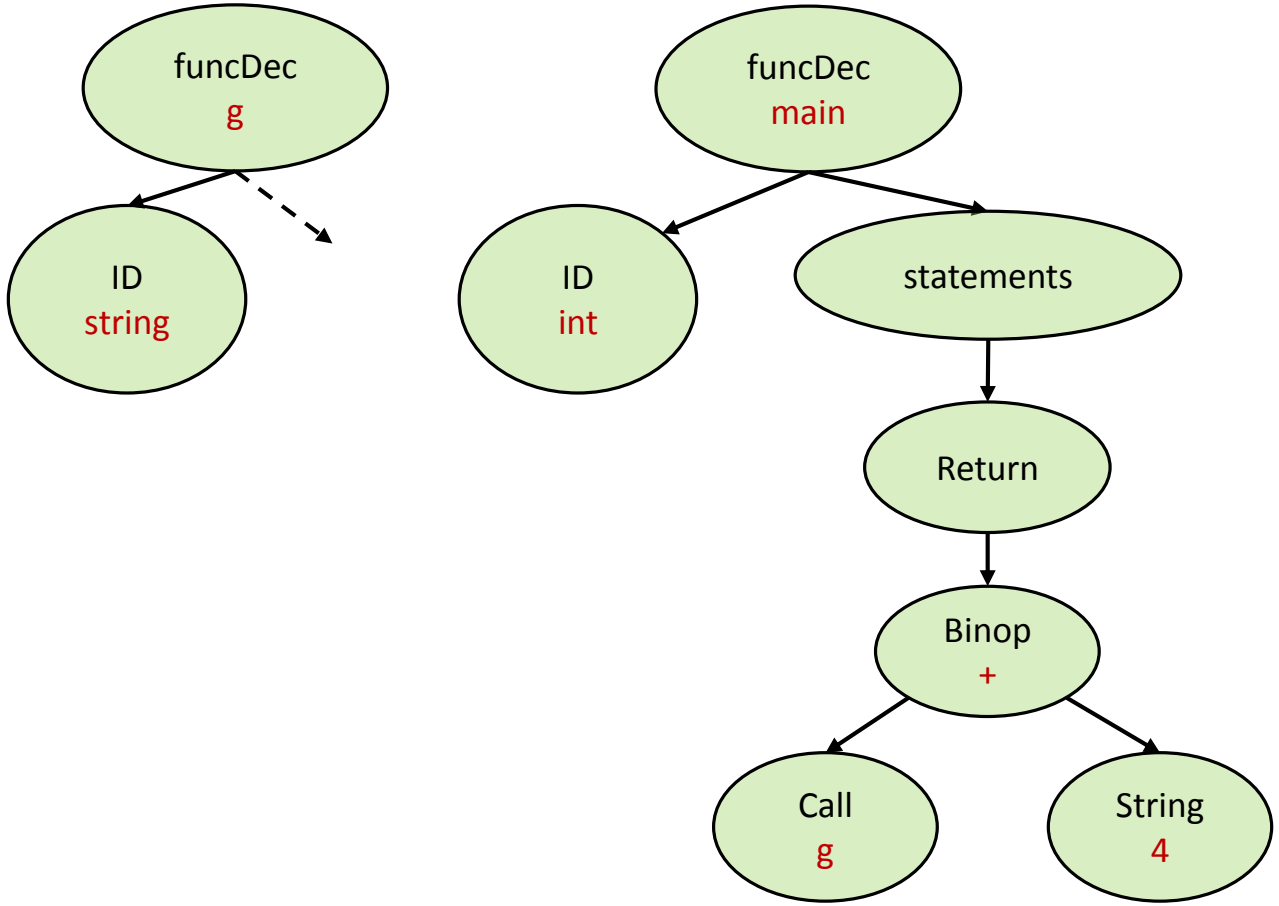
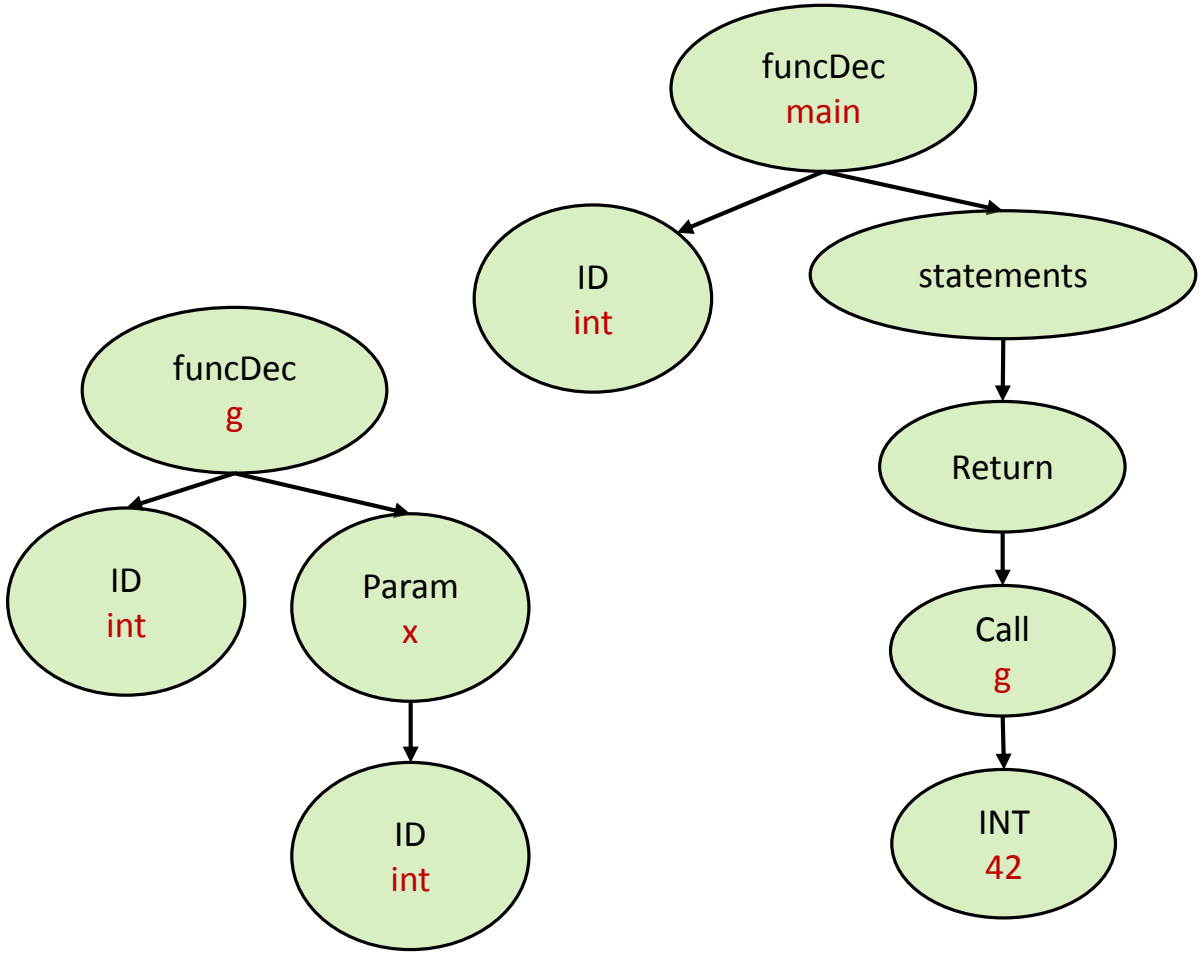


