Code #4: EVENODD

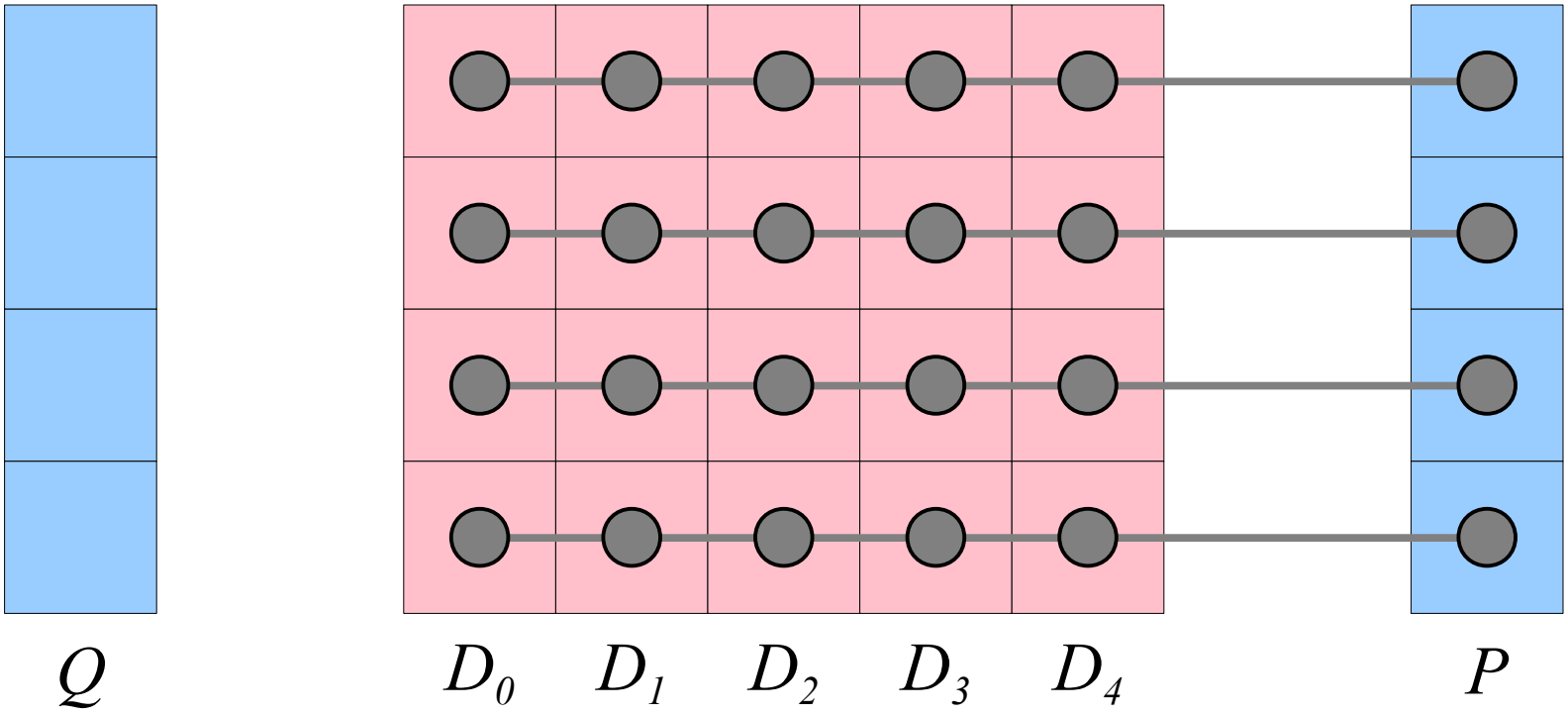
(1994)

EVENODD – Properties & Constraints

- RAID-6: $m = 2$
- Systematic
- Horizontal
- MDS
- $w = 1$: Only XOR operations.
- k must be a prime (that will be relaxed).
- r is set to $k-1$.

