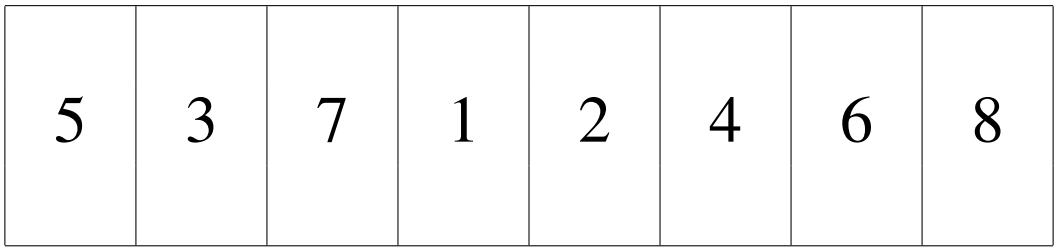
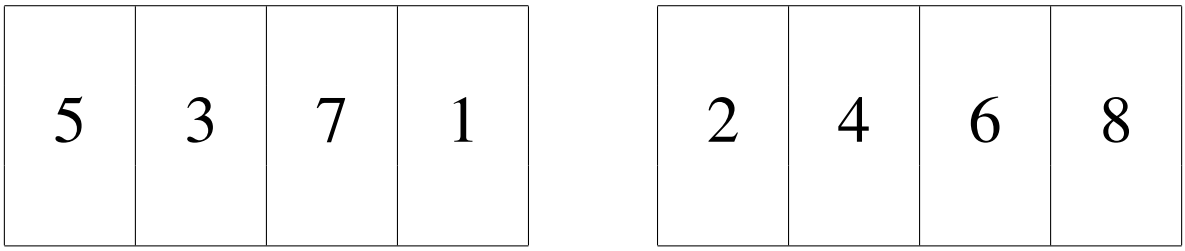
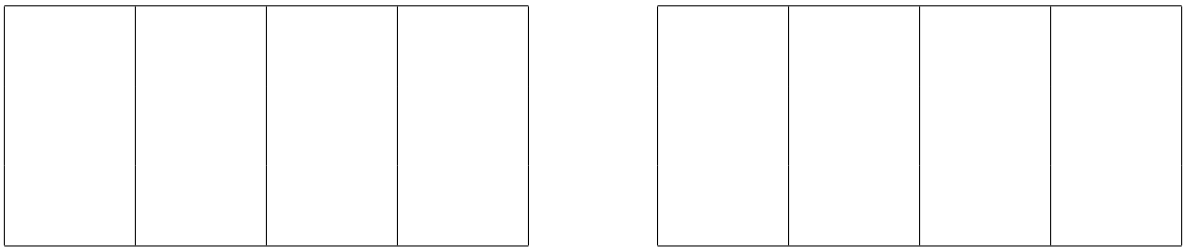
Computer Science 385
Design and Analysis of Algorithms
Siena University
Spring 2026

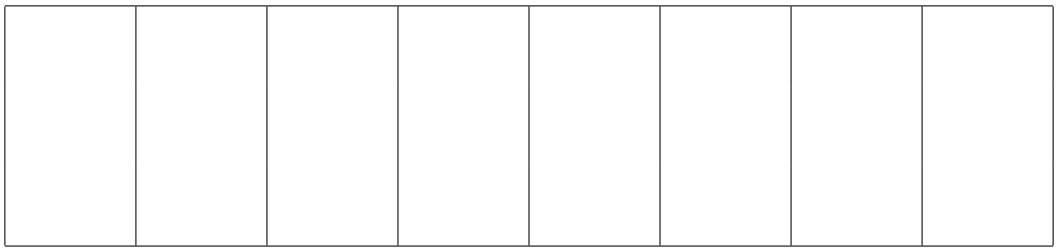
Mergesort Practice

Basic Idea









Consider the MERGE algorithm on the front of the separate pseudocode sheet.

Suppose B and C contain the following values, so $p = 8$ and $q = 6$.

B

0	1	2	3	4	5
11	33	44	66	88	99

C

0	1	2	3	4	5	6	7
22	55	77	111	122	133	140	143

Show the contents of array A when the `while` loop has finished executing.