Function Calls

```
int g(int x) {
  return x + 1;
}
int main() {
  return g(42);
}
```



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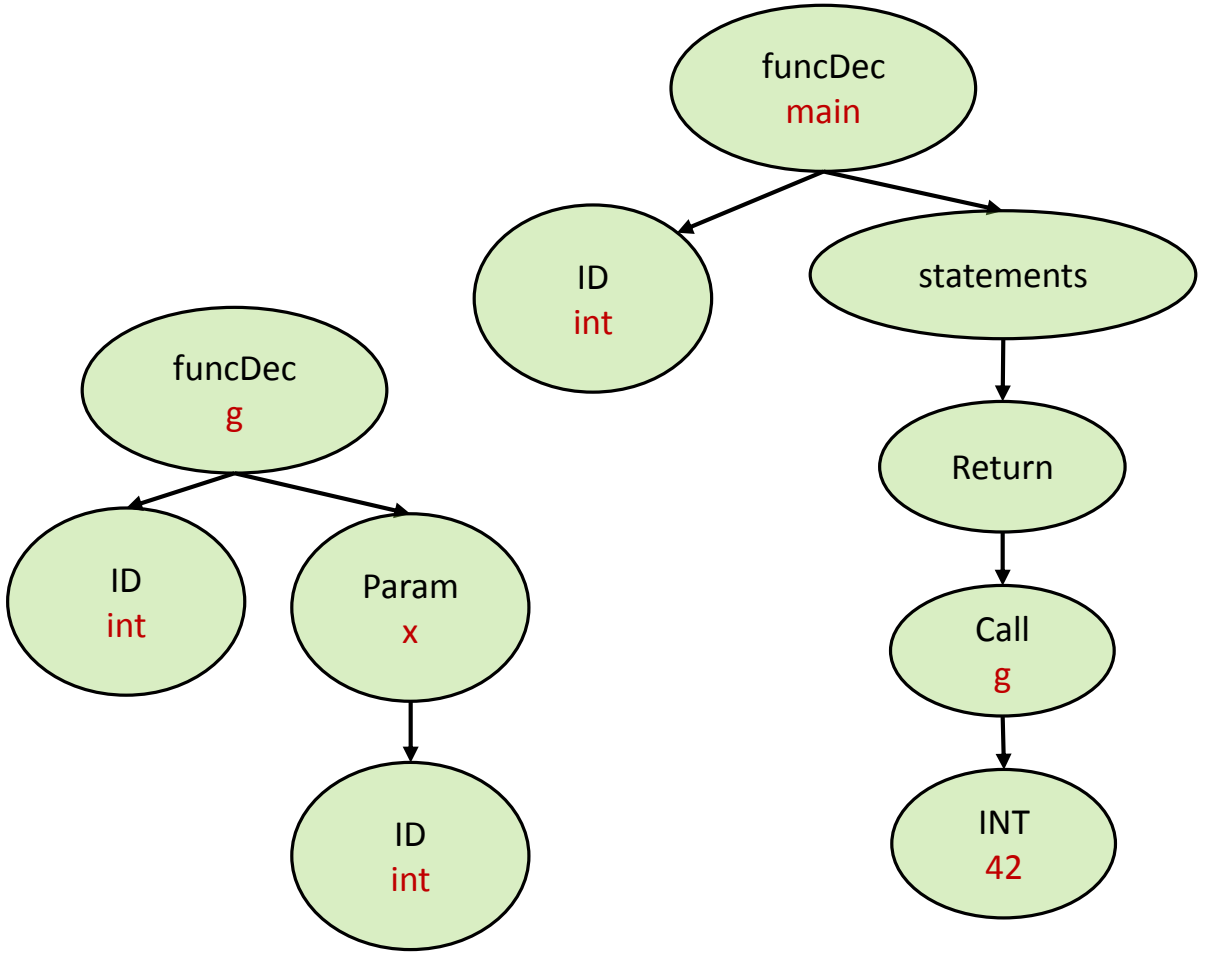
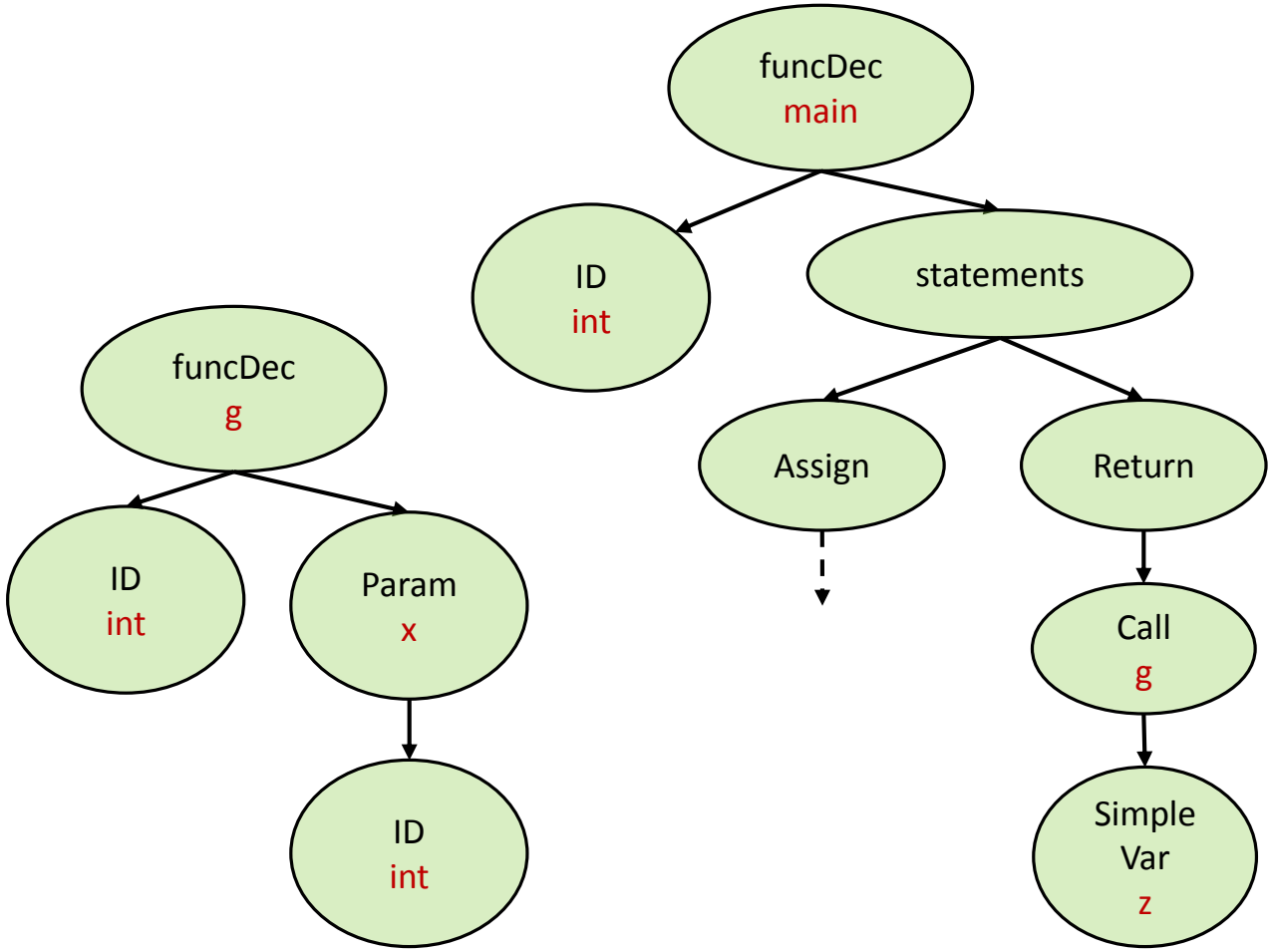


