CS/80 - Lists (recap) + Sorting

Announcements

- Program 3 graded
- Program 5 checkpoint tomorrow
- Will have 1 more HW before the next midterm
Explanation of P.4 issues

Error was constructor

Order of initialization is important
Lists - recap

Code I added:
- copy constructor
- destructor
- operator=

Plus:
const_iterator class
why?
Vectors versus lists

Q: What would operator \[\] look like in a list?

\[O(n)\]

```cpp
my_list [12]
```

```
initialize it = begin();
for (int i = 0; i < target; i++)
    it++;
return *it - current \rightarrow - data;
```
Vectors versus lists (cont)

Running times:

<table>
<thead>
<tr>
<th>Operator</th>
<th>Vectors</th>
<th>Lists</th>
</tr>
</thead>
<tbody>
<tr>
<td>[]</td>
<td>(O(1))</td>
<td>(O(n)) (if we cook it)</td>
</tr>
<tr>
<td>find (or in)</td>
<td>(O(n))</td>
<td>(O(n))</td>
</tr>
<tr>
<td>insert</td>
<td>(O(n))</td>
<td>(O(1))</td>
</tr>
<tr>
<td>erase/remove</td>
<td>(O(n))</td>
<td>(O(1))</td>
</tr>
</tbody>
</table>

all \(O(\log n)\)
Searching

What is linear search?

Binary search?

assume sorted. ×

with $O(1)$ work, eliminate half the list

$T(n) = 1 + T(n/2) = 1 + 1 + T(n/4) = (1+1+1 + T(n/8))$

$\rightarrow T(n) = O(\log_2 n)$
Sorting

Name some sorting algorithms.

- Bubble sort 1 + n-1 comparisons
- Selection sort I look these up
- Insertion sort
- Quick sort
- Merge sort
Bubble

\[ n-1 \] to get largest

\[ n-2 \] to get 2\textsuperscript{nd} largest

\[ n-3 \]

\[ \vdots \]

\[ i \]

\[ 1 \]

\[ \sum_{i=1}^{n-1} i = \frac{n(n-1)}{2} \]

\[ = O(n^2) \]
Quick sort

- select a “random” pivot

\[ T(n) = n-1 + T(\frac{n}{2}) + T(\frac{n}{2}) \]
\[ = n-1 + 2T(\frac{n}{2}) \]
\[ = O(n \log n) \]

\[ \frac{56}{56} \]
\[ \frac{56}{56} \]

worst case: \( O(n^2) \)