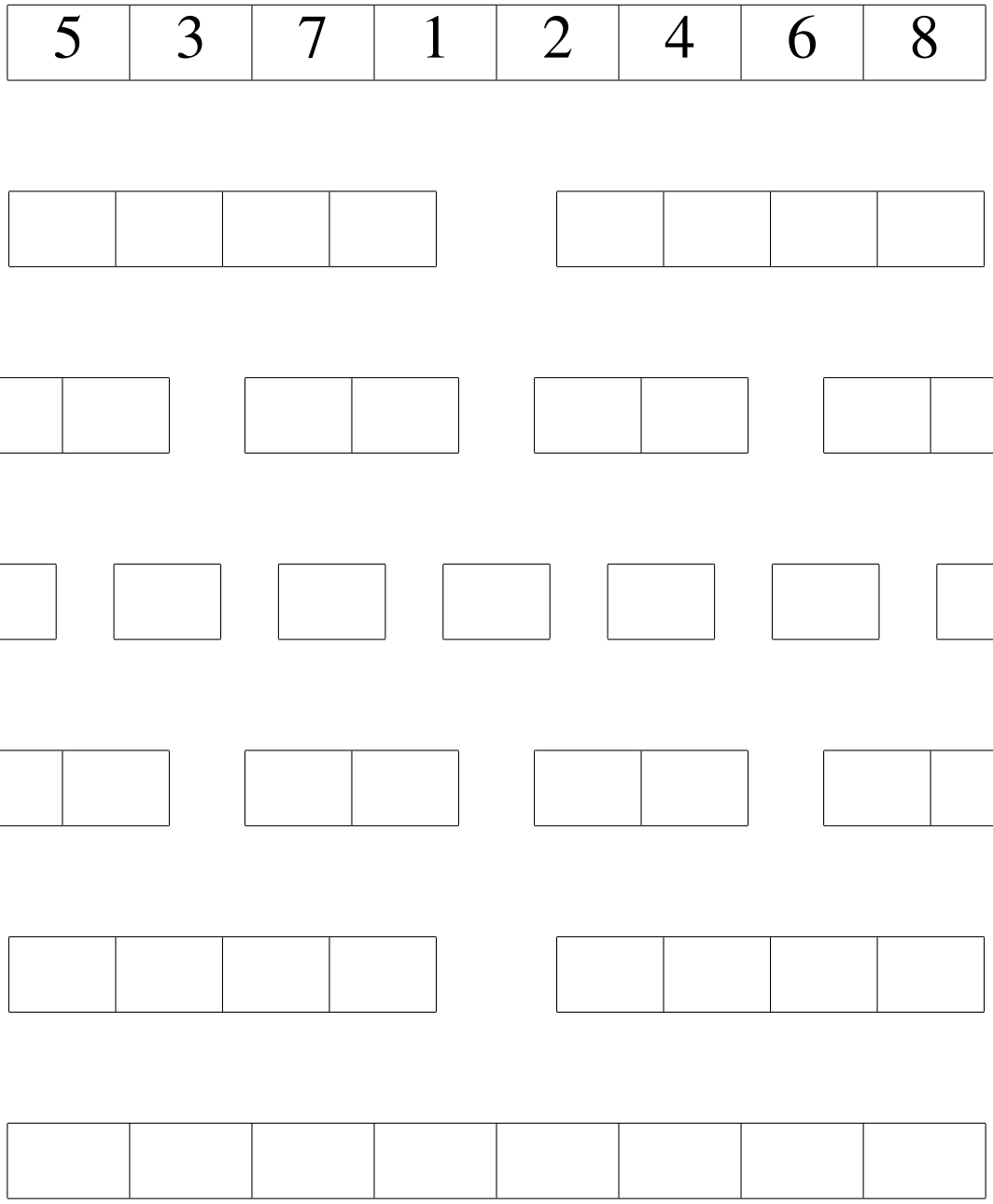
Show the contents of array A after the `if-else` statement following the `while` loop has finished executing.

Worst case, how many times is k incremented in the `while` loop?

Worst case, how many items are copied from C to A and from B to A after the `while` loop?

Based on your answers to the previous three questions, what is the Big O worst case running time of algorithm MERGE? Express your answer in terms of n, where $n = p + q$ is the size of array A.

Tracing through MERGESORT



How many split steps will it take?

Then we will have _____ merge steps

Each merge step involves sub-arrays totaling in size to _____

At the level with k independent merges, each will merge into arrays of size ____ for a total of ____ operations

This suggests an overall complexity of _____

Analysis (assume $n = 2^k$):

Basic operation:

Recurrence:

$$C(n) =$$

Worst case?

$$C_{worst}(n) =$$

By the master theorem,

$$C_{worst}(n) \in \Theta(\quad)$$

Mergesort is *not* in place. Space overhead: $\Theta(\quad)$