Decomposition

Announcements

Modular Design

Separation of Concerns

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A design principle: Isolate different parts of a program that address different concerns

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A modular component can be developed and tested independently

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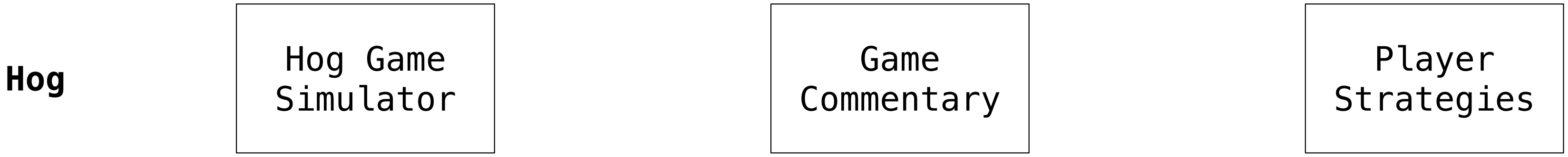

Hog

Hog Game Simulator

Game Commentary

Player Strategies

Separation of Concerns

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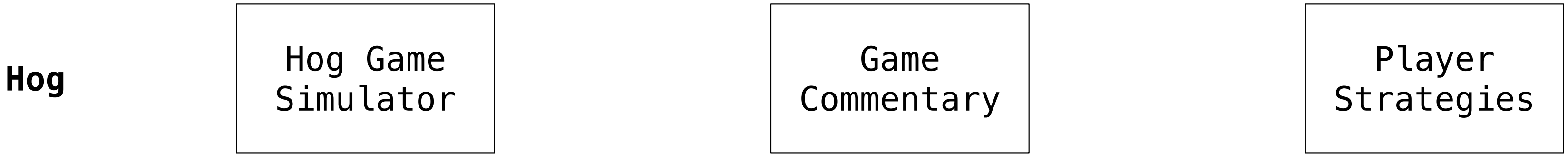

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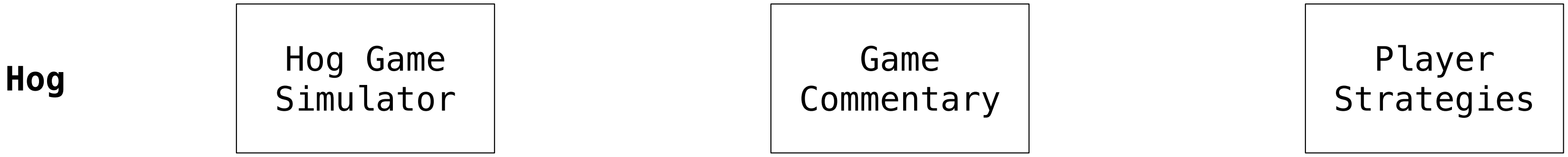

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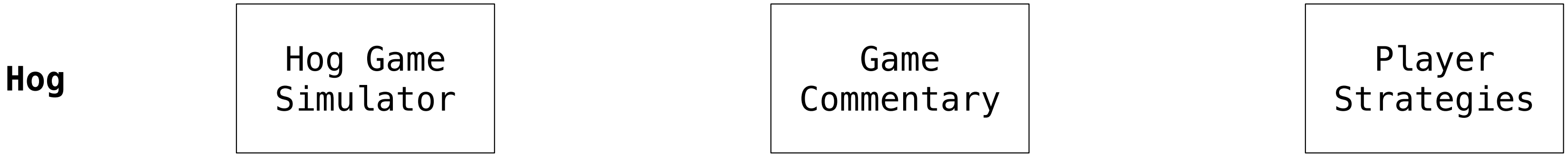

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- Event descriptions

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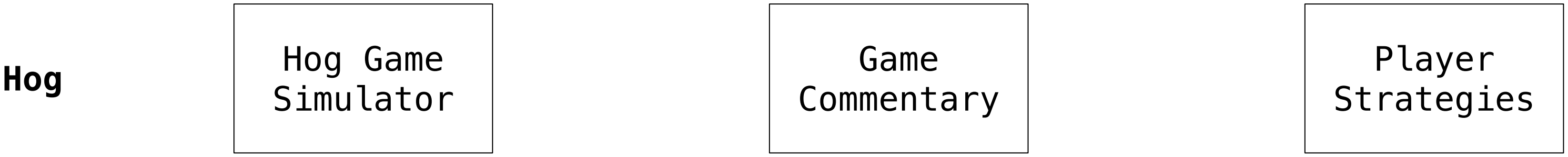

