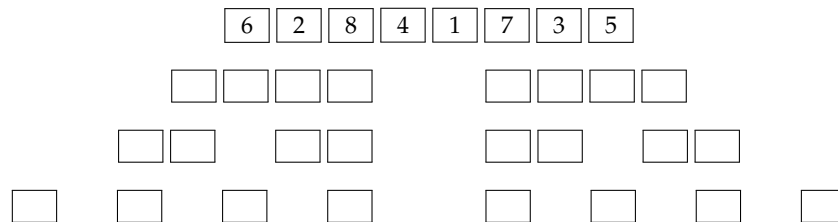


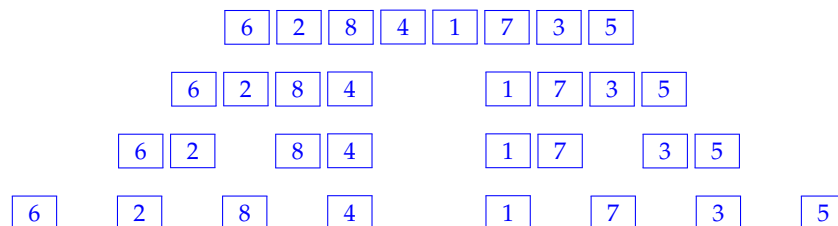
1. **Merge Sort** works in two steps:

1. **Split:** Divide the list in half repeatedly until each piece has only one element (a single-item list is already sorted).
2. **Merge:** Combine the smaller lists back together two at a time, arranging them in order as you merge.

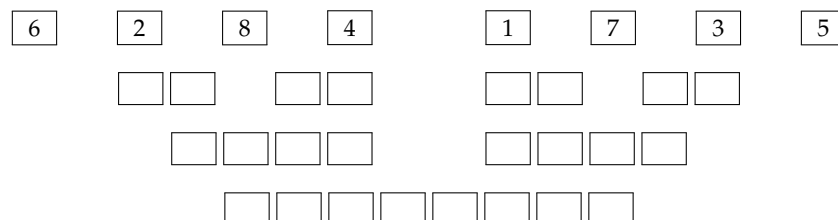
a. Fill in the missing pieces of the splitting step.



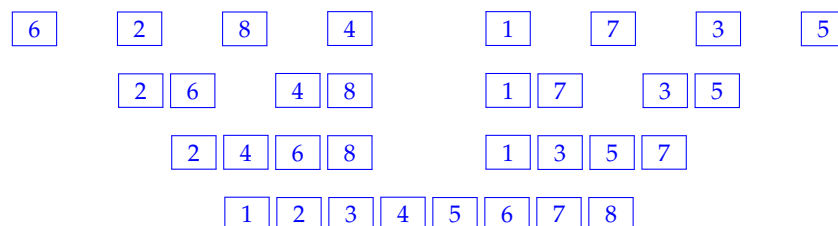
Solution:



b. Now merge back up, one level at a time. Each merged list must be in **sorted order**.



Solution:



c. The very last merge combines [2, 4, 6, 8] and [1, 3, 5, 7]. Trace it: each time, compare the front element of each list and take the smaller one. The first row is done for you.

Left List	Right List	Compare	Take	Merged List So Far
[2, 4, 6, 8]	[1, 3, 5, 7]	2 and 1	1	[1]
[2, 4, 6, 8]	[3, 5, 7]			
		right list is empty	take what remains	

Solution:

Left List	Right List	Compare	Take	Merged List So Far
[2, 4, 6, 8]	[1, 3, 5, 7]	2 and 1	1	[1]
[2, 4, 6, 8]	[3, 5, 7]	2 and 3	2	[1, 2]
[4, 6, 8]	[3, 5, 7]	4 and 3	3	[1, 2, 3]
[4, 6, 8]	[5, 7]	4 and 5	4	[1, 2, 3, 4]
[6, 8]	[5, 7]	6 and 5	5	[1, 2, 3, 4, 5]
[6, 8]	[7]	6 and 7	6	[1, 2, 3, 4, 5, 6]
[8]	[7]	8 and 7	7	[1, 2, 3, 4, 5, 6, 7]
[8]	[]	right list is empty	take what remains	[1, 2, 3, 4, 5, 6, 7, 8]

d. Now write a function that performs the same merge automatically.

The function should take two **sorted lists** and return one sorted list containing all of their elements.

For example:

```
merge([2, 4, 6, 8], [1, 3, 5, 7])
```

should return:

```
[1, 2, 3, 4, 5, 6, 7, 8]
```

Write the function below. You may assume that both input lists are already sorted.

```
def merge(listA, listB):
```

Solution:

```
def merge(left, right):
    result = []

    i = 0
    j = 0

    while i < len(left) and j < len(right):
        if left[i] < right[j]:
            result.append(left[i])
            i += 1
        else:
            result.append(right[j])
            j += 1

    while i < len(left):
        result.append(left[i])
        i += 1

    while j < len(right):
        result.append(right[j])
        j += 1

    return result
```