Fill in your name and NetID. Please do not open the quiz until I tell you to do so.

**Directions:** Answer the following questions to the best of your ability. When appropriate, we encourage you to show your work, to help us understand your thought process. Quizzes count toward your grade; please take them seriously.

1. In a BST, what is **value invariant** - that is, what is true about the value of a parent node, compared to the values stored in its children and descendants?

2. In a max heap, what is **value invariant**?

3. In a heap, how is the data actually physically stored (as opposed to how we think about it)?

4. If we have a max heap, and we want to remove the minimum, how would we do this? Why is this a bad idea?
5. Assume that I already know what the “bubble up” and “bubble down” operations do in a heap. Now, explain (in English, or in some very simply pseudocode) how to perform each of the following operations:

insert

delete maximum value

build-max-heap (starting with an array of random data)