Serial #

○

- 1 points for not writing your serial number

King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE430: Information Theory and Coding (072)
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Quiz 5: Cyclic Codes

Name: KEY

In all parts show your steps

3 1. Consider a (7,4) code defined by the generator polynomial, $g(X)=1+X^2+X^3$. Is $c(x)=1+X+X^4+X^5$ a valid codeword at the output of this systematic encoder.

3 2. Sketch the general block diagram for a Migget decoder

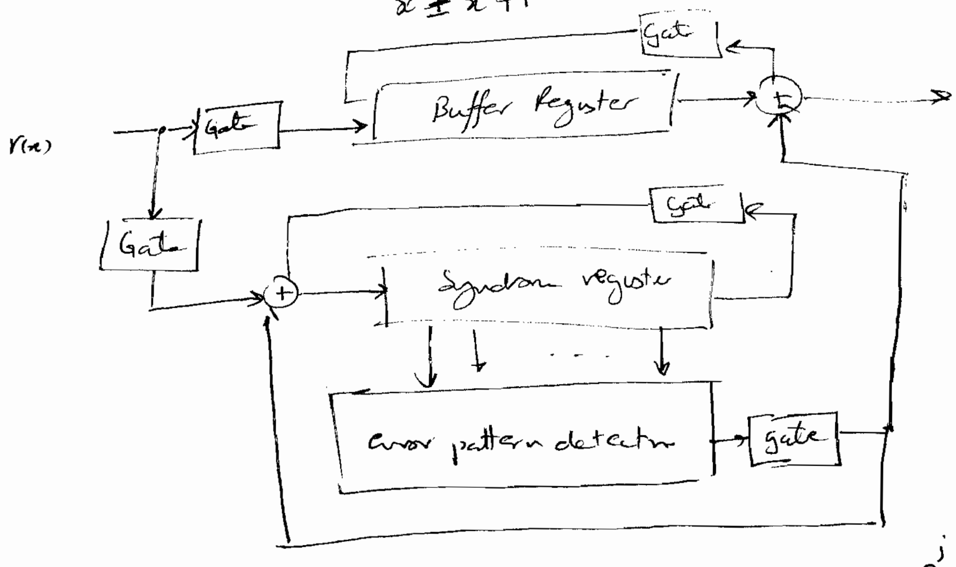
4 3. Given that $X^9+1=(X+1)(X^2+X+1)(X^6+X^3+1)$. We would like to design a $(9,k)$ code which has the following property: Correct single error. Find k, and the generator matrix $g(x)$.

1. $\text{Rem}\left[\frac{c(x)}{g(x)}\right] = 1+x+x^4+x^5 \Big|_{x^3=x^2+1} = \cancel{1}+\cancel{x}+\cancel{x^3}+\cancel{x}+x^4+\cancel{x^2} \Big|_{x^3=x^2+1}$

$= x^3+x \Big|_{x^3=x^2+1} = x^2+x+1$

(not a valid code word because syndrome $\neq 0$)

2.



3. Start by finding roots conjugates $(\alpha^i)^{2^j \bmod n}$

$l=1 \Rightarrow$

α^0

① $\alpha^1, \alpha^2, \alpha^4, \alpha^8, \alpha^7, \alpha^5$ ← six roots $l=2$

α^3, α^6 $l=2$

$\Rightarrow$ if we chose the factor of power 6 $\Rightarrow$ $l=2 \Rightarrow d_{min}=l+1=3$ ①
for single error correcting code $d_{min}=3 \Rightarrow g(x)=(x^6+x^3+1)$ ①

$\Rightarrow r=6 \Rightarrow k=3$ $(9,3)$ code.

①

"*It is better to do the right problem the wrong way than the wrong problem the right way*"- Richard Hamming