Function Calls

```
int g(int x) {
   return x + 1;
}
int main() {
   string z = "..."
   return g(z);
}
```



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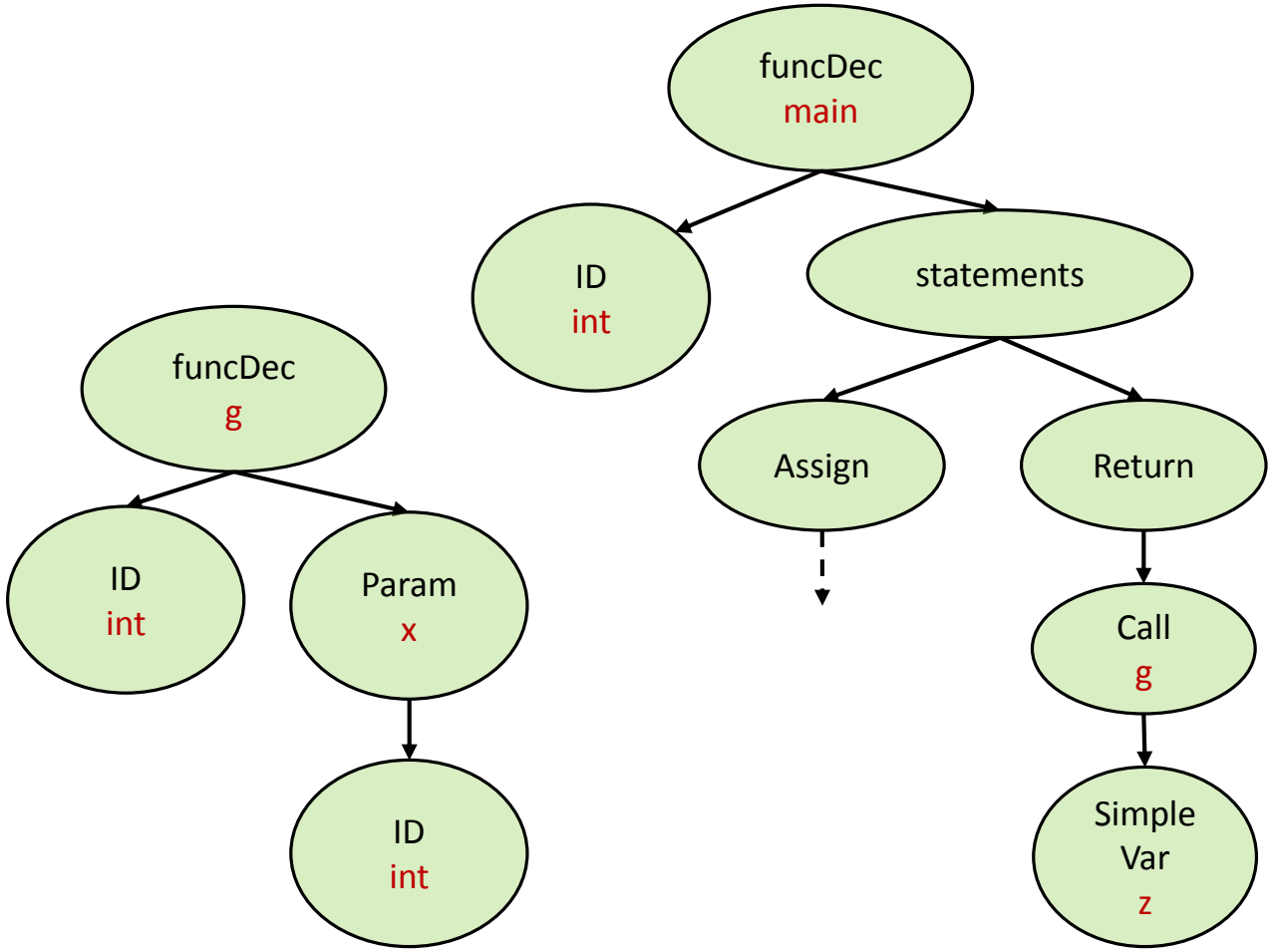
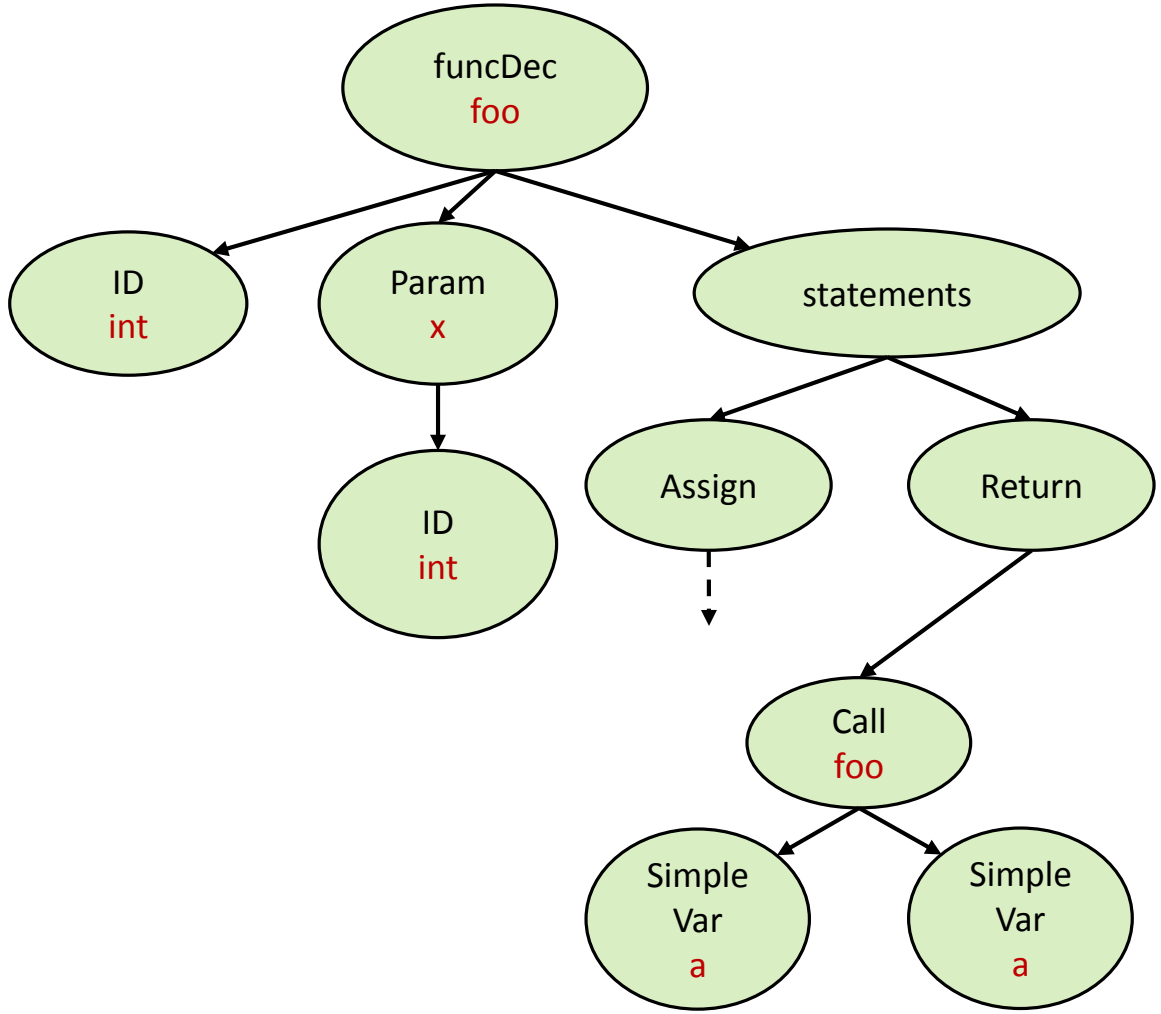


