2) (10 pts) ALG (Heaps)

    a.   (3 pts) Fill in the array representation of a heap that meets all of the following conditions:

        i.   The minheap contains exactly eight integer values, without any duplicate values.
       ii.   The minheap does *not* contain the value 14.
      iii.   Inserting 14 into the minheap would cause us to incur the **best**-case possible runtime for insertion.

Note: Index 0 is omitted because in the traditional storage of a heap using an array, that index is not used.

Index	1	2	3	4	5	6	7	8
Value	**1**	**2**	**4**	**12**	**9**	**7**	**6**	**16**

Grading Note: Many, many answers work. Any answer that is a valid heap with a value less than 14 in index 4 should receive full credit. 1 pt for any valid heap, 2 more points if index 4 is less than 14.

    b.   (3 pts) Fill in the array representation of a heap that meets all of the following conditions:

        i.   The minheap contains exactly eight integer values, without any duplicate values.
       ii.   The minheap does *not* contain the value 98.
      iii.   Inserting 98 into the minheap would cause us to incur the **worst**-case possible runtime for insertion.

Note: Index 0 is omitted because in the traditional storage of a heap using an array, that index is not used.

Index	1	2	3	4	5	6	7	8
Value	**101**	**102**	**104**	**112**	**109**	**107**	**106**	**116**

Grading Note: Many, many answers work. Any answer that is a valid heap with all values greater than 98 should receive full credit. 1 pt for any valid heap, 2 more points all values exceed 98.

    c.   (4 pts) Is it possible to draw a single minheap that simultaneously meets all of the conditions given in parts (a) **and** (b) of this problem? If so, draw such a minheap. If not, explain why not. If you're giving an explanation, be brief and clear, but also complete.

No, it's not possible. In order for this to happen, the parent of 14 (at the bottom level of the tree) needs to be less than 14. That means the root is also less than 14. If the root is less than 14, then the root is also less than 98 (obviously), and so there's no way for 98 to achieve the worst-case runtime when we insert it (which would require the 98 to percolate all the way up to the root node position).

Grading: 2 pts for saying it's not possible, 2 pts for the reason given.