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quiz → 4

7

Unit-5 - Ring, field and Integral domain

Unit-6 - Generating function & Recurrence Relations

└ DIY 3

FOLT. CS13P04 ← 3-4 3

Unit-4 → Unit 5

Algebraic System

one binary operation

⟨S, *⟩ → binary operation

set

Semigroup
monoid
Group
A.G.

System of Integers → Addition
- - Real no. Multiplication

Prim
Arithmetic modulo 5

Add. Mul
+ ×

extend → more than one binary operations.

2-operations — Ring
field
Integral domains

Unit-5 :=> Ref. D.M. by Tremblay and Manohar

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(ch-3)

Algebraic System with two binary operation

notation

not addition

Ring: → An algebraic system $\langle S, +, \cdot \rangle$ is called Ring if + and $\cdot$ on S satisfy the following three properties:

All the properties w.r.t. the operation,

1) $\langle S, + \rangle$ is an abelian group

2) $\langle S, \cdot \rangle$ is semigroup.

3) The operat. $\cdot$ is distributive over +

i.e. $a, b, c \in S$

$a \cdot (b + c) = a \cdot b + a \cdot c$ $\quad (b + c) \cdot a = b \cdot a + c \cdot a$

Ring.

$\langle S, +, \cdot \rangle \rightarrow$

$\langle S, + \rangle \rightarrow$ additive identity $(-a)$

$\langle S, \cdot \rangle \rightarrow$ multiplicative identity (a^{-1})

$+$, $\div$

not addition

not multip

$\langle S, +, \cdot \rangle$

$\langle S, + \rangle$ - A.G. →

$\langle S, \cdot \rangle$ → Commutative also.

→ monoid → identity would exist

→ Commutative Ring.

→ Ring with identity.

Zero element

↳ A group Can not have zero element.

$\langle Z_4, +_4 \rangle$

[1] [3]

[0]
[1]
[2]
[3]

$+_4$

$\times_4$

↳ $\frac{[1] \cdot [3]}{4}$ → [0]

not closed

Whether $\langle S - \{0\} \rangle$ is closed w.r.t. Operation ∘

a, b. $a \neq 0$, $b \neq 0$ ⇒ $a \cdot b \neq 0$

$\langle S, +, \cdot \rangle$ ⇒ Ring without divisor of zero. →

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Integral domain :- A Commutative Ring ⟨S, +, ·⟩ with identity and without divisor of zero is called Integral domain.

⟨S, +, ·⟩ → Any non-zero element of S has a multiplicative inverse in S.

field

⟨S, ·⟩

2 1/2 ·× 2

Field :- A Comm. Ring in which

Integral domain but not a field

→ Both I.D. and field

$a.(b+c)$

$R = \{a, b, c, d\}$

Ring — Yes / No

$+$	a	b	c	d
a	a	b	c	d
b	b	a	d	c
c	c	d	b	a
d	d	c	a	b

$\cdot$	a	b	c	d
a	a	a	a	a
b	a	a	b	a
c	a	b	c	d
d	a	a	d	a

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Sub-Ring :

$\langle S, +, \cdot \rangle \to$ Ring $\to$ Identity

$R \subseteq S$ $\quad \langle R, +, \cdot \rangle \to$ Sub Ring

If $\langle R, +, \cdot \rangle$ is itself a Ring with the operation + and $\cdot$

~~Sub~~ Ring.

Ring $\to \langle I, +, \cdot \rangle$

||

Sub Ring.

Set of odd integers

Set of even Integers

Ring Homomorphism :-

Let $\langle R, +, \cdot \rangle$ and $\langle S, \oplus, \odot \rangle$

$g : R \to S$ if for any $a, b \in R$.

$g(a+b) = g(a) \oplus g(b)$ and $g(a \cdot b) = g(a) \odot g(b)$

$\Downarrow$ group homomorphism

$\langle R, + \rangle \to \langle S, \oplus \rangle$

$\Downarrow$ Semigroup homomorphism

$\langle R, \cdot \rangle \to \langle S, \odot \rangle$.

Distributive property is preserved

$g\left[a \cdot (b+c)\right] = g(a \cdot b + a \cdot c)$ $\Rightarrow$ g is valid

X — X — U

End of Unit-5

Unit-4 & Unit-5 → Unit → A.S.

Unit 6 → R.R. & G.F.

Ref:→ Kenneth Rosen - Ch-8 → Advanced Counting technique

8.1 → Appln of R.R. Towers of Hanoi → R.R.

8.2 Solve. linear R.R.

↳ Homogen with Constant Coeffs

↳ Non-

8.3

8.4. Divide and Con → R.R. Merge-Sort

↳ G.F.

8.3 → A Bridge b/w CS & RR

→ Extended Binomial theorem

→ G.F. to Solve R.R.

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Unit-1
Unit-2
Unit-3
Unit-4
5
6

Last - class

Unit-1, 2, 4 } 30 marks

3, 5, 6 } ⇒ 10 marks