

Task10

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Artificial Intelligence for the Web, VT21
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Februari 2021

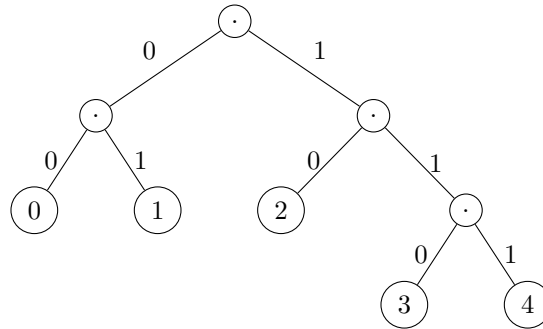
This task is about Golomb code and why it is considered as prefix-free code. Let's first understand the concept prefix-free. A code $f : X \rightarrow Y$ is a prefix-free code if no code word is a prefix of another code word, in other words, there does not exist any two distinct symbols $x_1, x_2 \in X$ such that $f(x_1)$ is the prefix of $f(x_2)$. An example of a prefix-free code can look like:

$$\{a = 0, b = 110, c = 10, d = 111\}$$

Let's now talk about Golomb code and try to analyse why it is considered as a prefix-free code. Golomb code uses a mathematical approach, with division and modulus of the binary representation of value x with a parameter M known as modulus. The result of division ($q_{variable}$) sets the amount of zeros in the beginning and the result of modulus ($r_{variable}$) sets the binary part and a delimiter, 1 is added to separate the two parts.

To summarize all this, let $n = q.m + r$, where $0 \leq r < m$. What to do now is basically divide m into n to get q as quotient and r as remainder. Then, the code for n has two parts, the first part is that q is coded in unary and the second part is that r is coded as prefix code.

Taking an example for $m=5$:



From the tree above, it obtains that:

$$\{0 = 00, 1 = 01, 2 = 10, 3 = 110, 4 = 111\}$$

which yields a prefix-free code because no code is a prefix of another code, meaning there is only one way to decode the codes.