

Time Complexity of Algorithm

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Step 1: Label the algorithm

```
12 std::vector<int> Sort::sort(std::vector<int> input)
13 {
14     std::vector<int> output = std::vector<int>();
15     int outputSize = static_cast<int>(input.size());
16     for (int i = 0; i < outputSize ; i++) {
17         int minIndex = -1;
18         int minAmount = INT_MAX;
19         for (int j = 0; j < static_cast<int>(input.size()); j++) {
20             if (input.at(j) < minAmount) {
21                 minIndex = j;
22                 minAmount = input.at(j);
23             }
24         }
25         input.erase(input.begin() + minIndex);
26         output.push_back(minAmount);
27     }
28
29     return output;
30
31 }
```

Handwritten annotations on the code:

- Line 14: 1
- Line 15: 1
- Lines 16-24: $3n$
- Lines 25-26: $2n$
- Line 29: 1

Step 2: Solve big O

Solve Series

$$\sum_{i=1}^n 3i \Rightarrow \sum_{i=1}^n i = n + (n-1) + (n-2) + \dots + 1 = \frac{n(n+1)}{2}$$
$$\frac{n(n+1)}{2} = \frac{n^2 + n}{2} \Rightarrow n^2$$

$$T(n) = \underbrace{n^2}_{\text{from inner for-loop}} + \underbrace{5n}_{\text{from outer for-loop}} = O(n^2)$$

from inner for-loop from outer for-loop