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- Game rules
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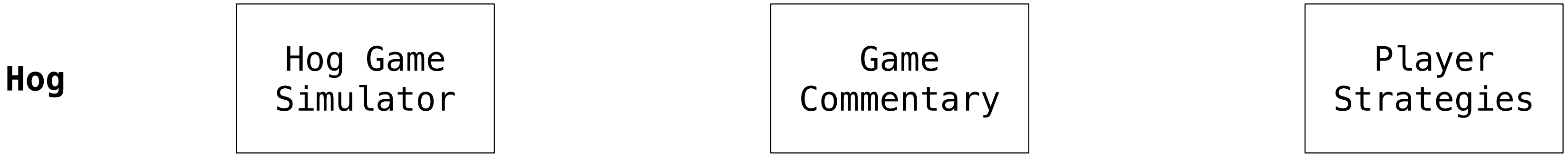

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- Strategy parameters (e.g., margins & number of dice)

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Ants

Ants Game Simulator

Actions

Tunnel Structure

Separation of Concerns

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Hog	Hog Game Simulator • Game rules • Ordering of events • State tracking to determine the winner	Game Commentary • Event descriptions • User input	Player Strategies • Decision rules • Strategy parameters (e.g., margins & number of dice)
Ants	Ants Game Simulator • Order of actions	Actions	Tunnel Structure

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Ants Game Simulator

- Order of actions
- Food tracking
- Game ending conditions

Actions

Tunnel Structure

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- Characteristics of different ants & bees

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- Entrances & exits

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Ants

Ants Game Simulator

- Order of actions
- Food tracking
- Game ending conditions

Actions

- Characteristics of different ants & bees

Tunnel Structure

- Entrances & exits
- Locations of insects

Example: Restaurant Search

Restaurant Search Data

```
Given the following data, look up a restaurant by name and show related restaurants.
```

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```
{"business_id": "gclB3ED6uk6viWlolSb_uA", "name": "Cafe 3", "stars": 2.0, "price": 1, ...}
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{"business_id": "gclB3ED6uk6viWlolSb_uA", "user_id": "xVocUszkZtAqCxgWak3xVQ", "stars": 1, "text":
 "Cafe 3 (or Cafe Tre, as I like to say) used to be the bomb diggity when I first lived in the dorms
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 "-Excuse me for being a snob but if I wanted a room temperature burrito I would take one home,
  stick it in the fridge for a day, throw it in the microwave for 45 seconds, then eat it. NOT go to
  a resturant and pay like seven dollars for one...", "date": "2009-04-30", ...}
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```

(Demo)

Example: Similar Restaurants

Discussion Question: Most Similar Restaurants

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Implement **similar**, a **Restaurant** method that takes a positive integer **k** and a function **similarity** that takes two restaurants as arguments and returns a number**.** Higher **similarity** values indicate more similar restaurants**.** The **similar** method returns a list containing the **k** most similar restaurants according to the **similarity** function, but not containing **self.**

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def similar(self, k, similarity):
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def similar(self, k, similarity):
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    others = list(Restaurant.all)
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    others.______________(______________)
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    others.______________(______________)

    return sorted(others, key=________________________________________)__________________
```

```
sorted(iterable, /, *, key=None, reverse=False)
    Return a new list containing all items from the iterable in ascending order.

    A custom key function can be supplied to customize the sort order, and the
    reverse flag can be set to request the result in descending order.
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```
def similar(self, k, similarity):
   "Return the K most similar restaurants to SELF, using SIMILARITY for comparison."

    others = list(Restaurant.all)

                remove
    others.______________(______________)

    return sorted(others, key=________________________________________)__________________
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    others = list(Restaurant.all)

    others.____remove_____(_____self_____)

    return sorted(others, key=_____lambda r: -similarity(self, r)_____)________________
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Example: Reading Files

(Demo)

Set Intersection

Linear-Time Intersection of Sorted Lists

```
Given two sorted lists with no repeats, return the number of elements that appear in both.
```

Linear-Time Intersection of Sorted Lists

`Given two sorted lists with no repeats, return the number of elements that appear in both.`