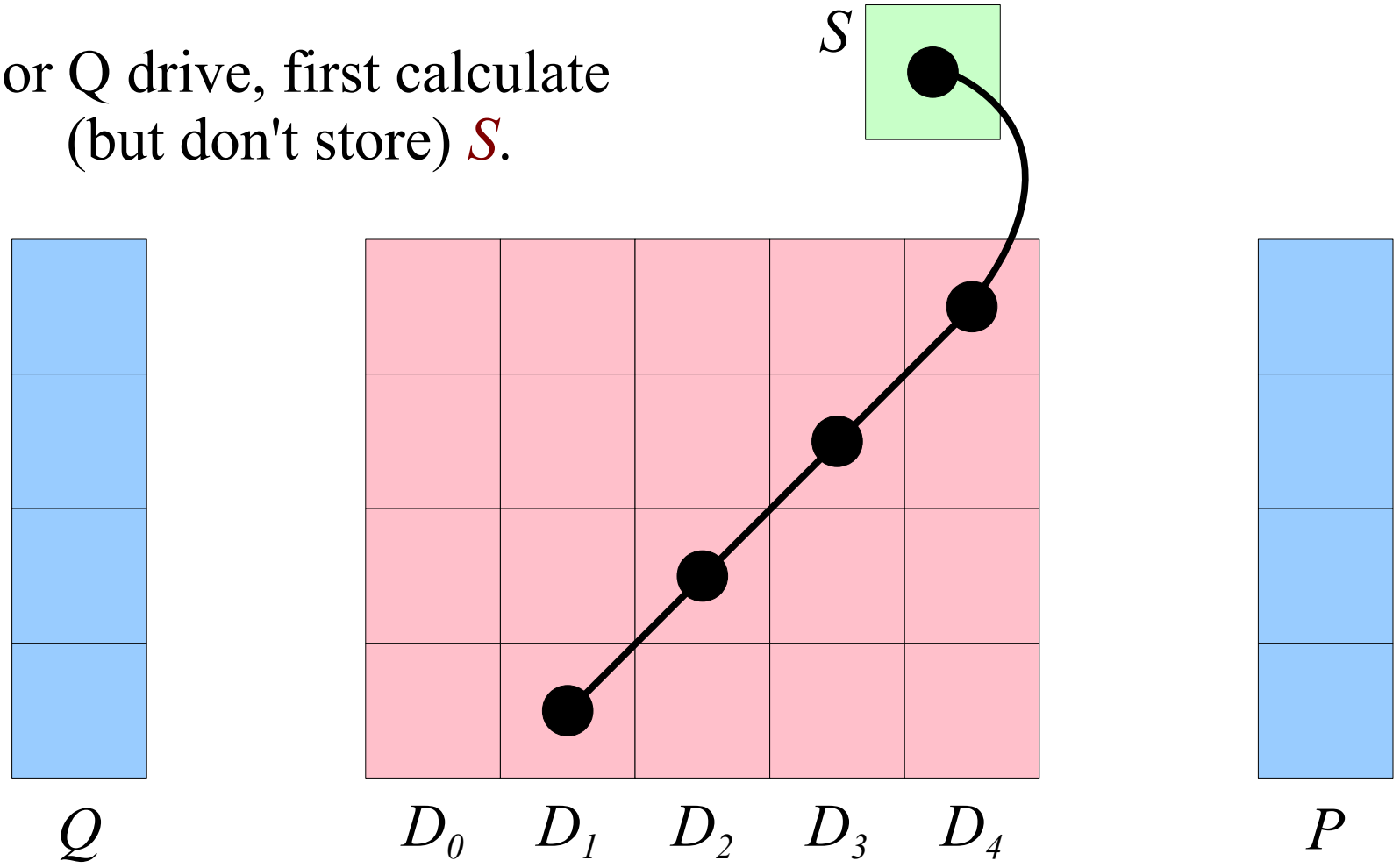
EVENODD Example: *k=5 (r=4)*

The *P* drive is parity (like in most codes).
Lines denote XOR relationship.



