Name:Chao Jiang

ECE5563 — Spring 2015 **HW 3** Due: Feb. 11

Problem 4.28

Develop a table similar to Table 4.9 for $GF(2^4)$ with $m(x) = x^4 + x + 1$.

The generator g must satisfy $f(g) = g^4 + g + 1 = 0$. and we will perform modulo 2 on the coefficients. we have the following.

$$
\begin{aligned}
g^4 &= -g - 1 = g + 1 \\
g^5 &= g(g^4) = g^2 + g \\
g^6 &= g(g^5) = g^3 + g^2 \\
g^7 &= g(g^6) = g^4 + g^3 = g + 1 + g^3 \\
g^8 &= g(g^7) = g^2 + g + g^4 = g^2 + g + g + 1 = g^2 + 1 \\
g^9 &= g(g^8) = g^3 + g \\
g^{10} &= g(g^9) = g^4 + g^2 = g + 1 + g^2 \\
g^{11} &= g(g^{10}) = g^2 + g + g^3 \\
g^{12} &= g(g^{11}) = g^3 + g^2 + g^4 = g^3 + g^2 + g + 1 \\
g^{13} &= g(g^{12}) = g^4 + g^3 + g^2 + g = g + 1 + g^3 + g^2 + g = g^3 + g^2 + 1 \\
g^{14} &= g(g^{13}) = g^4 + g^3 + g = g + 1 + g^3 + g = g^3 + 1
\end{aligned}
$$

$GF(2^4)$ using $x^4 + x + 1$

Power REP	Polynomial REP	Binary REP	Decimal (Hex) RPEP
0	0	0000	0
g^0	1	0001	1
g^1	g	0010	2
g^2	g^2	0100	4
g^3	g^3	1000	8
g^4	$g + 1$	0011	3
g^5	$g^2 + g$	0110	6
g^6	$g^3 + g^2$	1100	12
g^7	$g^3 + g + 1$	1011	11
g^8	$g^2 + 1$	0101	5
g^9	$g^3 + g$	1010	10
g^{10}	$g^2 + g + 1$	0111	7
g^{11}	$g^3 + g^2 + 1$	1110	14
g^{12}	$g^3 + g^2 + g + 1$	1111	15
g^{13}	$g^3 + g^2 + 1$	1101	13
g^{14}	$g^3 + 1$	1001	9