**44-642 Application Design: Patterns and Frameworks**

**Heaps**

1. Insert the following elements into a heap, in the order listed here. Draw the binary tree representation of the resulting heap.

**2 17 10 8 12**

1. Show the array representation of the heap from the previous problem.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** |
|  |  |  |  |  |

1. Add 9 to the above heap. Show the binary tree representation of the resulting heap.
2. Remove the top element from the heap in the previous problem. Show the binary tree representation of the resulting heap.
3. Insert the following elements into a heap, in the order listed here. Draw the binary tree representation of the resulting heap.

**19 18 3 8 20 15 12 9 23 14 7 37 50 22 2**

1. Add 5 to the above heap. Show the binary tree representation of the resulting heap.
2. Remove the top element from the heap in the previous problem. Show the binary tree representation of the resulting heap.
3. Remove the top element from the heap in the previous problem. Show the binary tree representation of the resulting heap.
4. Remove the top element from the heap in the previous problem. Show the binary tree representation of the resulting heap.
5. Show the array representation of the heap in the previous problem. Show the index, as well as the value stored at each index.