Function Calls

```
int foo(int k) {
  int a = k * 10;
  return foo(a, a);
}
```



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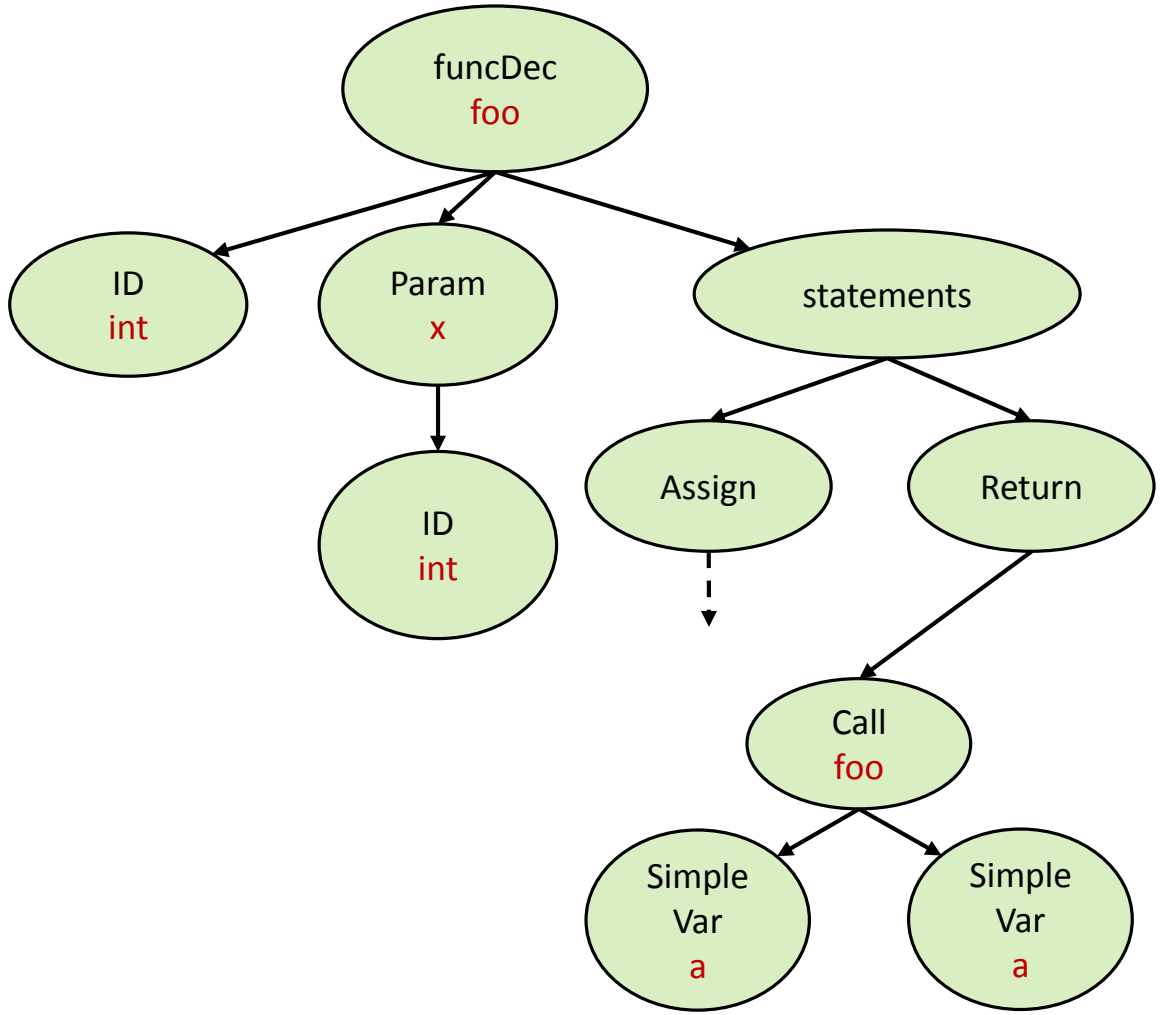
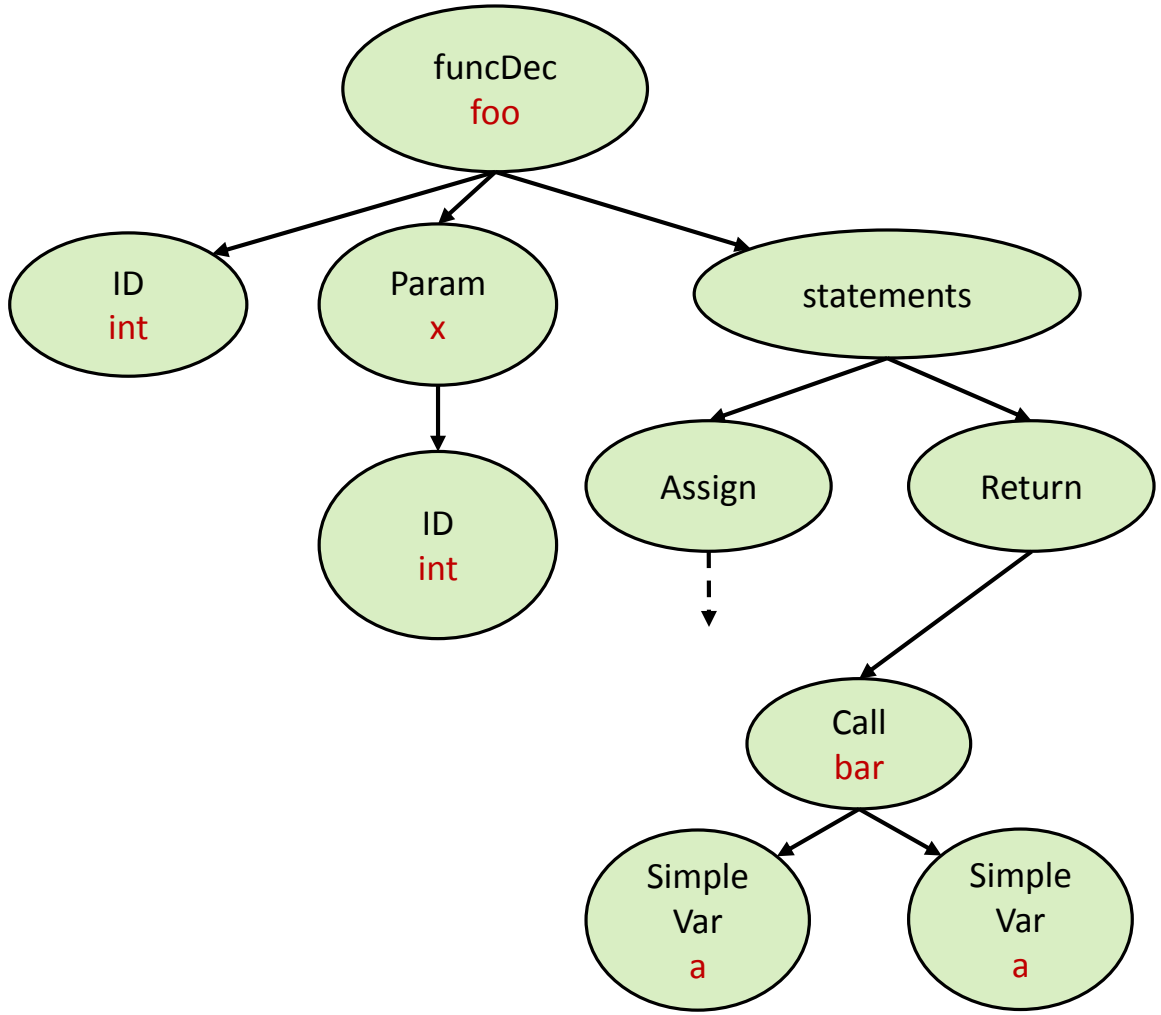


