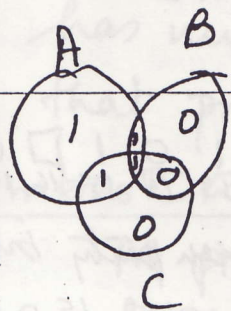
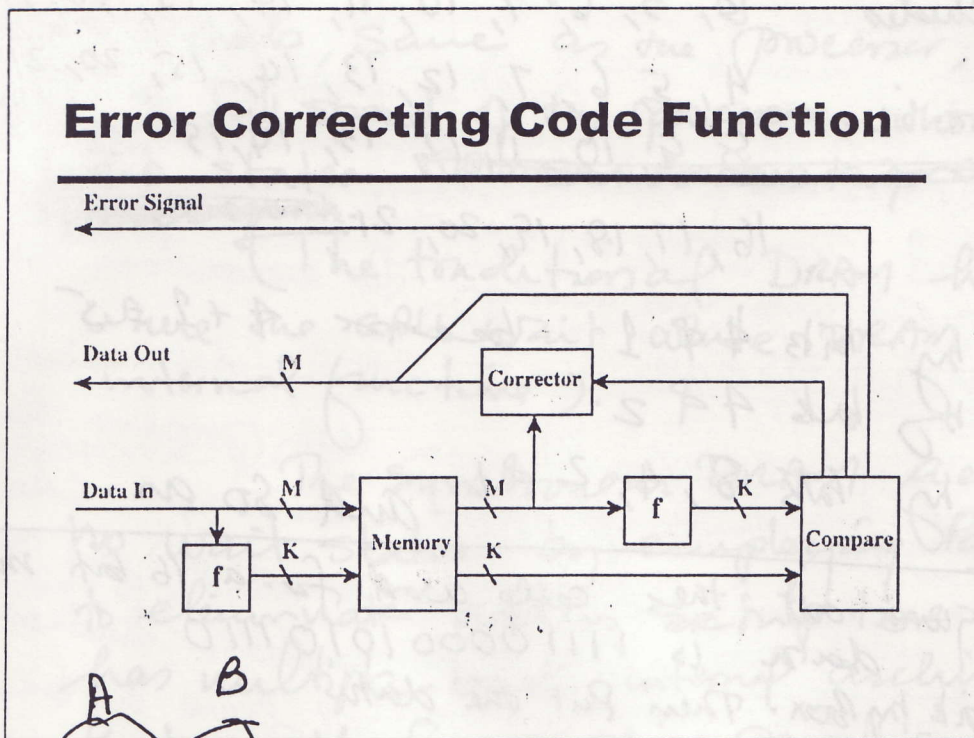


# Error Correcting Code Function



If an error changes one of the data bits. It is easily detected. See this example



Not ok

A is now even

B but has a parity bit

B is OK

C is now odd but has no parity bit it is zero

So the problem should have arisen where it is Cameras APC

Change that and try it!

We can use Hamming algorithm to construct error detecting codes for any memory word.

K parity bits are added to m-bit word.

Now word is then m+K bits.

We can mix the data of parity. Number from 1 to 21 not 0 to 20

All bits that are power of 2 are parity bits, rest are data bits. For a 16 bit word, 5 parity bits are added → 1, 2, 4, 8, 16. The rest are data bits.

Bits needed  $2^k - 1$   $2^3 - 1$

This data A bit requires a word of 3 bits parity bit

Only single bit errors can be corrected.

Each parity bit checks specific positions.

Parity Bit 1	checks bits	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21
2	checks	2, 3, 6, 7, 10, 11, 14, 15, 18, 19.
4		4, 5, 6, 7, 12, 13, 14, 15, 20, 21
8		8, 9, 10, 11, 12, 13, 14, 15
16		16, 17, 18, 19, 20, 21.

Bit 5 is checked by bits 4 & 1 because  $4 + 1 = 5$

Bit 6 is checked by bits 4 & 2

Bit 15 is checked by bits 8, 4, 2 & 1 and so on.

Let us try figure out the code word for a 16 bit number  
data is 1111000010101110

Mark parity bit by box. Then put the data

<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	1	1	1	<input type="checkbox"/>	0	0	0	0	1	0	1	<input type="checkbox"/>	0	1	1	1	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Now place the parity after counting one for each parity bit checks.

Example Parity bit 1 checks 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

There are 5 in ones. So put a zero.

<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>				<input type="checkbox"/>								<input checked="" type="checkbox"/>					
1	2		4				8								16					

Suppose an error was introduced and the new code word is

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	0	1	1	<input type="checkbox"/>	0	0	0	0	1	0	1	<input checked="" type="checkbox"/>	0	1	1	1	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

- Parity bit 1 contains 4 ones. so parity is wrong. ✓
- 2 contains 5 ones. Correct.
- 4 contains five 1's incorrect
- 8 contains two 1's Correct
- 16 contains four 1's Correct

Error must be in one bit common to 1 and 4 parity bit lists.

Now take out the bits common in other lists. 5, 7, 13, 15, 21  
Leaves 8, 13, 21  
all 6 bits in correct