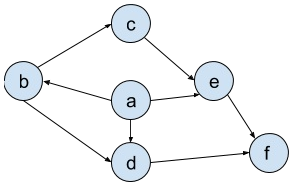
Hashes

As we learned breifly at the end of class today, a *hash function* is a map from a set of information of varying sizes (for example, a string of arbitrary length) to a set of information of same length (for example, 32-bit integers). To be clear, this definition requires that the function be *deterministic*, meaning that if I put something in multiple times, I'll get the same answer out every time. Note that this doesn't disallow, and in fact cannot disallow, *collisions*: finding two inputs which hash to the same value. However, one desirable effect is that a hash function have *good avalanching*, meaning that the changes in input and changes in output are uncorrelated: if I change `hello` to `helln`, then their hashes should probably be very different.

Come up with a hash from binary numbers of any length to 32-bit integers that ensures that no two (distinct) numbers with the same length (*i.e.* number of bits) form a collision. Give an informal justification as to why you think you're right.

DAGs

Let us say that the *graphical form* of a DAG is the visual picture of the graph. Let us say that the *file form* of a DAG is as follows. Given a graph whose graphical form is:



It's file form is:

```
{a:[b, d, e], b:[c, d], c: [e], d: [f], e: [f], f: []}
```

What is a sure-fire way to write down something that *looks like* the file form of a DAG and ensure that it in fact *is* the file form of some DAG? Test out your hypothesis by creating two examples, and one non-example (example of the hypotheses not being held results in a non-DAG).