Function Calls

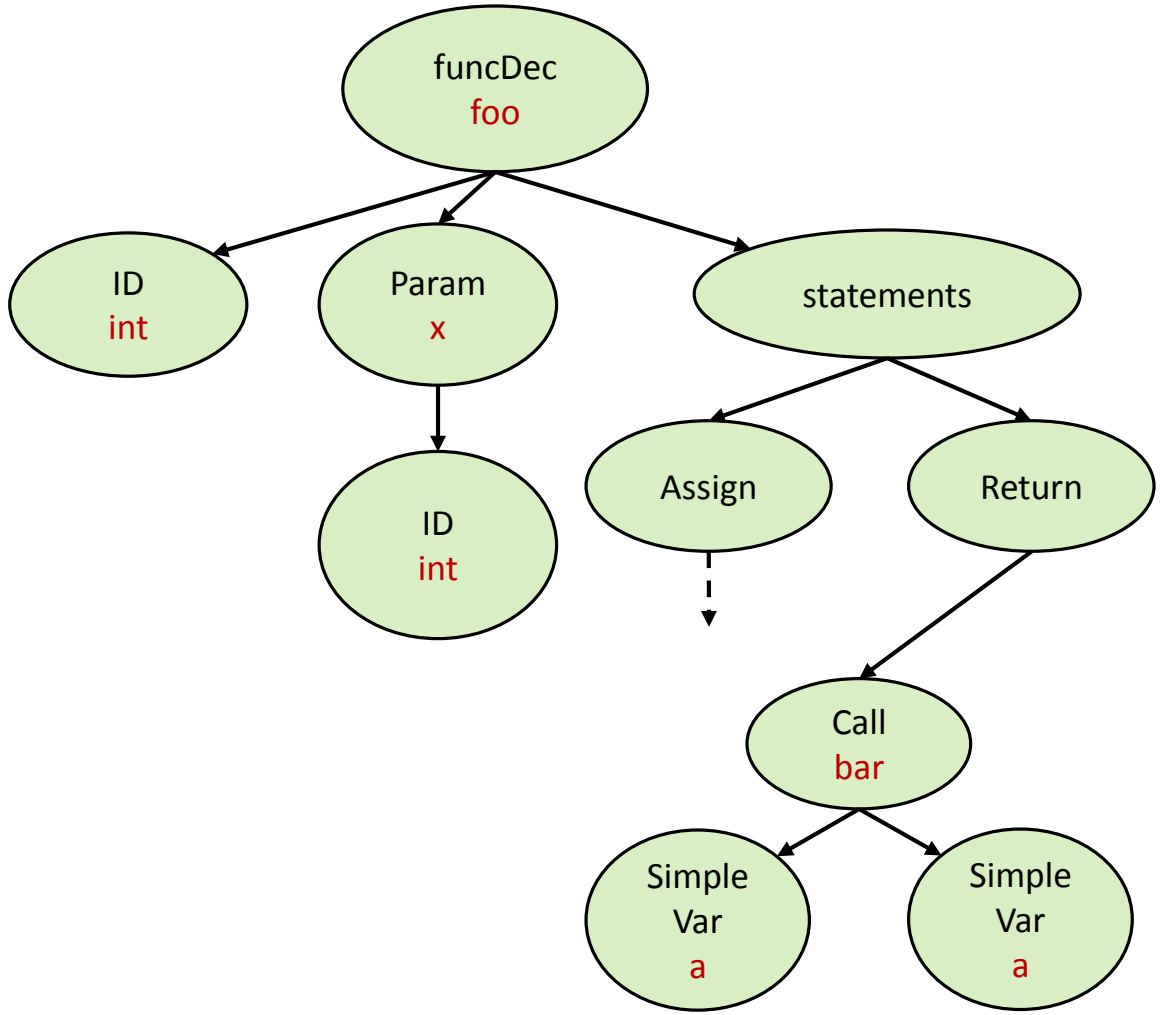
```
int foo(int k) {
  int a = k * 10;
  return bar(a, a);
}
```



Function Calls

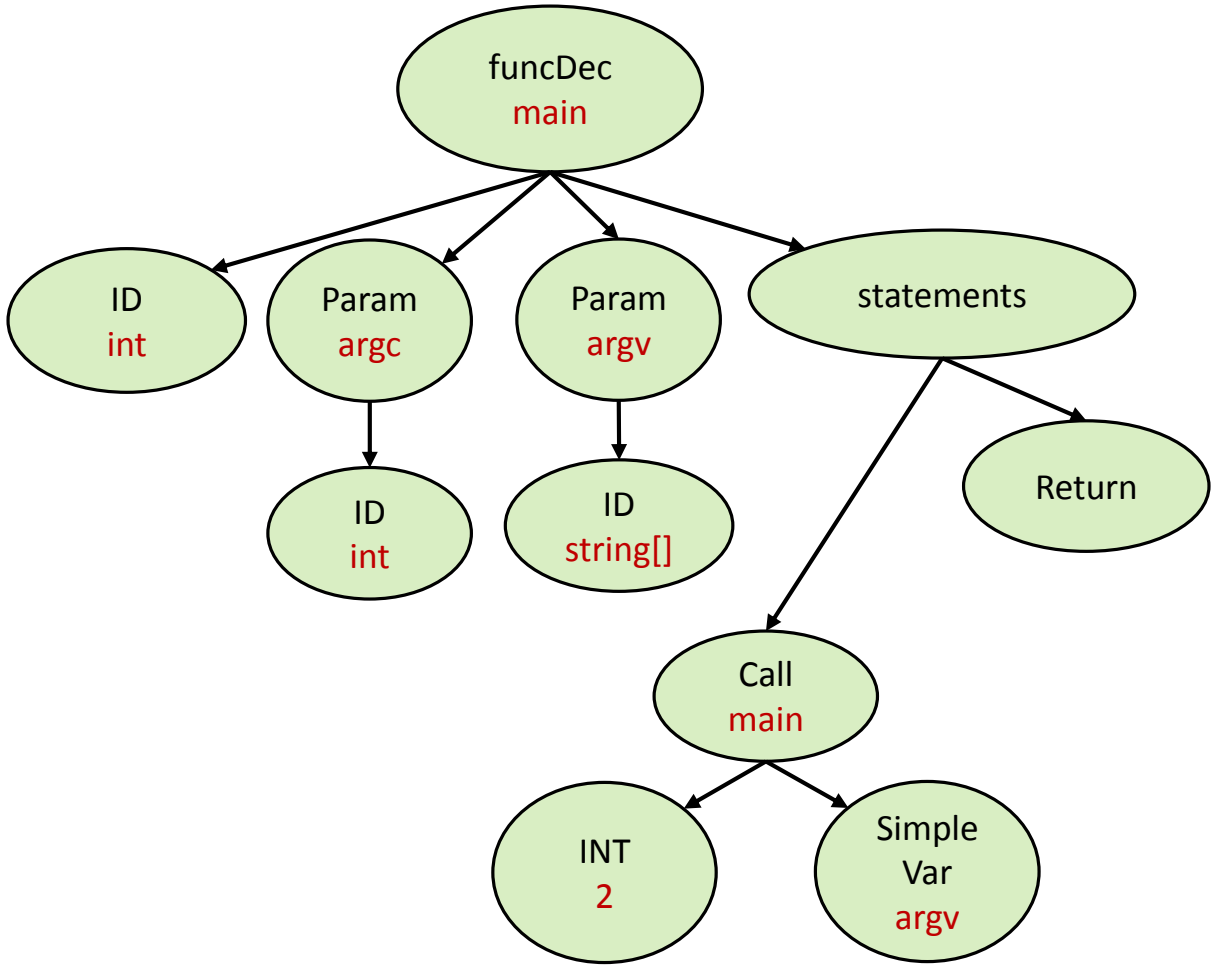
```
int foo(int k) {
  int a = k * 10;
  return bar(a, a);
}
```

