

## Outline

# Contents

1	Defining Sets	1
2	Operations on Sets	1
3	Relations	2
4	Functions	2

## 1 Defining Sets

### Set Theory

- Sets are *unordered collections* of *elements*
- Elements are usually named with lower case letters
- Sets are usually named with capital letters
- Concept of *set membership*
- Example:  $barina \in HOLDENS$

### Defining Sets

- Two basic ways:
  - enumeration
  - comprehension
- Enumeration:  $\{barina, astra, commodore\}$
- Comprehension:  $\{x \mid x \in S \wedge P\}$ 
  - $S$  defines the type of  $x$
  - $P$  is a predicate in  $x$ , constraining the set
- Example:  $\{x \mid x \in \mathbb{N} \wedge x \leq 10\}$ 
  - read (*the set of natural numbers*)  $x$  such that  $x$  at most 10
  - note a) typing, and b) constraint

## 2 Operations on Sets

### New Sets from Old

- Union:  $S \cup R$
- Intersection:  $S \cap R$
- Powerset:  $\mathbb{P}(S)$
- Cartesian Product:  $S \times R$

See the B summary for formal definitions of these

## 3 Relations

### Relations

- A relation  $S \leftrightarrow R$  is a formal statement of the correspondence between elements of two sets
- Example:  $CARS \leftrightarrow PRICE$
- A relation is a set of sets of ordered pairs:  $S \leftrightarrow R = \mathbb{P}(S \times R)$
- Note the effect of the powerset: the set of relations  $S \leftrightarrow R$  includes the empty set (no relation), the set of all ordered pairs ( $S \times R$ ) (everything related to everything), as well as all subsets in between.
- the set of elements in the left of the ordered pairs is called the *domain*
- the set of elements in the right of the ordered pairs is called the *range*

### Relation Examples

- No price information known:  $\{\}$
- *barina* costs \$13990:  $\{(barina, 13990)\}$
- *astra* costs \$25490:  $\{(barina, 13990), (astra, 25490)\}$
- “optioned up” *barina* costs \$25490:  $\{(barina, 13990), (barina, 25490), (astra, 25490)\}$
- Note that elements in both domain and range need not be unique.
- $dom(BULLETA) = \{barina, astra\}$
- $ran(BULLETA) = \{13990, 25490\}$