

Graphics and Sorting

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Opening Discussion

- Minute essay comments:
 - How do you make multiple buttons press when one is pressed?
 - I don't do reddit.
 - Nesting of components (and code).
 - How long until iRobot?
 - What did I do during my sabbatical?
 - How to notice things like missing)?
 - What is my favorite dragon?
 - Layout vs. contents?

More

- Stigma of tracking.
- What car would I own?
- If you try to load an image that isn't there the program crashes.

Key Events

- There are three event types for keys.
 - KeyPressed
 - KeyReleased
 - KeyTyped
- Listen to the keys object in a component to get these.
- Compare the key value in the event to values in the Key object.
 - `if(e.key==Key.A) ...`
 - `if(e.key==Key.Left) ...`

Animations

- For animations and many other things we want code to happen at regular intervals.
- We can set this up with a `javax.swing.Timer`.
 - `new Timer(delay: Int, ae: ActionListener)`
 - Delay is in milliseconds.
 - `Swing.ActionListener(handler: (ActionEvent) => Unit)`
- The function body will be executed at the desired intervals.

Motivation

- There are many reasons that you might want the data you are working with to be in a particular order.
- If nothing else, humans often like seeing things in certain orders.
- It turns out that ordered data can be beneficial for the computer as well.
- Putting things in order by some value is called sorting.

Methods of Sorting

- If I ask you to sort a bunch of items, how would you go about doing it? Describe your approach.
- How does it vary for different types or configurations of objects?

$O(n^2)$ Sorts

- We are going to look at three different sorting techniques today.
- These sorts all do work that is proportional to the square of the number of elements.
- That isn't good for large collections, but the sorts are fairly simple to write.
- These work “in place” so we use arrays.
- Each involves an inner loop that reorders things and an outer loop that makes the inner one happen over and over.

Bubble Sort

- Inner loop:
 - Compare adjacent elements and swap them if they are out of order.
- Outer loop:
 - Repeat $n-1$ times or until no swaps are done.
 - The latter option is called a flagged bubble sort.

Selection Sort

- This is often called a min-sort or a max-sort depending on how you write it. I'll describe a min-sort here.
- Inner loop:
 - Find the smallest element and SWAP it into position if not already there.
- Outer loop:
 - Repeat $n-1$ times so all elements are in the right place.
- Does only $O(n)$ swaps, but still $O(n^2)$ comparisons.

Insertion Sort

- Inner loop:
 - Take the next element and shift it down to the right spot.
- Outer loop:
 - Run through all the elements starting with the second.
- This sort is actually a bit faster (factor of 2) on random data. It is really efficient on nearly sorted data.

Watching Them Work

- One advantage of doing graphics before sorting is that we can write code to visualize what is happening when we sort numbers with these sorts.
- Let's write this code and watch our sorts work.

Minute Essay

- Show me what would happen after each iteration of the inner loop if we min-sort these values.
 - 4, 7, 1, 3, 8, 2