Invalid



Function Calls

```
int main(int argc,
         string argv[]){
  main(2, argv);
  return 0;
}
```



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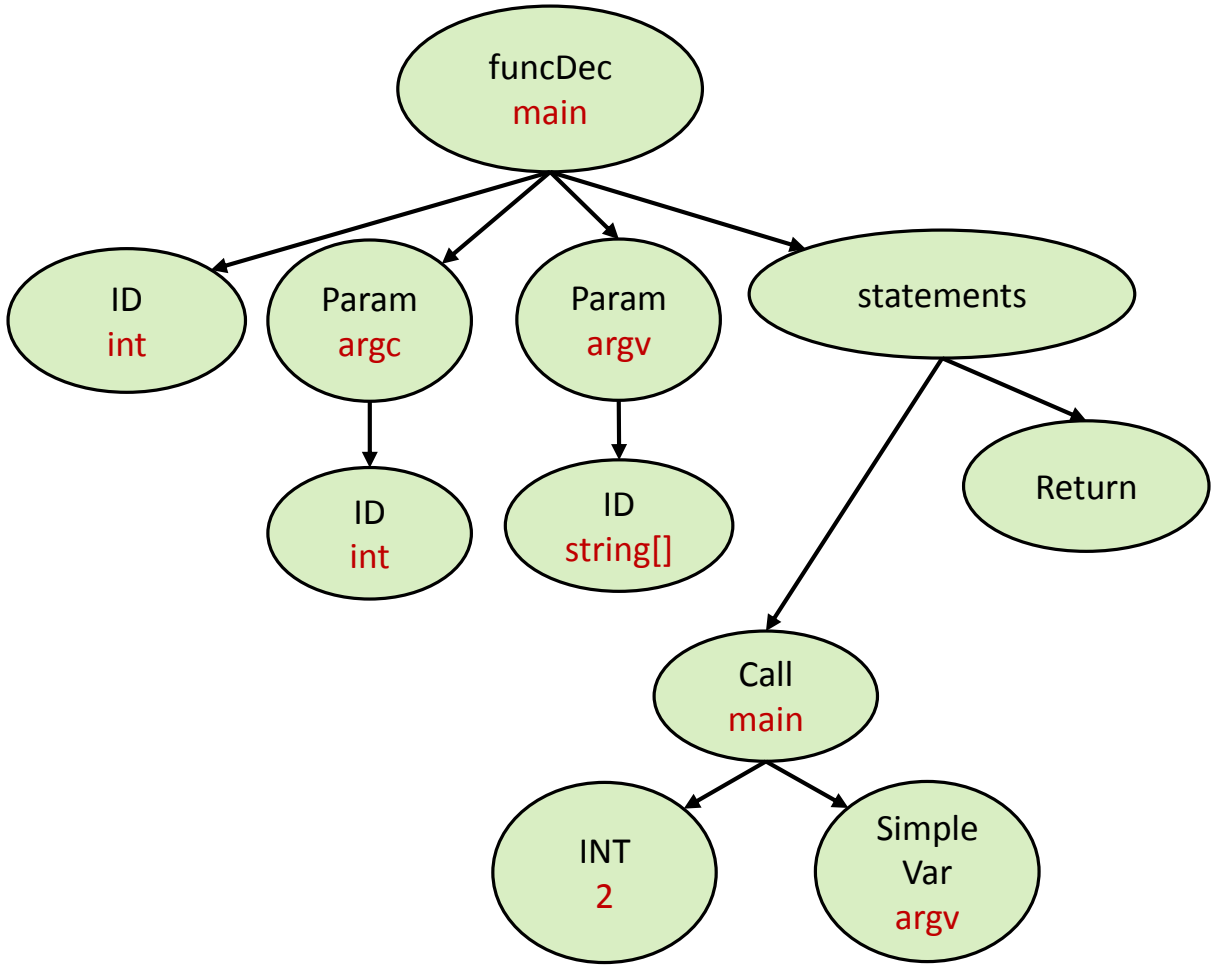
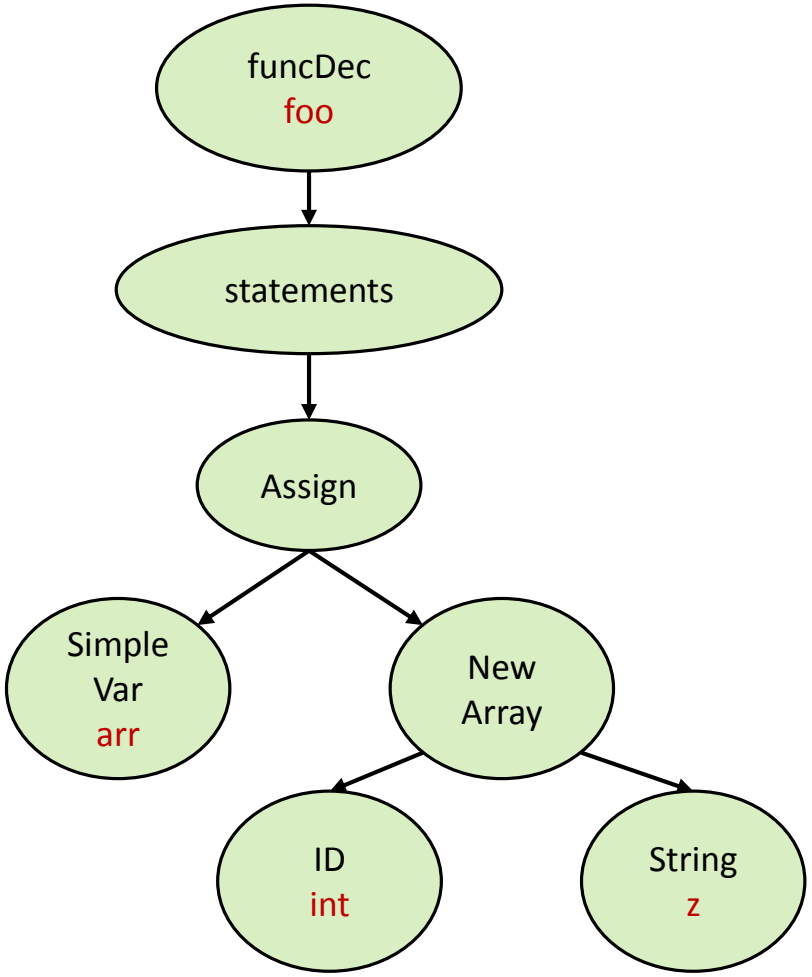