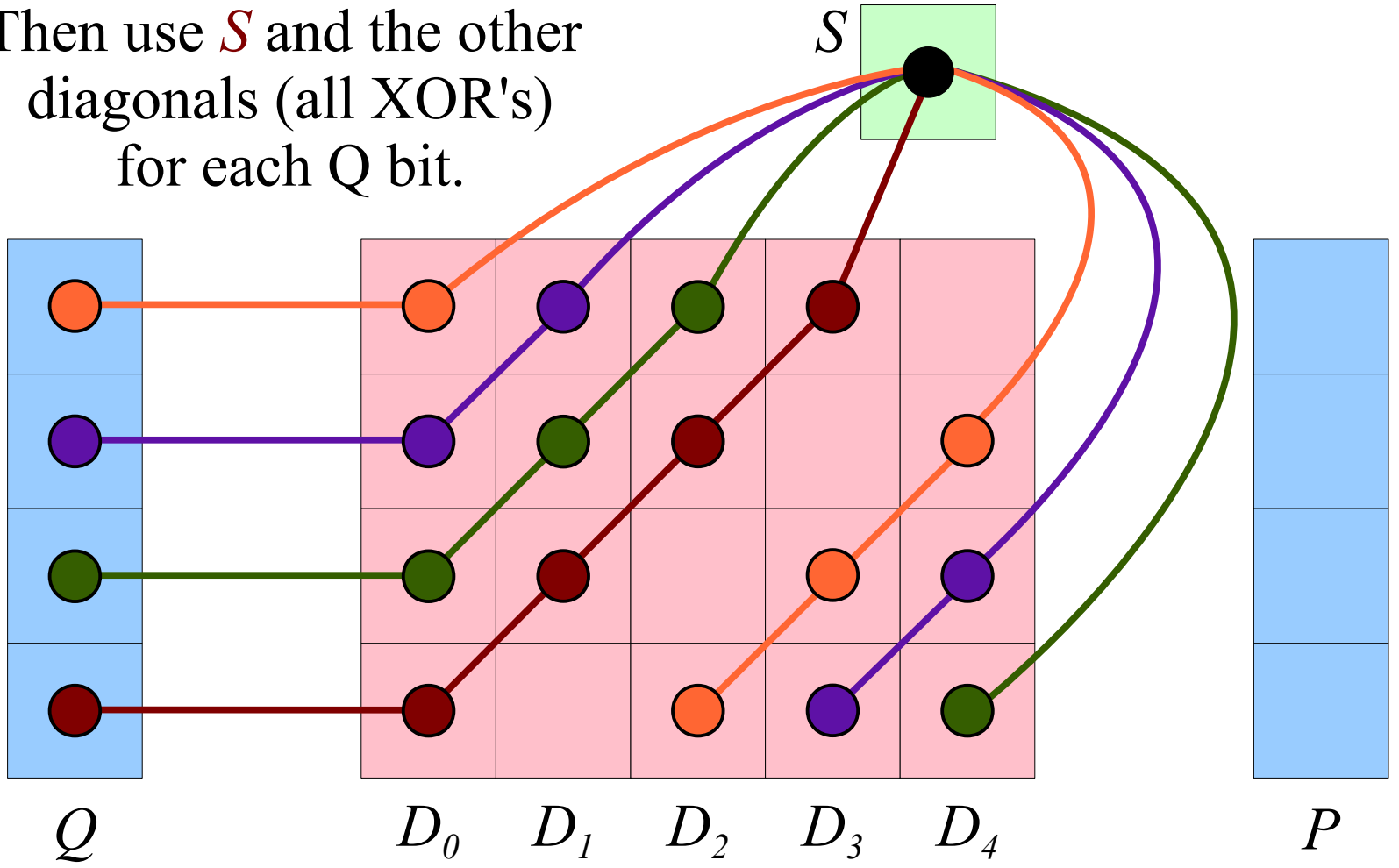
EVENODD Example: *k=5 (r=4)*

For Q drive, first calculate (but don't store) *S*.



