

Great Ideas in Computing

University of Toronto CSC196
Fall 2025

Class 5: September 25 (2026)

Announcements and Agenda

Announcements

- Office Hours: Mondays and Wednesdays 10:30-11:30.
- I corrected the final question for Assignment 1.
- Tentative schedule for guest presentations:
September 30: Professor Peter Love will discuss quantum computation
October 21: Professor Thomas Ristenpart will discuss computer security
November 6: Professor Ohad Shamir will discuss some theoretical aspects of neural networks.

Today's Agenda

- Today is part tutorial, part class. So ask questions.
- Going over floating point representation.
- The dictionary data type
- Data structures for the dictionary data type.

A few more comments on floating point numbers

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Before we do another discussion, **what is the benefit of floating point representation?**

When I started explaining floating point representation, I said that the IEEE standard uses a biased exponent rather than having a sign bit for the exponent and an implied '1' for the fractional part. I have said for the assignment we will ignore these *details* and use a bit for the exponent sign and will not use the implied '1' for the fractional part. **Why am I claiming these are details and why does the IEEE standard use a biased exponent and the implied 1?**

Dictionaries

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- *Search*: Look up if someone is in the organization and if so retrieve the information for this person.
- *Update content*: Change the information regarding an item
- *Insert*: Add a new person to the organization
- *Delete*: Remove a person from the organization.

Sets of objects with these operations are referred to as a *Dictionary* data type. In a static dictionary, we only want to look up and possibly modify records; in a dynamic dictionary, we also want to add and delete records. We can use different *data structures* to implement such a data type.

There can be many more operations that we want to perform on collections of data. More generally how one maintains and operates on data is known as the field of *data bases*. Analyzing data and extracting new (often statistical) information from collections of data is now called *data science* or *data analytics*. More ambitious learning of new information from data can be called *machine learning*.

Dictionaries lead to interesting concepts and ideas

- Many ways to implement a dictionary. What is important is to again note that there are almost always **TRADEOFFS** in whatever we do in computing (and in life). **How do you compare alternatives when there are multiple criteria for any given choice?** When can we say that choice 1 is better than choice 2 according to the given criteria?

Dictionaries lead to interesting concepts and ideas

- Many ways to implement a dictionary. What is important is to again note that there are almost always **TRADEOFFS** in whatever we do in computing (and in life). **How do you compare alternatives when there are multiple criteria for any given choice?** When can we say that choice 1 is better than choice 2 according to the given criteria?
- Here are some well known ways (called *data structures*) to implement a dictionary.
 - 1 An unordered list in an array
 - 2 An ordered list in an array
 - 3 A linked list
 - 4 A (balanced) search tree.
 - 5 A hash table.