Arrays

```
void foo(void) {
  int[] arr = new int[“z”];
}
```



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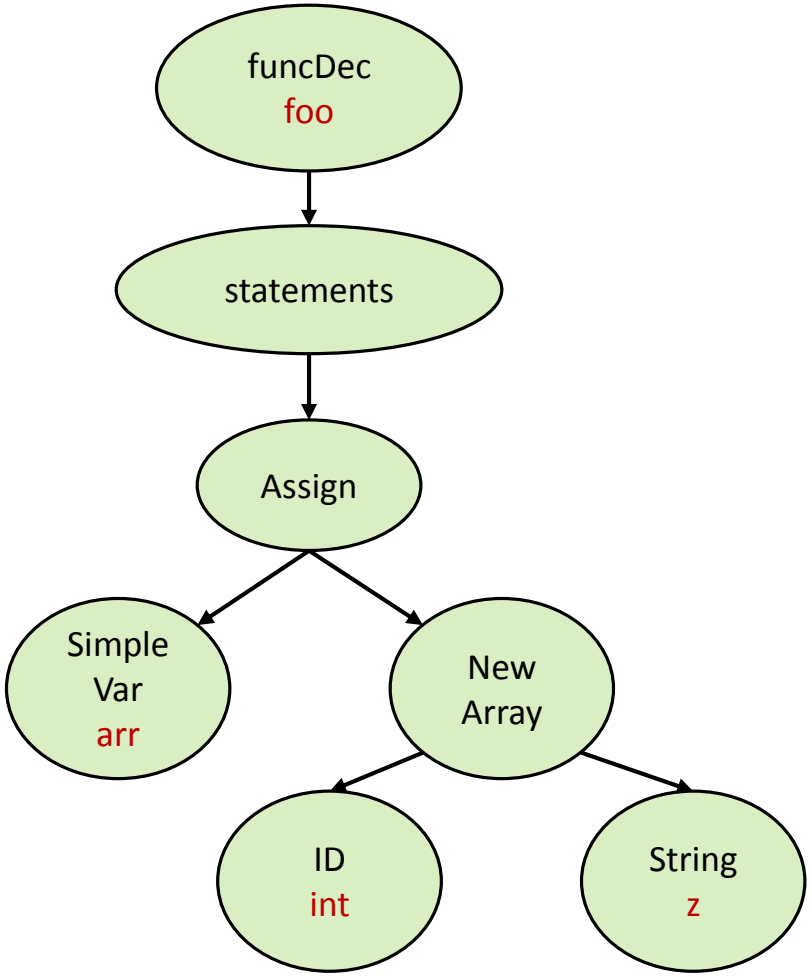
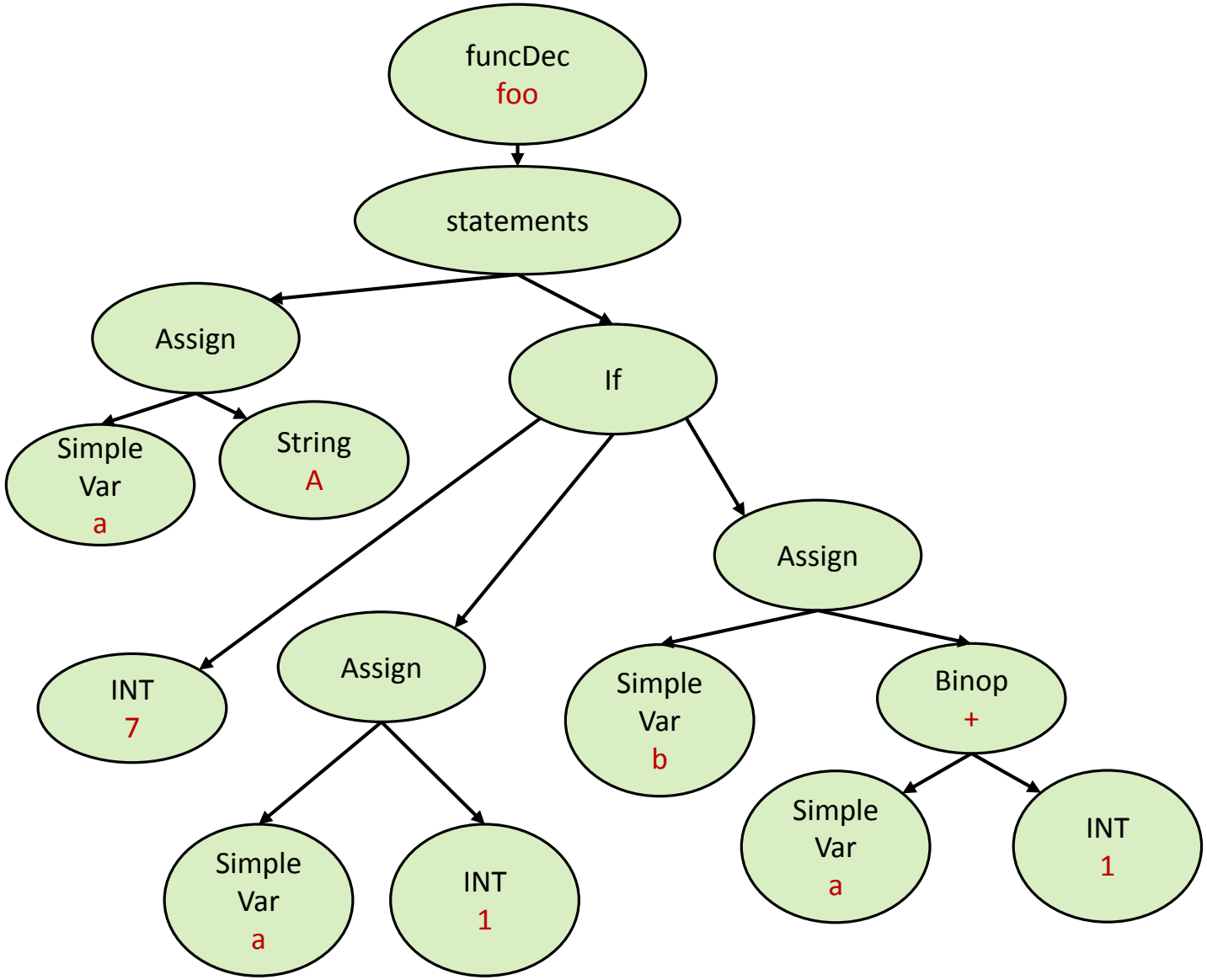


Scopes

```
void foo(void) {
   string a = "A";
   if (7) {
      int a = 1;
      int b = a + 1;
   }
}
```



