Discussion 14: Parity, ECC, RAID

Hamming ECC

Recall the basic structure of a Hamming code. Given bits 1, . . . , m, the bit at position 2^n is parity for all the bits with a 1 in position n. For example, the first bit is chosen such that the sum of all odd-numbered bits is even. 010 -> odd parity and 11 -> even parity.

Bit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Data	P1	P2	D1	P4	D2	D3	D4	P8	D5	D6	D7	D8	D9	D10	D11
P1	X		X		X		X		X		X		X		X
P2		X	X			X	X			X	X			X	X
P4				X	X	X	X					X	X	X	X
P8								X	X	X	X	X	X	X	X

i. How many bits do we need to add to 0011_2 to allow single error correction?

ii. Which locations in 0011_2 would parity bits be included?

iii. Which bits does each parity bit cover in 0011_2?

iv. Write the completed coded representation for 0011_2 to enable single error correction.

v. How can we enable an additional double error detection on top of this?

vi. Find the original bits given the following SEC Hamming Code: 0110111_2

vii. Find the original bits given the following SEC Hamming Code: 1001000_2

RAID

Fill out the following table:

	Configuration	Pro / Good for…	Con / Bad for…
RAID 0			
RAID 1			
RAID 4			
RAID 5			

Note: RAID 2 and 3 are conceptually the same as RAID 4, but with bit-striping and byte-striping instead.