3	4	6	7	9	10

Linear-Time Intersection of Sorted Lists

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3	4	6	7	9	10

1	3	5	7	8

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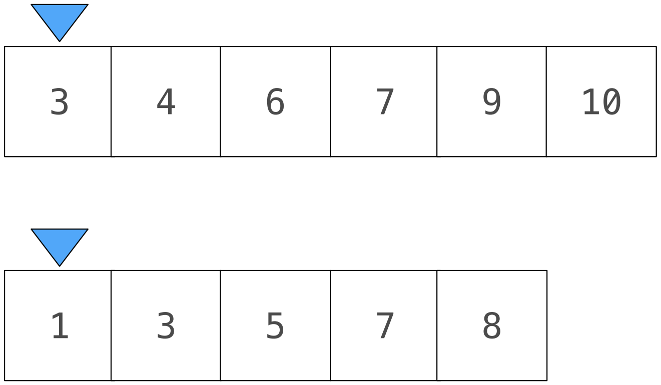

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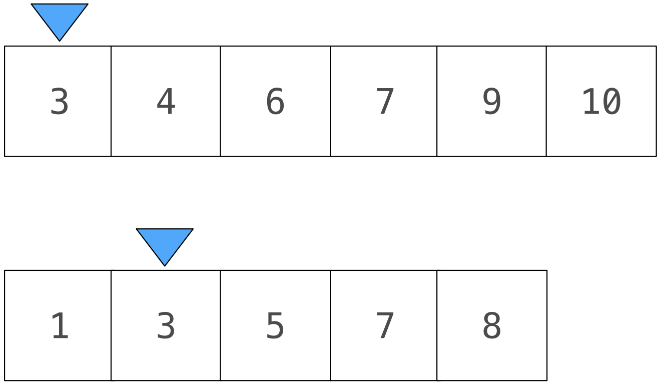

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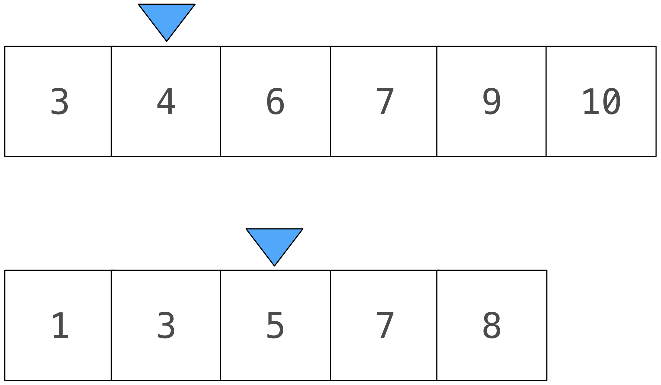

3 4 6 7 9 10

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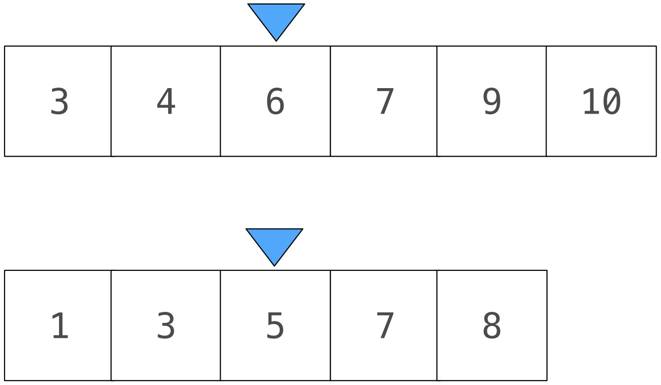

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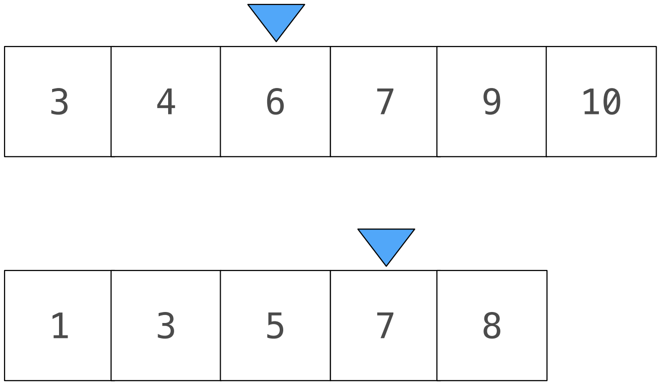

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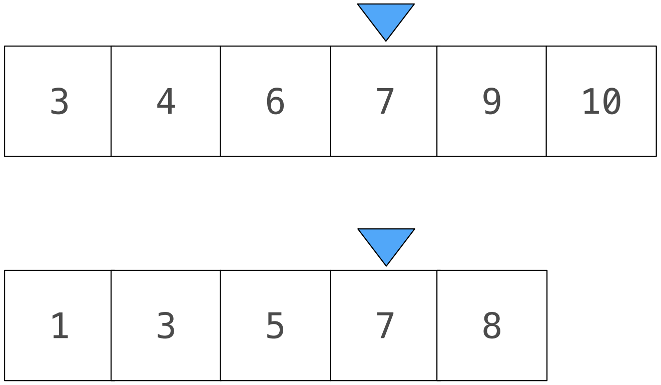

