Why

We want language for recording the elements of some set that appear at regular intervals of time.

Definition

Let A be a set. An *observation sequence* (or *time series*) in A is a mapping $a : \mathbf{Z} \to A$.

If $A = \mathbf{R}^d$ in which case we call a a *vector-valued observation sequence* or *vector-valued time series*.

Examples

Examples include temperature readings, seismograph readings, sunspot numbers, export quantities, and so on.

Time invariance

The most basic assumption we can make is that the observation sequence a exhibits some regularity over time. This assumption is naturally related to the assumption of time-invariance in physical laws.[1]

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[1]Future editions will expand on this discussion.

Observation Sequences

Vectors

Real Vectors

N-Dimensional Space — Space Vectors — Plane Vector Sums and Differences

Distance — Plane Vectors

Space Distance

Plane Distance

Interval Length — Real Space

Intervals

Real Line — Real Plane

Real Order — Integral Line

Real Numbers — Fields — Rational Order — Geometry

Rational Numbers — Rings — Lists

Natural Fractions — Integer Arithmetic — Set Numbers — Direct Products

Integer Products — Natural Additive Identity — Natural Multiplicative Identity — Finite Sets

Natural Powers — Integer Sums — Integer Order — Comparisons — Natural Arithmetic — Identity Elements — Equivalent Sets — Family Unions and Intersections

Natural Products — Integer Numbers — Orders — Operations — Function Inverses — Function Images — Function Composites — Families

Natural Sums — Natural Order — Converse Relations — Equivalence Relations — Functions

Recursion Theorem — Relations

Peano Axioms — Ordered Pair Projections

Natural Induction — Set Products

Natural Numbers — Set Powers — Generalized Set Dualities

Set Symmetric Differences — Successor Sets — Unordered Triples — Set Dualities — Intersection of Empty Set — Partitions — Set Unions and Intersections

Set Complements — Pair Unions — Set Intersections — Ordered Pairs

Set Differences — Set Unions — Pair Intersections

Empty Set — Unordered Pairs

Set Specification

Set Equality

Set Inclusion

Deductions

Quantified Statements

Logical Statements

Statements

Identities — Sets

Names

Letters — Objects