Computer Science I – Exercise
Heaps

Kavan Lima 4/8/25

1) In an array-based implementation of a Heap, the left-child of the left-child of the node at index i, if it exists, can be found at what array location?

$4i$

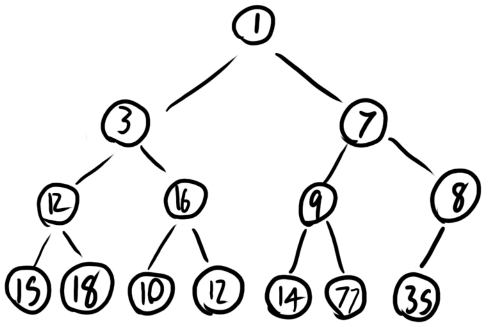
2) In an array-based implementation of a Heap, the right-child of the right-child of the node at index i, if it exists, can be found at what array location?

$4i+3$

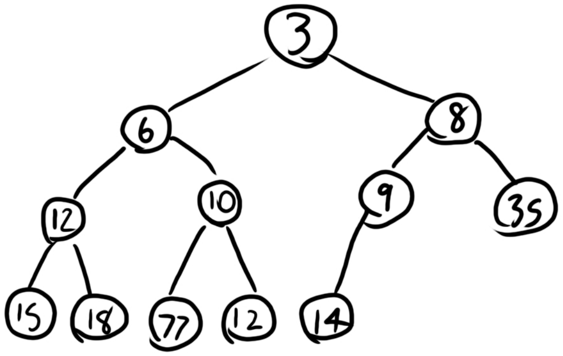
All the following questions are related to minheap

3) Show the result of inserting the item 7 into the heap shown below:

```
                    1
           /                 \
         3                      8
      /     \                /     \
   12          6            9        35
  /  \       /  \         /  \
15   18    10   12      14   77
```



4) Show the result of removing the minimum element from the original heap in question #2 (without 7) from above.



5) Show the array representation of the original heap from question #~~2~~.3

3	6	8	12	10	9	35	15	18	77	12	14	

6) Run the whole Heapify function on the following random values: (note that our target is to build minheap)
(this is the function that builds a heap in O(n) time)

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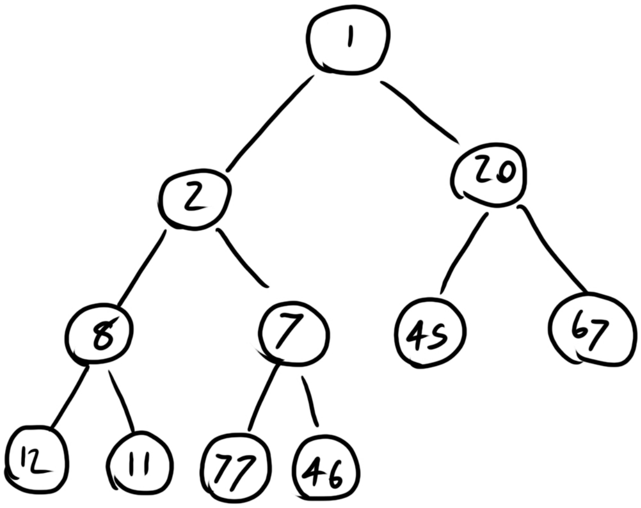
```
              77
           /       \
         8           45
       /    \      /     \
     12      2   20       67
    /  \    / \
   1   11  7  46
```



You don't have to write how to do heapsort. But, make sure you know the steps of heapsort

7) Explain each step shown in the code below, for the percolateDown function:

```
void percolateDown(struct heapStruct *h, int index) {

  int min; //declare min

  if ((2*index+1) <= h->size) { // if right child exists
    //find the smaller child
    min = minimum(h->heaparray[2*index], 2*index, h->heaparray[2*index+1], 2*index+1);
    //if current index is larger than min child
    if (h->heaparray[index] > h->heaparray[min]) {
      swap(h, index, min); //swap the positions
      percolateDown(h, min); //call percolateDown again with min as index
    }
  }
  else if (h->size == 2*index) { //if only left child
     if (h->heaparray[index] > h->heaparray[2*index]) //compare self with left
      swap(h, index, 2*index); //swap if self is larger
  }
}
```

(Note: Please reference heap.c *without looking at this function*, if necessary.)