Cyclic Sequences

Praneesh Padam
praneeshpadam@gmail.com

***Abstract*—This paper studies some properties of cyclic sequences.**

I. Introduction

Sequences which consist of only repeating objects of information. For example, we can consider the sequence of binary values representing the number 42:

1 0 1 0 1 0

The smallest partition that repeats itself is [1 0]. We can introduce positional indexes that map to our elements which are unique to each sub-sequence,

$$p_1 \to 0 \;\; p_2 \to 1$$

Now we can represent our original sequence in the form of smaller sequences of variable form:

42 = p q r s

$$p_1 p_2 q_1 q_2 r_1 r_2 s_1 s_2$$

Just like we mapped individual elements of our sub-sequence, we can also map the sub-sequences themselves, such that:

$$p \to 0 \;\; q \to 1 \;\; r \to 2 \;\; s \to 3$$

II. Distance

Let k be the number of elements in each sub-sequence

Case 1: Distance between elements $p_{\mathrm{i}} \in p$ and $s_{\mathrm{j}} \in s$

Distance d is given by,

$$d = |p_{\mathrm{f}} - p_{\mathrm{i}}| + |s_{\mathrm{j}} - s_0| + |p_{\text{index}} - s_{\text{index}} - 1| + |p_{\text{index}} - s_{\text{index}} - 1| * k$$

III. Occurrences

Let size represent the size of a sub-sequence

To find the occurrences of a_{n} in a range of the sequence

Let pos be the set consisting of all the locations of each a_{n} in a complete sub-sequence

Occurences o is given by,

$$o = length(p \cap pos) + length(s \cap pos) + size * (k - 2)$$

IV. Prediction

Let sub represent a complete sub-sequence

From element p_{i}, find what the n^{th} element would be,

Let num be the number of sub-sequences possible,

$$num = |n - (p_{\mathrm{f}} - p_{\mathrm{i}})|/size$$

if num is a natural number, then n^{th} element is the last element in our last sub-sequence

if num is a decimal number, then the decimal part represents the partial sub-sequence where the last element is the n^{th} element

Let z be the decimal part of num

Element is given by,

$$el_{\mathrm{n}} = last - element((1/z) * sub)$$