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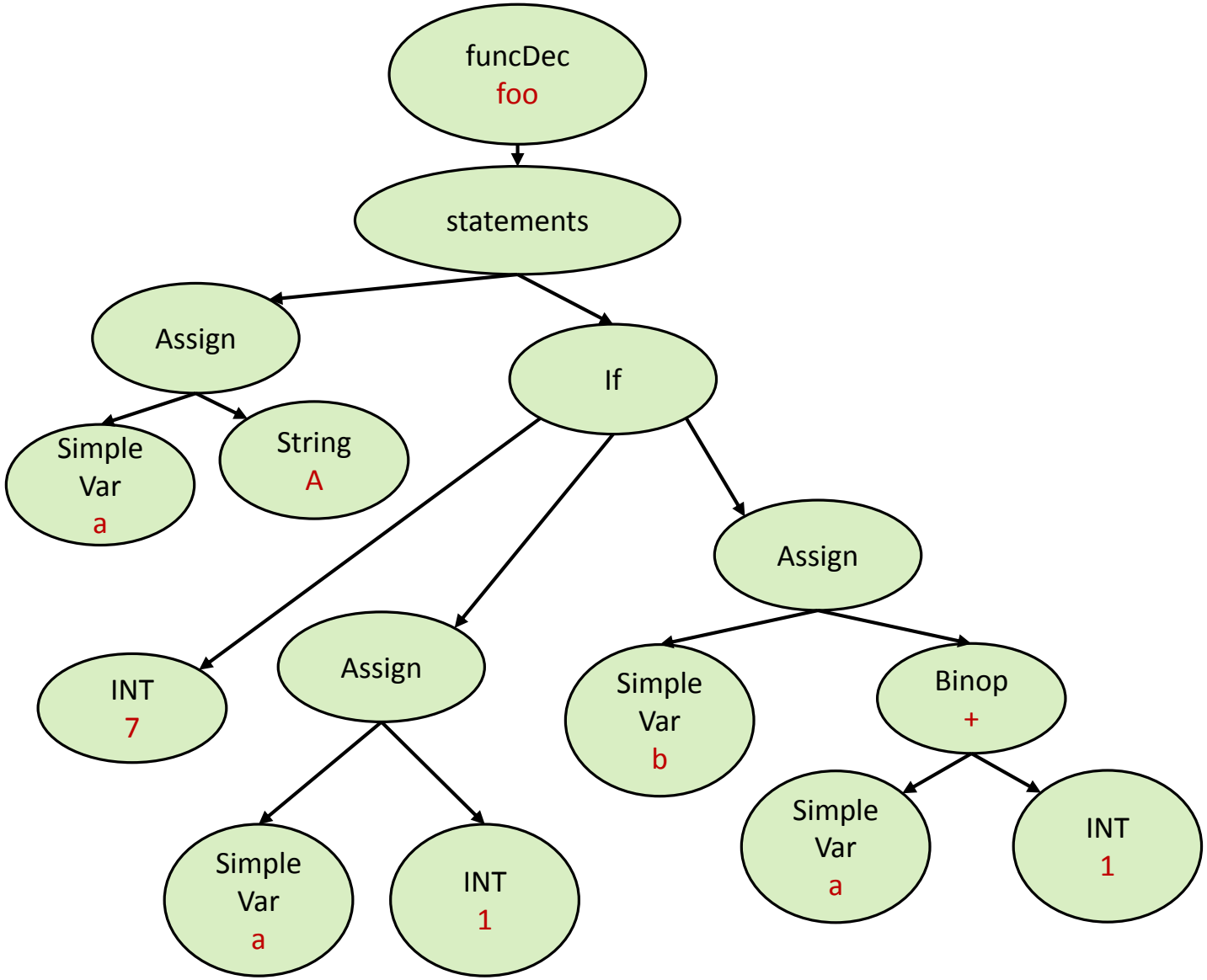

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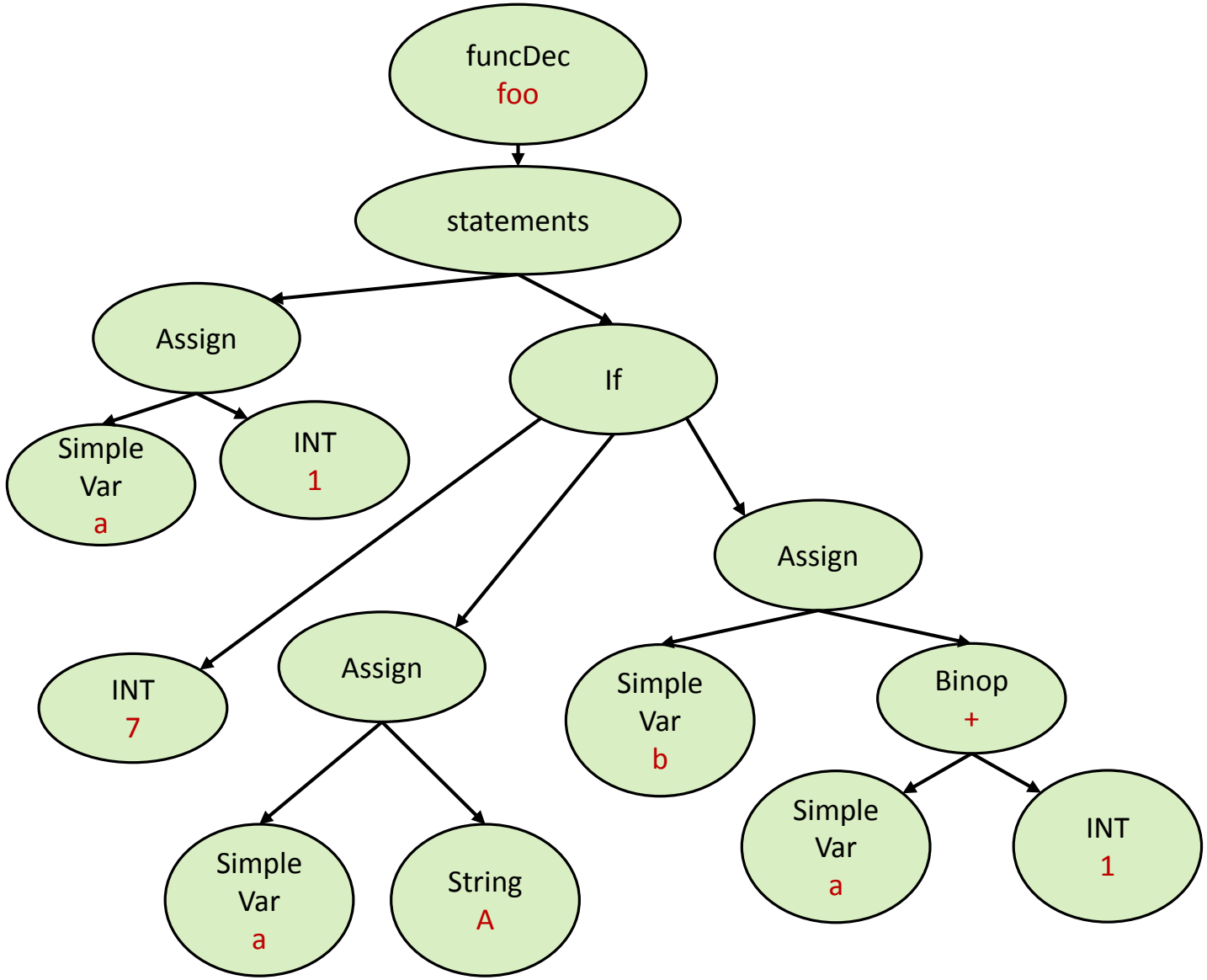

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