EVENODD Example: *k=5 (r=4)*

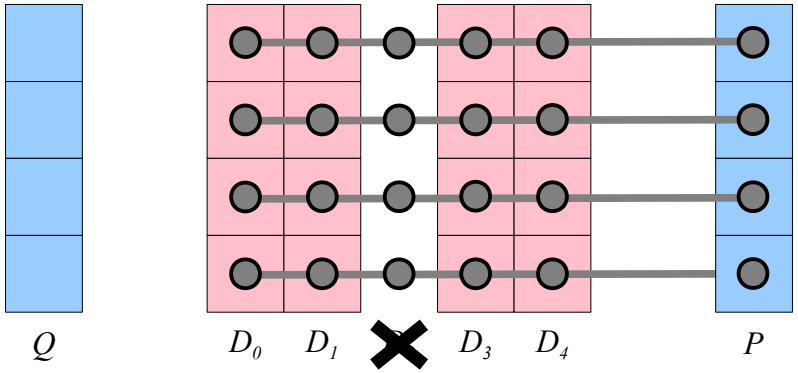
Then use *S* and the other diagonals (all XOR's) for each Q bit.



You'll note, each diagonal chain is missing one data drive.

EVENODD Example: *k=5 (r=4)*

Decoding single failures is simple: just use the P drive (more on that later with Cheng).

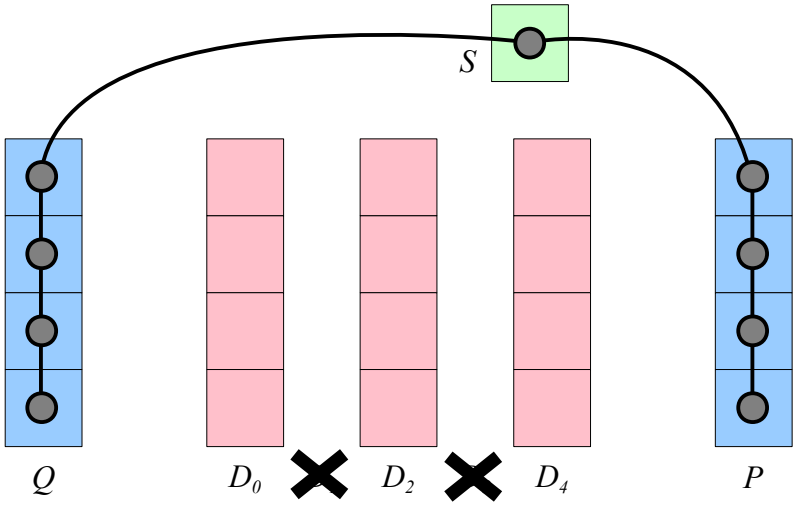


The difficult case is decoding when two data disks fail.

So, we'll go through an example when D_1 and D_3 fail.

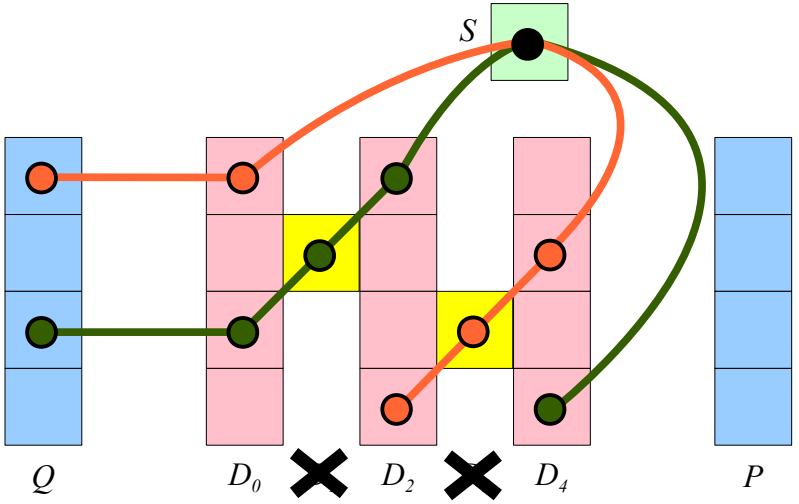
EVENODD Example: *k=5 (r=4)*

The first thing to do is calculate *S*, which equals the XOR of all of the bits in P and Q.