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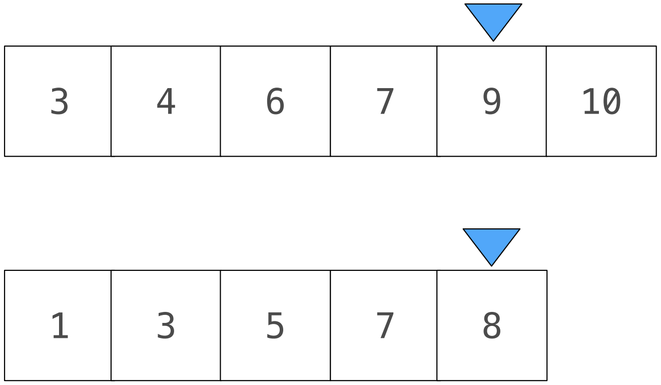

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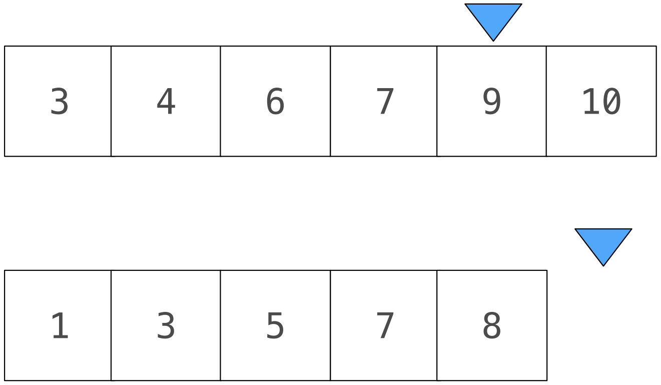

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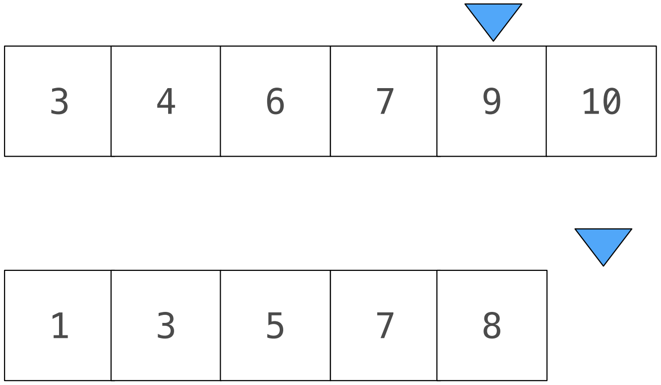


3 4 6 7 9 10

1 3 5 7 8

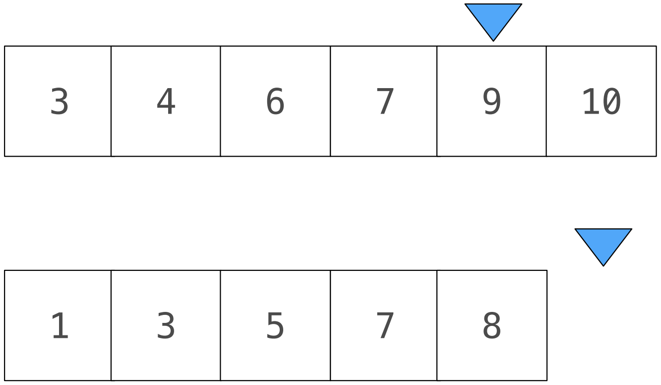
```
def fast_overlap(s, t):
    """Return the overlap between sorted S and sorted T.

    >>> fast_overlap([3, 4, 6, 7, 9, 10], [1, 3, 5, 7, 8])
    2
    """
    i, j, count = 0, 0, 0

    while ____________________________________________:
        if s[i] == t[j]:
            count, i, j = ____________________________
        elif s[i] < t[j]:
            __________________________________________
        else:
            __________________________________________
    return count
```

Linear-Time Intersection of Sorted Lists

Given two sorted lists with no repeats, return the number of elements that appear in both.

