

# 1 Sets

The universal set ( $\mathcal{U}$ ) contains everything. The empty set ( $\emptyset$ ) contains nothing. Some assignments:

$$\mathcal{B}_1 = \{1, 3, 5, 7\}, \quad \mathcal{B}_2 = \{2, 4, 6, 8\}, \quad \mathcal{B}_3 = \{9, 10\}$$

Define:

$$\mathcal{A} = \bigcup_{i=1}^3 \mathcal{B}_i = \{1, \dots, 10\}$$

The cardinality of a set  $\mathcal{S}$  is denoted  $|\mathcal{S}|$  and is the number of elements in the set.

$$|\mathcal{B}_1| = 4, \quad |\mathcal{B}_2| = 4, \quad |\mathcal{B}_3| = 2, \quad |\mathcal{B}_1 \cup \mathcal{B}_2| = 8, \quad |\emptyset| = 0$$

# 2 Spaces

A number space (denoted  $\mathbb{S}$ ) is characterised by a set of entities with a set of axioms. For example:

$$\begin{aligned} \mathbb{N} &= \{x : x \text{ is positive integer}\} \\ \mathbb{Z} &= \{x : x \text{ is an integer}\} \\ \mathbb{R} &= \{x : x \text{ is a real number}\} \end{aligned}$$

# 3 Vectors and Matrices

A matrix (denoted  $\mathbf{M}$ ) is a rectangular array of values. A vector (denoted  $\mathbf{v}$ ) is a column or row of values (that is a one-dimensional matrix).

$$\mathbf{I}\mathbf{x} = \mathbf{x}, \quad \mathbf{A}\mathbf{A}^{-1} = \mathbf{I}, \quad \mathbf{x}^{-1}\mathbf{1} = \sum_i x_i$$

# Glossary

$\mathbf{I}$	the identity matrix.	$\mathbb{Z}$	the set of integers.
$\mathbf{M}^{-1}$	the inverse of $\mathbf{M}$ .	$\mathbb{N}$	the set of natural numbers.
$\mathbf{M}$	a matrix.	$\mathbb{R}$	the set of real numbers.
$\mathbf{v}$	a vector.	$ \mathcal{S} $	the cardinality of $\mathcal{S}$ .
$\mathbf{1}$	the vector of 1s.	$\emptyset$	the empty set.
$\sum \sum$	$n$ -ary summation.	$\mathcal{S}$	a set.
$\bigcup \bigcup$	$n$ -ary union.	$\{\dots\}$	set contents.
$\mathbb{S}$	a number space.	$\{\mathbf{x} : \dots\}$	set membership.
		$\mathcal{U}$	the universal set.