



**KTH Computer Science  
and Communication**

# **A summary of Groups and Rings SF2729**

JIM HOLMSTRÖM



# Abstract

This paper contains a brief summary of the course Groups and Rings which is given at KTH in Stockholm. The basis for this is the book: A First Course In Abstract Algebra by John B. Fraleigh.

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# Chapter 1

## Definitions

### 1.1 Structures

#### 1.1.1 Set

#### 1.1.2 Group

#### 1.1.3 Ring

#### 1.1.4 Field

### 1.2 Substructures

#### 1.2.1 Subgroup

#### 1.2.2 Subring

#### 1.2.3 Ideal

### 1.3 Relations between structures

#### 1.3.1 Homomorphism

#### 1.3.2 Isomorphism

#### 1.3.3 Group action

### 1.4 Bijective functions

#### 1.4.1 Permutation



## Chapter 2

# Useful theorems

### 2.1 LOREM IPSUM

#### 2.1.1 Lagrange's Theorem

#### 2.1.2 Cauchy's Theorem





## Chapter 3

# Misc. Later put into some of the above chapters

### 3.0.3 Equivalence relation $\mathfrak{R}$

$\mathfrak{R}$  is an equivalence relation on a set  $\mathcal{S}$   
 $\Leftrightarrow$

$$\begin{cases} x\mathfrak{R}x \\ x\mathfrak{R}y \Rightarrow y\mathfrak{R}x \\ x\mathfrak{R}y \wedge y\mathfrak{R}z \Rightarrow x\mathfrak{R}z \end{cases}, \forall x, y, z \in \mathcal{S} \quad (3.1)$$

### 3.0.4 Binary operations $*$

$$\begin{aligned} * : \mathcal{S} \times \mathcal{S} &\rightarrow \mathcal{S} \\ (x, y) &\mapsto *((x, y)) = x * y \end{aligned} \quad (3.2)$$

The binary function  $*((x, y))$  is denoted by  $x * y$ .

**Closed under  $*$**

**Commutative**

**Associative**

$$(a * b) * c = a * (b * c) \quad (3.3)$$

Which gives us