

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. | $\{x : \dots\}$ | set membership. |
| | | \mathcal{U} | the universal set. |