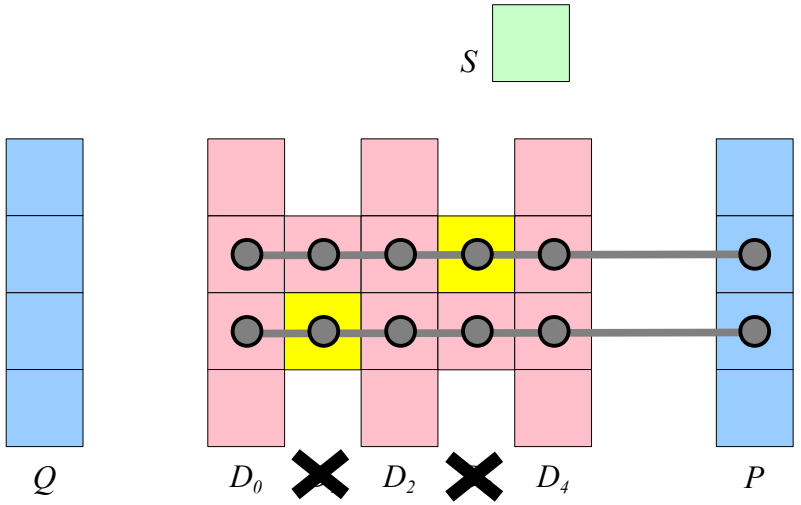
Then recall that each diagonal is missing a drive.

Use the ones missing D_1 and D_3 to recover one bit in D_3 and D_1.

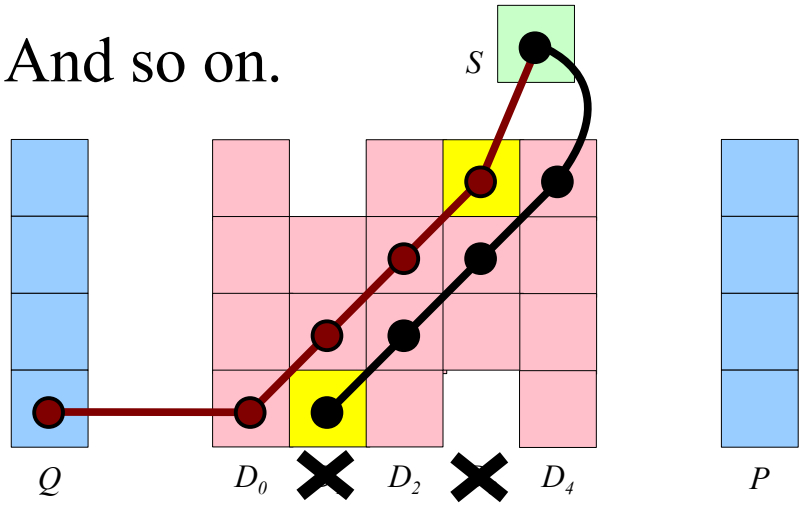


EVENODD Example: *k=5 (r=4)*

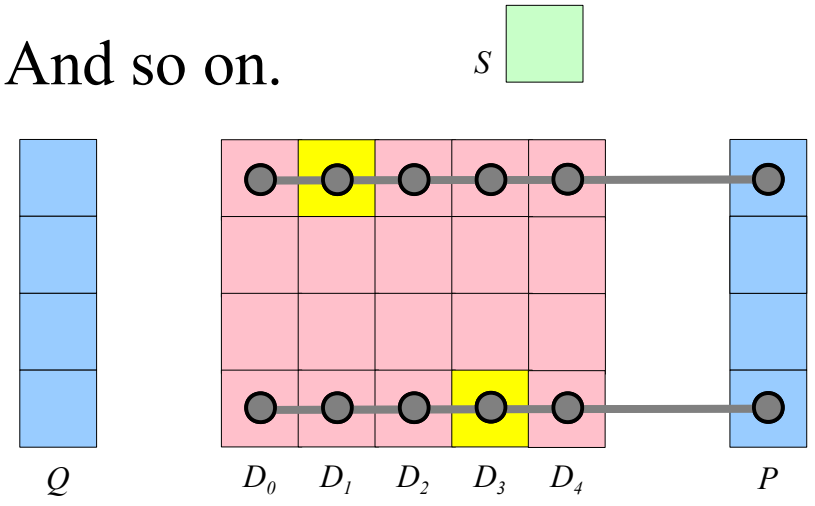
Now use these new bits and the P drive to decode two more bits.



