Comparison Sort Algorithms
The Merritt Sort Taxonomy
Figure 4.1

Design Patterns for Data Structures

\[ \begin{align*}
L & \xrightarrow{\text{Split}} L1 \\
L1 & \xrightarrow{\text{Sort}} L1' \\
L1' & \xrightarrow{\text{Join}} L' \\
L' & \xrightarrow{\text{Sort}} L2' \\
L2' & \xrightarrow{\text{Sort}} L2 \\
L2 & \xrightarrow{\text{Split}} L \\
L & \xrightarrow{\text{Split}} L1 \\
\end{align*} \]
Design Patterns for Data Structures

Figure 4.2

(a) The merge sort algorithm.

(b) The quick sort algorithm.
(a) The insertion sort algorithm.

(b) The selection sort algorithm.
The definition of a heap

A heap is a binary tree.

- It has a max-heap shape.
- It has a max-heap order.
Max-heap order:

For every node other than the root, the value of the node is at most the value of its parent.
(a) The initial list is not a heap.

Max-heap shape
Not max-heap order

(b) List $L$ after build heap.

Max-heap shape
Max-heap order
Figure 4.4

(b) List $L$ after build heap.

(c) List $L_1$ after the split.
Design Patterns for Data Structures

Figure 4.5

1. **Build Heap**
   - Input: 7 3 1 6 2 8 5 4
   - Output: 8 6 7 4 2 1 5 3

2. **Split**
   - Input: 8 6 7 4 2 1 5 3
   - Output: 7 6 5 4 2 1 3, 8

3. **Sort**
   - Input: 7 6 5 4 2 1 3
   - Output: 1 2 3 4 5 6 7
   - Input: 8
   - Output: 8

4. **Join**
   - Input: 1 2 3 4 5 6 7, 8
   - Output: 1 2 3 4 5 6 7 8