Chapter 1 outline:

- Introduction, sets and elements (this past Monday)
- Set operations; visual verification of set propositions (this past Wednesday)
- Introduction to SML; cardinality and Cartesian products (**Today**)
- Making types and functions in SML (next week Wednesday)
- More about functions in SML; introduction to lists [Chapter 2] (next week Friday)

Today (full agenda):

- **[Programming]** Introduction to the SML interpreter
- **[Programming]** Basic programming terminology
- **[Programming]** Types
- **[Sets]** Cardinality, disjointedness, partitions
- **[Sets and Programming]** Tuples and Cartesian products
- **[Programming]** Type analysis ("afterclass" video)

Which are valid ML types?

`int`	`double`
`char`	`val`
`string`	`real`
`int * int`	`int * char`

Compute the cardinality:

$|\{1, 2, 3, 4, 5\} \cup \{3, 4, 5, 6\}|$

$|[0, \pi) \cap \mathbb{Z}|$

$|\mathit{FacultyInThisRoom} - \mathit{StudentsInThisRoom}|$

Which are disjoint?

$\mathbb{Z}$ and $\mathbb{R}$

$\mathbb{Z}$ and $\mathbb{R}^-$

$[0, 5)$ and $[5, 10)$

Plants and *Fungi*

MathClasses and *CSCIClasses*

DeciduousTrees and *ConiferousTrees*

1.8.1 What is the cardinality of $\{0, 1, 2, \ldots n\}$?

1.8.3 One might be tempted to think $|A \cup B| = |A| + |B|$, but this is not true in general. Why not? (Assume A and B are finite.)

1.8.6 Describe three distinct partitions of the set $\mathbb{Z}$.

1.9.5 Based on our description of the real number plane as a Cartesian product, explain how a line can be interpreted as a set.

1.9.6 Explain how $\mathbb{C}$, the set of complex numbers, can be thought of as a Cartesian product.

1.9.7 Any rational number (an element of set $\mathbb{Q}$) has two integers as components. Why not rewrite fractions as ordered pairs (for example, $\frac{1}{2}$ as $(1, 2)$ and $\frac{3}{4}$ as $(3, 4)$) and claim that $\mathbb{Q}$ can be thought of as $\mathbb{Z} \times \mathbb{Z}$? Explain why these two sets *cannot* be thought of as two different ways to write the same set. (There are at least two reasons.)

```
#1(5, 4) + int(4.0 / 3.1)
```

```
(5 + 7, String.sub("hello", 2))
```

```
(((1, 2), 5.7, (#"A", #"x")), 8, "bye")
```

For next time:

Watch "afterclass" video about type analysis (pandemic-era)

Pg 26: 1.6.(1-5)
Pg 32: 1.8.(2, 4, 5)
Pg 36: 1.9.(3, 4, 8, 9, 10)

Note that the ML problems should be submitted on paper with the rest of the assignment. Submission to the automated grader starts with the assignment due Jan 24.

Skim 1.(10 & 11)