Fill in the Blanks

Fill in the following blanks related to min-heaps. Let `N` is the number of elements in the min-heap. For the entirety of this question, assume the elements in the min-heap are **distinct**.

1. `removeMin` has a best case runtime of _____ and a worst case runtime of _____.
2. `insert` has a best case runtime of _____ and a worst case runtime of _____.
3. A _____ or _____ traversal on a min-heap *may* output the elements in sorted order. Assume there are at least 3 elements in the min-heap.
4. The fourth smallest element in a min-heap with 1000 elements can appear in _____ places in the heap.
5. Given a min-heap with $2^N - 1$ distinct elements, for an element
   - to be on the second level it must be less than _____ element(s) and greater than _____ element(s).
   - to be on the bottommost level it must be less than _____ element(s) and greater than _____ element(s).

   Hint: A complete binary tree (with a full last-level) has $2^N - 1$ elements, with N being the number of levels.