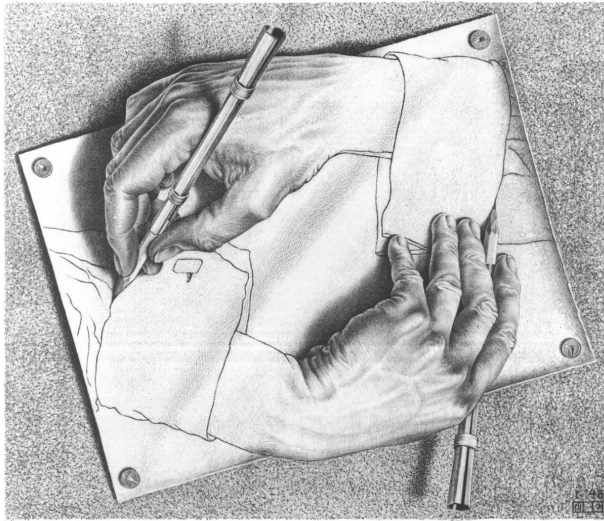


Recursion and Self-Reference

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Thought Questions:

Is recursion a paradox? Why do recursive computer programs execute? What is the difference between recursion in programming as you saw in lecture and the recursion in the drawing “Drawing hands” by M. C. Escher?

Thought Candies:

This sentence is false. (Epimenides Paradox)

This sentence does not explain self-reference, but it is self-referential.

Recursion defines recursion. (Try to google “recursion”!)

Appetizer Activity:

Come up with your own variations of the Epimenides Paradox. If you have one, write it on the whiteboard!

Compilers : A Chicken and Egg Problem?

Compilers are human-readable programs that translate other human-readable programs into a form that is easier for a machine to process. Compilers can even be written in the same language they compile; a concept known as “bootstrapping”.

So what compiles the compiler? Does it compile itself?

Section Problem:

Given a C++ program as a string, find all the functions it contains and store the function prototypes and their corresponding line numbers inside a map. The function prototype is the key and the corresponding line number is the value.

Let's say, we are given the following piece of code:

```
#include <iostream>
#include "console.h"

using namespace std;

const int DEPTH = 3;
int main() {
    performRecursion(DEPTH);
    return 0;
}

void performRecursion(int depth) {
    if (depth == 0) {
        cout << "This program is not self-referential" << endl;
    } else {
        performRecursion(depth - 1);
    }
}
```

Then, your map should contain:

```
int main() : 7
void performRecursion(int depth) : 12
```

Hint: A stack might be a useful data structure.

Implement the following function:

```
void mapFuncToLineNum(string & input, Map<string, int> & funcLines)
```

After you are done, discuss the robustness of your program. Would it work on any input? When would it fail? Can it run on itself? (i.e. the input string contains your program.)

Challenge: Quines!

Write a program that outputs its own code. These kind of programs are called "quines," named after American philosopher and logician Willard Van Orman Quine.

Craving for more?

- "Gödel, Escher, Bach - An Eternal Golden Braid" by Douglas R. Hofstadter
- Ken Thompson's speech "Reflections on Trusting Trust" (<http://cm.bell-labs.com/who/ken/trust.html>) has examples of how the C compiler is written in C and can compile itself
- Stanford Encyclopedia of Philosophy: <http://plato.stanford.edu/entry/self-reference/>