And so on.

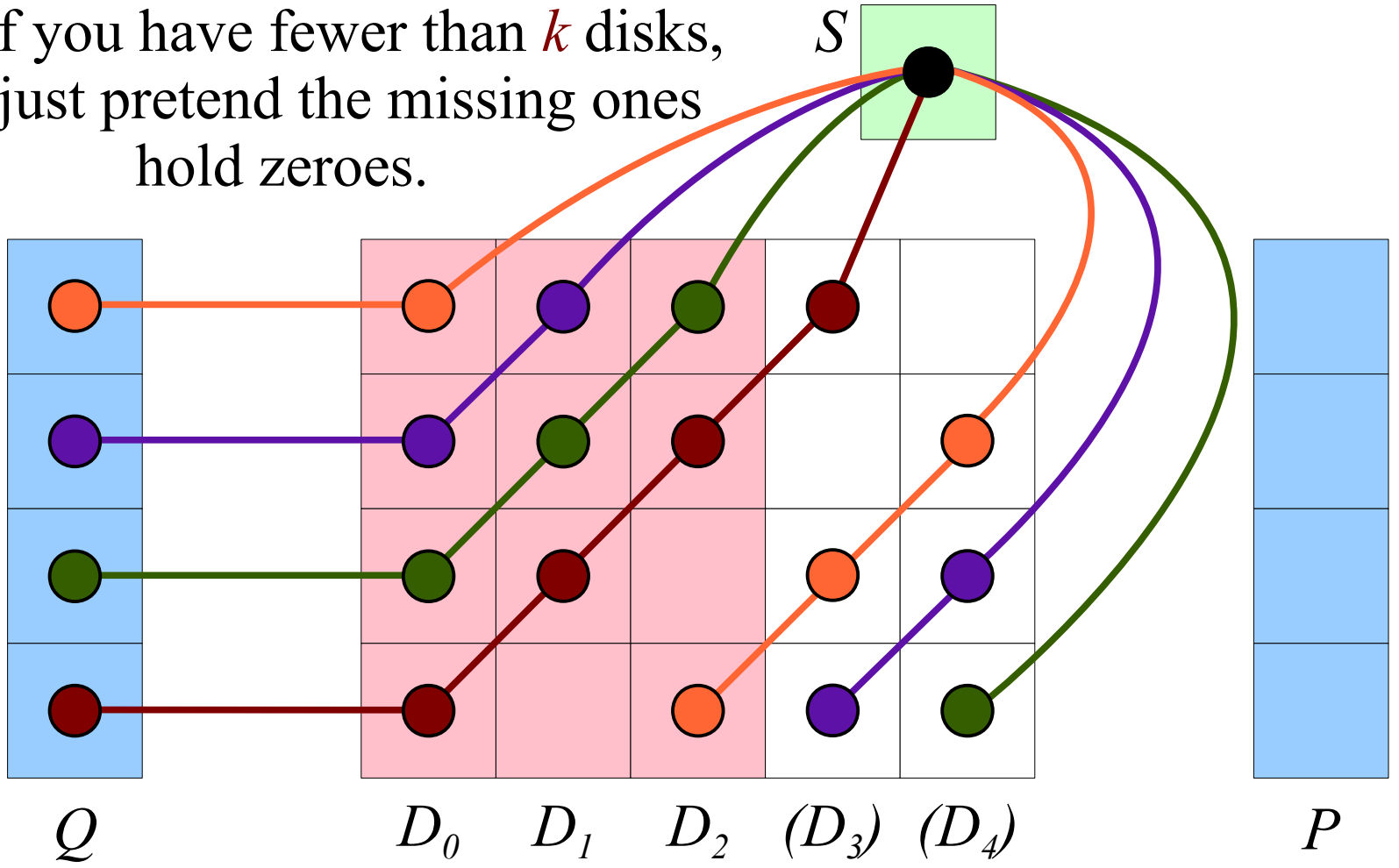


And so on.



Shortening the code.

If you have fewer than *k* disks, just pretend the missing ones hold zeroes.



You can do that with any horizontal code.