

Practice lessons of Theory of automata and Formal languages

Prof. Karl Thurnhofer Hemsí
Computer Science and Computer Language Department
University of Málaga

January 21, 2022

Practice 4

Program Numbering and **EXWHILE**

4.1 Set up

1. Run VirtualBox. Choose the Virtual Machine named ‘TALF18-19_Ubuntu18’.
2. Go into the *Campus Virtual* and download the file “Practica4.tar.gz”.
3. Decompress it using the command: `tar -xzvf Practica4.tar.gz`.

4.2 Coding and Decoding

The definitions of the coding and decoding functions seen in the theory can be easily implemented using any programming language, since they are based only on mathematical formulas. In this practice we provide a set of Octave scripts defining all these functions.

- Cantor coding and decoding.
- Gödel coding and decoding.
- sentence2N, CODE2N and WHILE2N for WHILE coding.

- N2sentence, N2CODE and N2WHILE for WHILE decoding.

Exercises

1. Open GNU Octave (which is already installed).
2. Set the working directory to the practice folder “octave-encoding”.
3. Code the vectors $(3, 2)$ and $(1, 0, 0, 0, 0)$ using both Cantor and Gödel coding functions. Are the resulting number the same?
4. Examine the results of the previous exercise. What is the principal difference between both coding functions?

4.3 Extended WHILE

As we have seen in theory lessons, the extended WHILE languages allows us to use more control sentences than the simple version. It is also possible to call functions from inside another function.

The file “codificaciones.txt” is an EXWHILE program that defines the Cantor coding-decoding for \mathbb{N}^2 . It takes a natural number as input and it performs a decoding and then code again the result.

Exercises

1. It is possible to create a Cantor coding EXWHILE program for any vector length? Why?
2. Using the programs of “codificaciones.txt”, create a program to code and decode vectors of \mathbb{N}^3 .

Activities

1. Create the simplest WHILE program that computes the *diverge* function (with zero arguments) and compute the codification of its code.
2. Create an Octave script that enumerates all the vectors.
3. Create an Octave script that enumerates all the WHILE programs.