Data Structures: Course Outline

Pat Morin
COMP2402

Carleton University
Me

▶ Professor Dr. Patrick Ryan Morin

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▶ Not "sir", "doctor Morin", or "mister Morin"
▶ Use your hand (or say excuse me) to get my attention

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▶ From 8:30–16:30, Monday–Friday, I can usually be found in 5177HP
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What is a Data Structure?

- Stores data

Examples: Integers, Strings, Floats, ...

Can answer questions about the stored data

Example: What is the data stored at position \( i \) (\( \text{get}(i) \))?

Example: What is the smallest data value greater than or equal to \( x \) (\( \text{find}(x) \))?

Can add or remove data (sometimes)

Example: Add the element \( x \) at position \( i \) (\( \text{add}(i,x) \))
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Data structures underly every computer system

- Computer file system (data structure maps file names onto hard drive sectors)
- Google and other search engines (data structure maps keywords onto webpages containing those keywords)
- Video games (data structures determine if game objects collide)
- Geographic systems (data structures find data relevant to the current view/location)
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  - A collection, a set, a sequence, a map, the world, . . .

- **What operations does it support?**
  - adding elements, removing elements, membership testing, finding elements, range searching, . . .

- What kind of performance does it have?
  - how long does each operation take?
  - how much space does it use?

First two define the **interface**

Performance is determined by the **implementation**
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- Computer scientists are best equipped (skills-wise) to
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  - implement data structures
  - design new data structures
When Should We Study Data Structures?

▶ Start as soon as possible
When Should We Study Data Structures?

- Start as soon as possible
- Continue for the rest of your career
When Should We Study Data Structures?

- Start as soon as possible
- Continue for the rest of your career
- Knowing the right data structure can
- Help you impress your boss
- Give your software an advantage over your competitors
- Save you a lot of work
- Allow you to make new scientific breakthroughs
- Make you rich
- Learning about data structures is rewarding for its own sake
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- Here, in school
- Later, at work

“I took your course on data structures about two years ago now, and today I was reminded why it was probably one of the most useful ones I've ever taken. I use a software package for game development and noticed that a certain feature was behaving strangely. I tinkered with it and confirmed it was not caused by something I was doing (or not doing). Nope! Turns out hashing was implemented incorrectly and it simply did not test for certain hashing collisions. This occurred very rarely, but most noticeably with strings. I submitted a bug report and it has been elevated in their bug tracker to the highest priority.”

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Instructor: Pat Morin
Office hours: Wednesday 10:00–12:00, 5177HP
  TA Office hours will be posted on culearn
Webpage: culearn.carleton.ca
Textbook: Open Data Structures (in Java)
Grading Scheme

Assignments \( 5 \times 10\% = 50\% \)
Mid-Term Exam \( 15\% \)
Final Exam \( 35\% \)

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- Assignments are marked by a submission server
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<table>
<thead>
<tr>
<th>Component</th>
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</tr>
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- Exams are multiple-choice Scantron
Automatic Assignment Marking

- To submit an assignment, you zip it up and submit to a server that
  
  ▶ unzips (zip files only, please)
  ▶ compiles (must compile)
  ▶ tests (for correctness and speed)
  ▶ displays and records your mark

Pros:
- Submit as often as you like (most recent mark is recorded)
- No surprise marks
- TA time is allocated to helping you

Cons:
- No marks for trying
- Improperly packaged, non-compiling code = 0

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▶ “The submitting server was great. I was able to get 100% on every assignment.”

▶ “The marking server was very cool, I very much enjoyed the ability to know how well I did instantly.

▶ “Without it I don’t think I would have done as well on the assignments because for a lot of them I thought I was doing it right, but the server then told me otherwise.

▶ “. . . has both pros and cons (a notable con is the improbability of getting anything other than 0 or 100% on a question),. . . ”

▶ “There server submission was OK, but given the choice I’d rather have a TA look at my work and mark it, then they could tell me what was exactly wrong with it.”
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