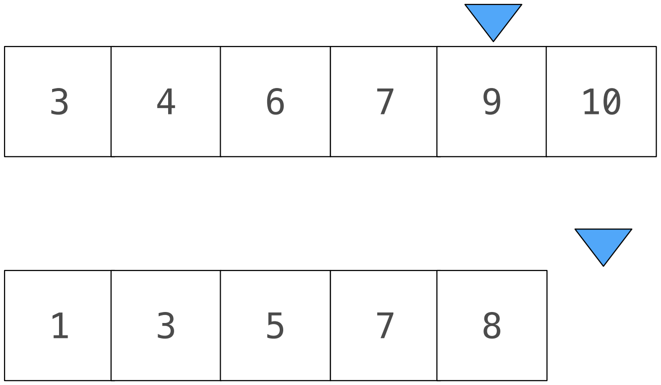


```
def fast_overlap(s, t):
    """Return the overlap between sorted S and sorted T.

    >>> fast_overlap([3, 4, 6, 7, 9, 10], [1, 3, 5, 7, 8])
    2
    """
    i, j, count = 0, 0, 0
    while ______i < len(s) and j < len(t)______:
        if s[i] == t[j]:
            count, i, j = ____________________
        elif s[i] < t[j]:
            ______________________________
        else:
            ______________________________
    return count
```

Linear-Time Intersection of Sorted Lists

Given two sorted lists with no repeats, return the number of elements that appear in both.



3	4	6	7	9	10

1	3	5	7	8

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    i, j, count = 0, 0, 0

    while       i < len(s) and j < len(t)        :
        if s[i] == t[j]:
            count, i, j =   count + 1, i + 1, j + 1
        elif s[i] < t[j]:
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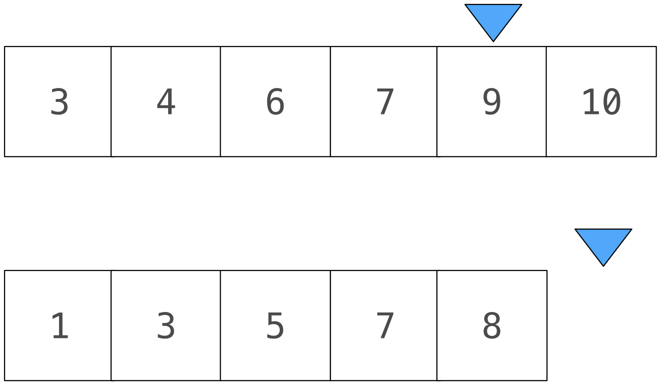

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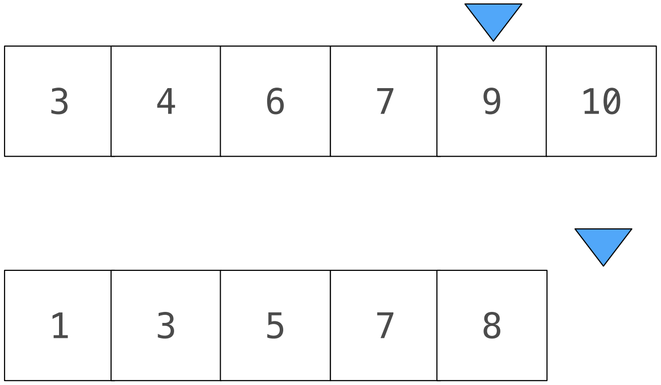

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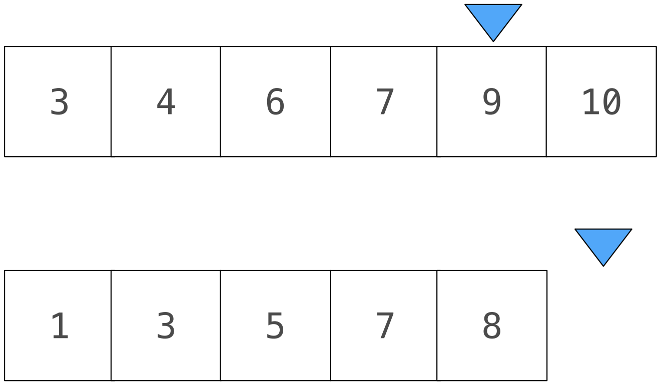
            count, i, j = __count + 1, i + 1, j + 1__
        elif s[i] < t[j]:
            ______i = i + 1______
        else:
            ______j = j + 1______
    return count
```

Linear-Time Intersection of Sorted Lists

```
Given two sorted lists with no repeats, return the number of elements that appear in both.
```



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            count, i, j =  count + 1, i + 1, j + 1
        elif s[i] < t[j]:
                          i = i + 1
        else:
                          j = j + 1
    return count
```

(Demo)