

Q1: Since $g(1) = 0$

$$\Rightarrow c(1) = m(1)g(1) = 0.$$

\Rightarrow all codewords of \mathcal{C}
are of even weight.

Q2: Since $(x+1) \mid (x^n - 1)$
and since $p(x) \mid (x^n - 1)$

$$\Rightarrow \text{L.C.M.}(x+1, p(x)) \mid x^n - 1$$

$$\because \text{g.c.d.}(x+1, p(x)) = 1$$

($p(x)$ is irreducible)

$$\Rightarrow g(x) = (x+1) \cdot p(x) \mid x^n - 1$$

$\Rightarrow \mathcal{C}$ is cyclic.

Q3

$d_{\min} \leq$ weight of any row
vector of G matrix

$$= \sum_{b \in \{0,1\}^m} \mathbb{1}_{\{b_i=1 \text{ for all } i \in S\}}$$

$$= 2^{m-|S|}$$

by choosing $|S|=r$

$$\Rightarrow d_{\min} \leq 2^{m-r}$$

Q4

$\Phi_1(x)$ has roots $\beta^1, \beta^2, \beta^4, \beta^8$

$\Phi_4(x)$ has roots β^4, β^8, \dots

$$\Rightarrow \Phi_1(x) = \Phi_4(x)$$

$$\Phi_3(x) \text{ has roots } \beta^3, \beta^6, \beta^{12}, \beta^{24}, \dots$$

$$\Phi_6(x) \text{ has roots } \beta^6, \beta^{12}, \beta^{24}, \dots$$

$$\Rightarrow \Phi_3(x) = \Phi_6(x)$$

For any even $j = i \cdot 2^r$

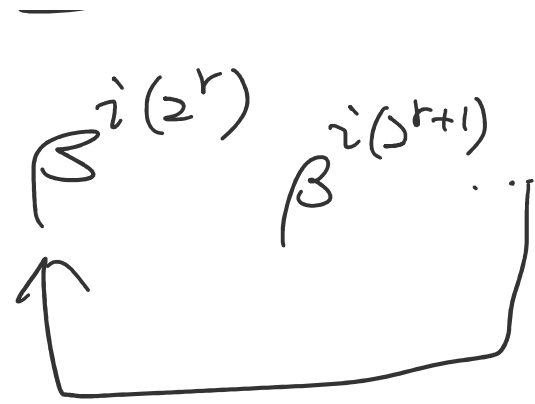
where i is odd

and $r \geq 1$.

$$\Phi_i(x) \text{ has roots } \beta^i, \beta^{i \cdot 2}, \beta^{i \cdot 2^2}, \dots$$

$$\Phi_{i \cdot 2^r}(x) \text{ has roots } \beta^{i \cdot 2^r}, \dots$$

$\tilde{\Phi}_j(x)$ has roots



$$\Rightarrow \tilde{\Phi}_i(x) = \tilde{\Phi}_j(x).$$