

B4.1 Tuples and the Cartesian Product

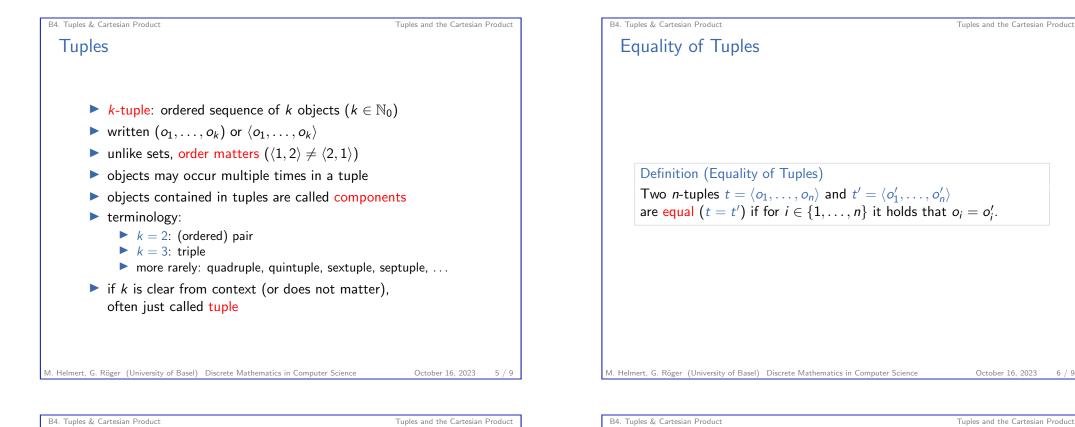
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M. Helmert, G. Röger (University of Basel) Discrete Mathematics in Computer Science	October 16, 2023	2 / 9

B4. Tuples & Cartesian Product

Sets vs. Tuples

- A set is an unordered collection of distinct objects.
- ► A tuple is an ordered sequence of objects.

Tuples and the Cartesian Product



Cartesian Product

Definition (Cartesian Product and Cartesian Power) Let S_1, \ldots, S_n be sets. The Cartesian product $S_1 \times \cdots \times S_n$ is the following set of *n*-tuples:

 $S_1 \times \cdots \times S_n = \{ \langle x_1, \ldots, x_n \rangle \mid x_1 \in S_1, x_2 \in S_2, \ldots, x_n \in S_n \}.$

The *k*-ary Cartesian power of a set *S* (with $k \in \mathbb{N}_1$) is the set $S^k = \{ \langle o_1, \dots, o_k \rangle \mid o_i \in S \text{ for all } i \in \{1, \dots, k\} \} = \underbrace{S \times \dots \times S}_{k \text{ times}}.$

René Descartes: French mathematician and philosopher (1596–1650) Example: $A = \{a, b\}, B = \{1, 2, 3\}$

$$A \times B = \{(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)\}$$
$$A^{2} = \{(a, a), (a, b), (b, a), (b, b)\}$$

