LECTURE 2 WEEK 1

Ro: Set of integer mod 6.

$$R_6 = \{0, 1, 2, 3, 4, 5\}$$

⊕₆ × ⊙₆.

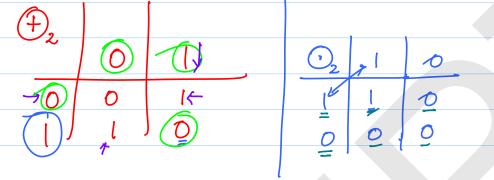
(+) ₆	0	1	2	3	4	5				
0	0	l	2	3	4	5	1			
1	l	2)	3	4	5	0				
2/	2	3	4	5	0	1				
3	3	4	5	0	l	2				
4	, 4	5	0	l	2	3				
5	5	0		2	3	4				

R, is Closed under addition

06	1	2	8	4	5	
11		2	3	4	5	
C 2	2	4	0	2	4	
3	3	0	3	0	3	
4	4	2	0	4	2	
5	5	4	3	2		

Ro is not a field because it does not have multiplicative inverses for some elements. Rp (where 'p is a prime), the set of integers mod p is always a field.

 $\mathcal{R}_2 : \mathcal{R}_2 = \left\{0, 1\right\}$



R2: 1s a field.

 $\bigoplus_{2} \rightarrow XOR$ gate / operation

O2 - AND oberation

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Vector Space V.

Let F be any field. Let V be a non-empty collection of objects called the "Vectors"

V is a vector space over F if rules for adding two vectors and Scalar multiplication exists such that V is closed under Vector addition & Scalar Multiplica

Mathematically:

- (ii) For u, v & V, u+v & V (iii) For a & F, u & V, a u & V and the following properties hold.
- (i) Commutativity: For all u, v & V, u+v=v+u
- (ii) Associativity: u, v, w & V, (u+v)+w = u+(v+w) For scalars α , $\beta \in \mathbb{F}$, $u \in V$ $\alpha \beta u = \alpha(\beta u)$

- Distributivity: $\alpha \in \mathbb{F}, \quad u, v \in V$ $\alpha(u+v) = \alpha u + \alpha v.$ $\alpha, \beta \in \mathbb{F}, \quad u \in V.$ $\alpha+\beta u = \alpha u + \beta u.$
- (iv) Additive Identity:

 QEV 8.t 0+4 = 4 for au

 4 EV
 - (v) Additive Inverse: For every u & U, there exists

-u e V 8.t u+(-u)=0

(Vi) Multiplicative Identity

(1) re u, ne v

Construct a & Component vectors Over the field F.

Let F=R. 2 copies of R.

 $\frac{\mathcal{U}_{2}}{\mathcal{U}_{2}} \stackrel{\sim}{\longleftarrow} \frac{\mathcal{U}_{1}}{\mathcal{U}_{2}} \stackrel{\sim}{\longleftarrow} \frac{\mathcal{U}_{2}}{\mathcal{U}_{2}} \stackrel{\sim}{\longleftarrow} \frac{\mathcal{U}_{1}}{\mathcal{U}_{2}} \stackrel{\sim}{\longrightarrow} \frac{\mathcal{U}_{1}}{\mathcal{U}_{2}} \stackrel{\sim}{\longrightarrow} \frac{\mathcal{U}_{1}}{\mathcal{U}_{2}} \stackrel{\sim}{\longrightarrow} \frac{\mathcal{$

How do we do vector addition?

 $u, v \in \mathbb{R}^2$ V is defined over \mathbb{R} .

$$U = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}$$
 $u_1, u_2 \in \mathbb{R}$

$$V_1, V_2 \in \mathbb{R}$$
.

$$u + v = (u_1) + (v_1) = (u_1 + v_1)$$

$$u_2 + v_2 = (u_2 + v_2)$$

$$v_2 + v_2 = (u_2 + v_2)$$

$$v_3 + v_4 = (u_1 + v_1)$$

$$v_4 + v_4 = (u_2 + v_2)$$

$$v_4 + v_4 = (u_1 + v_1)$$

$$v_5 + v_6 = (u_1 + v_1)$$

$$v_6 + v_6 = (u_1 + v_1)$$

$$v_7 + v_8 = (u_1 + v_1)$$

$$v_8 + v_8 = (u_1 + v_1)$$

$$v_8$$

Vector defined in the Addr. field R.

Scalar Multiplien:

$$d \in \mathbb{R}, \quad u = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}, \quad u_1, u_2 \in \mathbb{R}.$$

$$\frac{d \cdot u}{d \cdot u} = \frac{d \cdot u}{d \cdot u}$$

Scalar Multiplich of a vector. s Multiplich as defined in the field R. 1 Examples for vector spaces

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