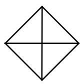


Why

Can flashlights speak?

Speech can be made to correspond to words. And words are sequences of letters. So, roughly, can we communicate letters with a flashlight? The game is: no sounds.

Discussion

Well, what can we do with a flashlight? Turn it on and off. So we can show blinks of light. Here's a thought: One blink means a. Two blinks means b. Three blinks means c. Four blinks means d. And so on.

Here's the rub: how do we know when one letter stops, and another begins. Put another way, does 7 blinks mean (g), or (b, a, d), since $2 + 1 + 4 = 7$, or (c, d), since $3 + 4 = 7$, or (d, c) and so on. If we change the game, maybe we can change the color of the flashlight. Or give a half-flash. Is a half-flash a "quick" flash, or is it a flash in which we have covered up half of the end of the flashlight?

The first question is a clue. The duration of the blink. How about the duration between blinks? A one second pause in between blinks for a letter. A three second pause for blinks in between letters. A five second pause for a space, to indicate a change of a word? Or an additional symbol, a "space", in our alphabet, communicated with 27 (!) blinks?

Definition

Let $\star$ represent a blink. The *flash code*[1] for the alphabet A (the latin lower case letters) is the function $f : A \to \mathcal{S}(\{\star\})$ defined by $f(a) = \star$, $f(b) = \star\star$, $f(c) = \star\star\star$, $f(c) = \star\star\star\star$ and so on. We call $f(a)$ the *code word* of $a \in A$. It is a sequence of blinks.

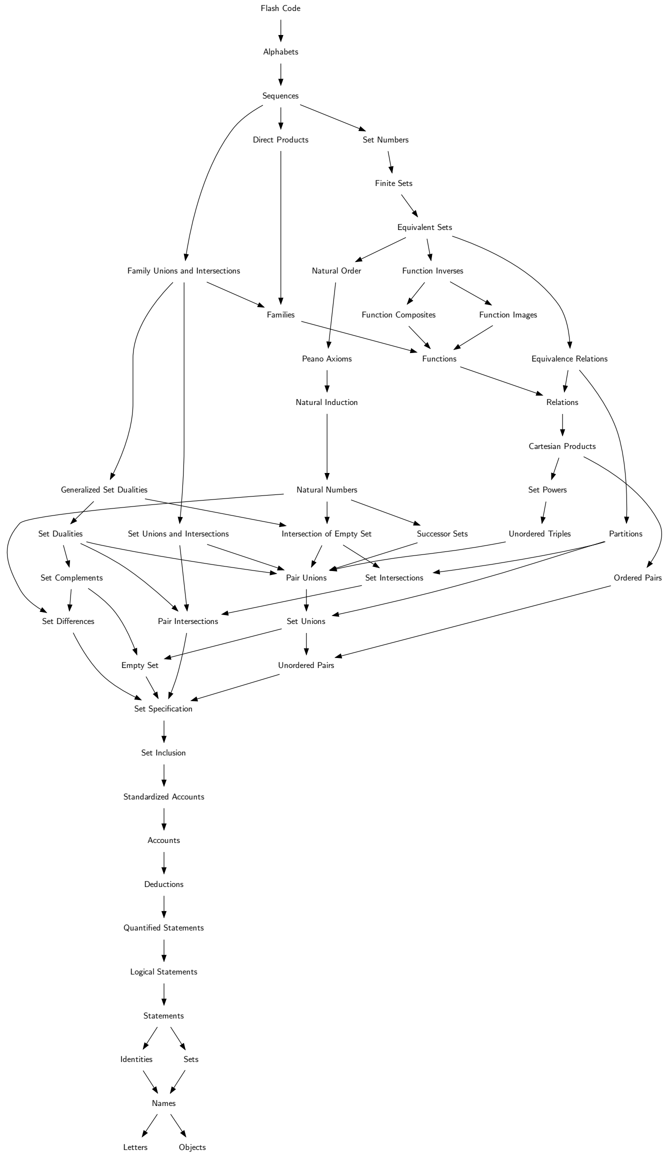
The idea is that if we give someone the *code word* $f(a)$ for a letter of our alphabet $a \in A$, they will be able to tell us a. In the language of functions, we want f to have an inverse. Clearly, f is invertible.

It is natural to extend the flash code for A to strings of A. Let $\square$ represent a long pause. Then we encode a sequence $x \in \mathcal{S}(A)$ by applying f to each element of x in turn, and including a $\square$ in between. The *flash code* for the strings $\mathcal{S}(A)$ is the function $g : \mathcal{S}(A) \to \mathcal{S}(\{\star, \square\})$ defined recursively, as $g(x) = f(x_1')$ for length one strings x', $g(x'') = f(x_1'')\square f(x_2)$ and for length n strings x by $f(x_1)\square g(x_{2:n})$. For example, we encode the word (string) (b, a, d) as

$$\star\star\square\star\square\star\star\star\star \tag{1}$$

Now suppose we are given a sequence as shown in (1). Well, so long as f is invertible, we look can decode the codewords (the blinks, in this case) in between the squares and recover the word.

[1] The etymology of code is from the Latin codex, in the legal tradition of a list of statutes. We may well use the term correspondence, or function, but code is standard.


Flash Code
Alphabets
Sequences
Direct Products
Set Numbers
Finite Sets
Equivalent Sets
Family Unions and Intersections
Natural Order
Function Inverses
Families
Function Composites
Function Images
Peano Axioms
Functions
Equivalence Relations
Natural Induction
Relations
Cartesian Products
Generalized Set Dualities
Natural Numbers
Set Powers
Set Dualities
Set Unions and Intersections
Intersection of Empty Set
Successor Sets
Unordered Triples
Partitions
Set Complements
Pair Unions
Set Intersections
Ordered Pairs
Set Differences
Pair Intersections
Set Unions
Empty Set
Unordered Pairs
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects