

1. (a) Addition Table for $GF(7)$

+	0	1	2	3	4	5	6
0	0	1	2	3	4	5	6
1	1	2	3	4	5	6	0
2	2	3	4	5	6	0	1
3	3	4	5	6	0	1	2
4	4	5	6	0	1	2	3
5	5	6	0	1	2	3	4
6	6	0	1	2	3	4	5

- (b) Multiplication Table for $GF(7)$

\times	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6
2	0	2	4	6	1	3	5
3	0	3	6	2	5	1	4
4	0	4	1	5	2	6	3
5	0	5	3	1	6	4	2
6	0	6	5	4	3	2	1

- (c) Additive Inverses of $GF(7)$

$$-0 = 0$$

$$-1 = 6$$

$$-2 = 5$$

$$-3 = 4$$

$$-4 = 3$$

$$-5 = 2$$

$$-6 = 1$$

(d) Multiplicative Inverses of $GF(7)$

$$-0 = \text{DNE}$$

$$-1 = 1$$

$$-2 = 4$$

$$-3 = 5$$

$$-4 = 2$$

$$-5 = 3$$

$$-6 = 6$$

2. (a) Addition Table for $GF(2^2)$

+	0	1	x	$x+1$	+	00	01	10	11
0	0	1	x	$x+1$	00	00	01	10	11
1	1	0	$x+1$	x	01	01	00	11	10
x	x	$x+1$	0	1	10	10	11	00	01
$x+1$	$x+1$	x	1	0	11	11	10	01	00

(b) Multiplicative Table for $GF(2^2)$

\times	0	1	x	$x+1$
0	0	0	0	0
1	0	1	x	$x+1$
x	0	x	x^2	x^2+x
$x+1$	0	$x+1$	x^2+x	x^2+2x+1

\times	0	1	x	$x+1$
0	0	0	0	0
1	0	1	x	$x+1$
x	0	x	$x+1$	1
$x+1$	0	$x+1$	1	x

\times	00	01	10	11
00	00	00	00	00
01	00	01	10	11
10	00	10	11	01
11	00	11	01	10

(c) Additive Inverses of $GF(2^2)$

$$-0 = 0$$

$$-1 = 1$$

$$-x = x$$

$$-(x + 1) = x + 1$$

(d) Multiplicative Inverses of $GF(2^2)$

$$-0 = \text{DNE}$$

$$-1 = 1$$

$$-x = \text{DNE}$$

$$-(x + 1) = x$$

3. (a) 00000000 00000000 00000000 00000000

(b) 63636363 63636363 63636363 63636363

(c) 63636363 63636363 63636363 63636363

(d) 63

4. (a) $k_1 = \text{e8e9e9e9 } 17161616 \text{ e8e9e9e9 } 17161616$

(b) $k_2 = \text{adaeae19 bab8b80f } 525151e6 \text{ 454747f0}$