# Algorithms and Data Structures for Data Science
# lab_search

CS 277
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# Learning Objectives

Review fundamental search strategies for lists of objects

Identify limitations of binary search on multiple match queries

Implement binary range search

# Range Search

Given a collection of objects, $C$, with comparable values and an object of interest, $q$, find ~~the first~~ instance(s) of $q \in C$.

ALL

Input:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 5 |

**Output:**  Range of indices matching $q$ if it exists, $(-1, -1)$ otherwise

# Binary Range Search

**Observation:** All matching values are going to be consecutive

| 0 | 2 | 2 | 2 | 3 | 3 | 3 |
|---|---|---|---|---|---|---|

1. Perform binary search

2. 'Extend' in both directions

# Binary Range Search

**Observation:** My search is looking for two *specific* values

| 2 | 3 | 3 | 3 | 3 | 4 | 4 |
|---|---|---|---|---|---|---|

1. Modify binary search to find the *first* or *last* matching value

# Binary Search (First in-order match)

```
1
2       # Comparing numbers snippet
3
4          if pivot == q:
5
6                  # Match case:
7                  # Treat like query is smaller
8                  # Remember last match!
9
10         elif pivot > q:
11
12                 # query is smaller case
13         else:
14
15                 # query is larger case
16
17     # Final Return Snippet
18     if saw_match:
19         return last_match
20     else:
21         return -1
22
23
```

| 2 | 3 | 3 | 3 | 3 | 4 | 4 |
|---|---|---|---|---|---|---|