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→ BCH codes

(t bit error correction possibility)

Formulas :

Block length $n = 2^m - 1$

No. of msg bits $k \geq n - mt$

Minimum distance $d_{min} \geq 2t+1$

Degree (r) of n, k $= n - k$

$k = n - r$

In Questions :

n

GF( )

~~p(x)~~

t

} Given (any two of these)

k

g(x)

} To find

Remember

If $n = 7$

$x^7 + 1 = (x+1)(x^3+x+1)(x^3+x^2+1)$

Min Poly	Elements of GF(8)
$(x+1)$	α^7
(x^3+x+1)	$\alpha^1, \alpha^2, \alpha^4$
(x^3+x^2+1)	$\alpha^3, \alpha^6, \alpha^5$

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If $n = 15$

$$x^{15} - 1 = (x+1)(x^4+x+1)(x^4+x^3+x^2+x+1)(x^2+x+1)(x^4+x^3+1)$$

Min Poly	Elem of GF(16)
$x+1$	α^{15}
x^4+x+1	$\alpha^1, \alpha^2, \alpha^4, \alpha^8$
$x^4+x^3+x^2+x+1$	$\alpha^3, \alpha^6, \alpha^{12}, \alpha^9$
x^2+x+1	α^5, α^{10}
x^4+x^3+1	$\alpha^7, \alpha^{14}, \alpha^{13}, \alpha^{11}$

→ How to solve?

1. Have GF & $p(x)$
   GF(8), $p(x) = x^3+x+1$
   GF(16), $p(x) = x^4+x+1$
2. Find $\alpha_1, \alpha_2 \dots$ by mod $p(x)$
3. Use the remember part & the below eqn
   $g(x) = \text{LCM}\,[f_1(x), f_2(x), f_3(x) \dots f_{2t}(x)]$
   $f_1 \rightarrow \alpha^1$; $f_2 \rightarrow \alpha^2$: Simply Multiply their Min Poly's
4. Use degree of $g(x)$ to find k
   $n - k =$ degree of $g(x)$