

# Simplifying Memory Management by Sharing Immutable Succinct Memory Images of Isomorphic Data Objects

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What can 2012 succinctly encode? [1,0,1,1,1,0,1,1,1,1]

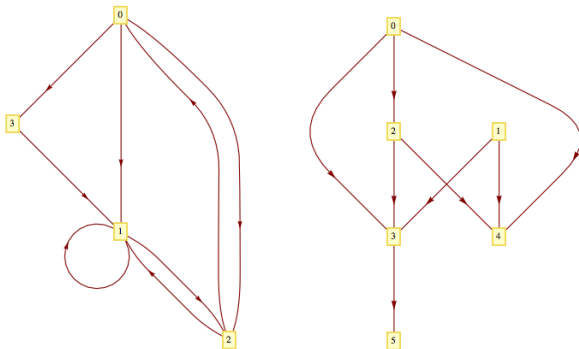


Figure: 2012: as a *digraph* and as a *DAG*

# What else can 2012 succinctly encode?

a set: [2,3,4,6,7,8,9,10]

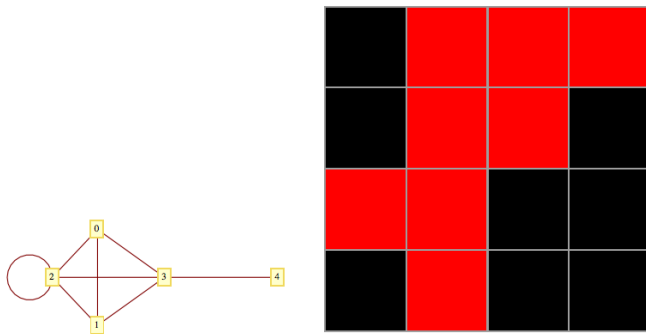


Figure: 2012: *as a graph and as a binary relation*

# What else can 2012 succinctly encode?

a hypergraph:  $[[0,1],[2],[0,2],[0,1,2],[3],[0,3],[1,3],[0,1,3]]$

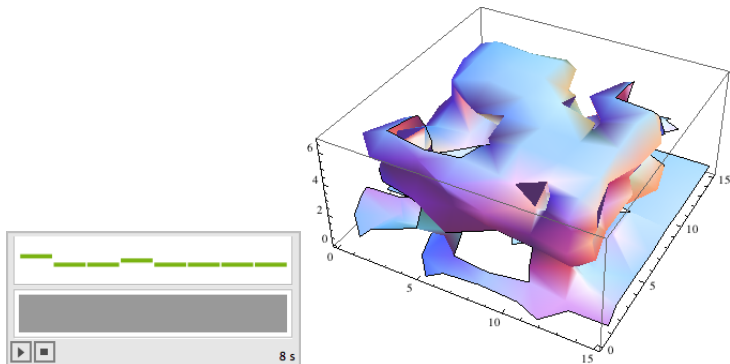


Figure: 2012: *as a sound track and as a shape*

# What else can 2012 succinctly encode?

DNA: [Adenine,Thymine,Cytosine,Thymine,Thymine,Cytosine]

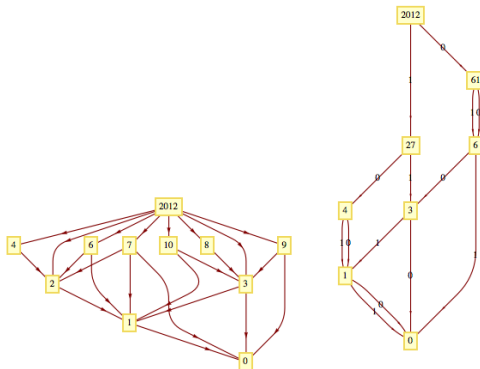


Figure: 2012: as DAGs representing a rose tree and a binary tree

# The Idea Itself

- from Gödel's theorems: unique *natural numbers* are associated to *formulas* and *proofs*
- from combinatorics: ranking/unranking *bijections* between trees, graphs etc. and natural numbers
- succinct representations - a lot of things fit in a few bits - as shown in the previous slides

⇒

- share a *unique succinct memory image* independently of what it represents externally
- this assumes that the image is *immutable* and the clients know what it *means* to them - for instance by keeping track of types
- note that objects fitting in a word are (obviously) just copied
- larger objects point to their smaller parts in the monotonically growing store of immutable objects

# Building such isomorphisms in a principled way

How to build these isomorphisms? 150 pages of literate Haskell at:

- <http://logic.csci.unt.edu/tarau/research/2010/ISO.pdf>
- <http://logic.csci.unt.edu/tarau/research/2010/ISO.hs>
- a few of them of them, this time in Java at:

<http://logic.csci.unt.edu/tarau/research/bijectiveNSF/>

Just in case - various tree types can also be used for *arbitrary size arithmetic computations*, see PPDP'10 paper - draft at:

[http://logic.csci.unt.edu/tarau/research/2010/tarau\\_ppdp2010\\_draft.pdf](http://logic.csci.unt.edu/tarau/research/2010/tarau_ppdp2010_draft.pdf)

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