1. Heap (Priority Queue Implementation)

1.3 What is the time complexity of the insert and extract operations in your implementation?

The insert operation places the new element at the end of the heap. Then it performs a “bubble up” step. In the worst case, this process might move the element from the bottom to the root position. Since the binary heap is a complete binary tree with height proportional to O(log n), the worst case time complexity for insertion is O(log n).

In the extract operation, the root element is removed in O(1) time. To maintain the heap structure after removing the root, the last element in the heap is moved to the root position. Then a “bubble down” step is performed. In the worst case, this element may have to move down the height of the tree, which again leads to a worst case time complexity of O(log n).

1. 4 Explain how the heap maintains its structure after an insertion or extraction.

Insertion = When a new element is added to the heap, it is placed in the next available position at the bottom to maintain the complete tree structure. However, this can violate the heap property. To fix this, the newly inserted element is compared with its parent. If the heap property is not maintained, the two elements are swapped. This “bubble up” process continues until the heap property is fully restored, ensuring every parent is correctly ordered relative to its children.

Extraction = When the root element is removed, the heap temporarily loses its proper structure. To correct this, the last element in the heap is placed at the root. This ensures the heap remains a complete tree but may violate the heap property. To restore the property, the root element is compared with its children, and swaps are made if necessary. This “bubble down” process continues until the heap property is restored, so that every parent child relationship once again follows the correct order.

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Imagen de la pantalla de un celular con letras

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Texto, Carta

Descripción generada automáticamenteUn conjunto de letras negras en un fondo blanco

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