Post questionnaire for p1:

1. Strategy: Looking through the whole list, finding the first pair of out of order numbers and swap them to see if it's ordered. 1a is easier because numbers are more spread out so that can easily spot the out of order pairs.
2. Shifting angle decides difficulty level. 2a is easier because the question graph and option graph is very similar.
3. Strategy: normal AVL(BST) insertion method. For 3a you can easily tell the tree is balanced so you can then check the invariant nodes directly. 3a doesn't require rotation, but check every other nodes. 3a is harder because you have to check every node.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4a is a little harder than 4b, because it involves more memory: keep a counter and comparing simultaneously. 4b is more like comparing leaves which involves less memory.
5. Intuitively, Hard to associate them together. Tree rotation: a lot of difficulty is in finding where the insertion element goes, involves 2d computation, while mental rotation involves a 3d rotations. 5b is much easier.

Post questionnaire for p2:

1. Strategy: Looking through the whole list, finding the most extreme element from the list and move it to its deserving position and check if it is sorted.1a is easier because numbers are more spread out so that can easily spot out the most extreme number from the list.
2. Shifting angle decides difficulty level. 2a is easier.
3. Strategy: normal AVL(BST) insertion method. Then check if it is balanced and finally all nodes. For this specific question, 3a is harder because you have to go through every single node visually.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4b is harder because it involves in more look back and forth.
5. For this specific question, 5a is harder. Don't think mental rotation and AVL rotation involve the same thinking process.

Post questionnaire for p3:

1. Strategy: finding the first pair of out of order numbers and swap them to see if it's ordered. The same difficulty level because can tell the answer from the first pair of unordered numbers.
2. Shifting angle decides difficulty level. 2b is harder.
3. Strategy: normal AVL(BST) method. 3a doesn't require rotation, but check every other nodes. Difficult in different ways. Hard to tell.
4. Strategy: zig-zaging path for 4a, elimination method for 4b. Don't think these 2 questions are similar. 4b is a little harder than 4a, because it involves more memory: remember many tree leaves.

5. Don’t think tree rotation and mental rotation is similar. Tree rotation: a lot of difficulty is in finding where the insertion element goes, involves 2d computation, while mental rotation involves a 3d rotations. 5b is much easier.

Post questionnaire for p4:

1. Strategy: Looking through the whole list, finding the most extreme element from the list and move it to its deserving position and check if it is sorted. 1b is harder.
2. Shifting angle decides difficulty level. But the transformation is still at the same difficulty level.
3. Strategy: normal AVL(BST) insertion method. Then check if it is balanced and finally all nodes. For this specific question, 3b is harder because it involves in AVL rotations.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). Don’t think those 2 questions are similar.
5. Think tree rotation and mental rotation is similar.

Post questionnaire for p5:

1. Strategy: counting the numbers of pairs of out of order numbers. 1b is easier because of the representation(array with index).
2. Shifting angle decides difficulty level. 2a is easier because the question graph and option graph looks very similar.
3. Intuitively, 3a is more intimidating because tree is more dense and bigger.
4. I am not used to doing that kind of question and get better over the course of the experiment. Don’t think 2 questions are similar. 4b is more difficult because it involves in more memory usage.
5. 5b is easier. For AVL insertion, it involves in more consideration: it can be wrong in so many ways. For mental process, tree rotation is more similar to mental rotation than array related questions because both tree rotation and mental rotation just rotate elements.

Post questionnaire for p6:

1. Strategy: Looking through the whole list, finding the most extreme element from the list and move it to its deserving position and check if it is sorted. Almost at the same difficult level.
2. Shifting angle decides difficulty level. 2a is easier because the question graph and option graph looks very similar.
3. Strategy: normal AVL(BST) insertion method. Then check if it is balanced and finally all nodes. For this specific question, 3a is harder because you have to check all nodes after insertion and balance.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). Don’t think 2 questions are similar. 4b is more difficult because the order of target is uncertain: for 4a, the resulting array should be ordered. But for 4b, you don’t know what does the answer should look like.

5. 5b is easier. For AVL insertion, it involves in more steps. Don't think those 2 questions are similar.

Post questionnaire for p7:

1. Strategy: finding a pair of out of order numbers and swap them to see if it's ordered. 1b is harder than 1a because the pattern is more complex (more unordered numbers)
2. Shifting angle decides difficulty level. 2b is harder.
3. Strategy: normal AVL method. 3b is harder because it involves AVL rotation
4. Strategy: zig-zaging path for 4a, elimination method for 4b. Don't think those 2 questions are similar. 4b is harder than 4a.
5. Don't think tree rotation and mental rotation is similar

Post questionnaire for p8:

1. Strategy: Greedy approach, finding a pair of out of order numbers and swap them to see if it's ordered. At about the same difficult level.
2. At about the same difficult level.
3. Strategy: normal AVL method. 3a is harder because the tree is denser.
4. Strategy: zig-zaging path for 4a. For 4b, keep track the relevance order of the tree and check if the candidate list comply with such an ordering.
5. Mental rotation is much easier. Approach is different. Mental rotation is more intuitively.

Post questionnaire for p9:

1. Strategy: Looking through the whole list, finding the most extreme element from the list and move it to its deserving position and check if it is sorted. Almost at the same difficult level.
2. Shifting angle decides difficulty level. 2b is harder.
3. Strategy: normal AVL method. 3a is harder because you have to do an extra step to check all nodes.
4. Strategy: For 4a, check odd and even number. Elimination method for 4b (Insert elements from 1 list into a tree). Almost at the same difficult level.
5. Mental rotation is much easier because of the type of problem.

Post questionnaire for p10:

1. Strategy: Greedy approach, finding the first pair of out of order numbers and swap them to see if it's ordered. Almost at the same difficult level. 1a is slightly more easier because linked list is easier to read.
2. Shifting angle decides difficulty level. 2b is harder.
3. Strategy: normal AVL method. Imagine what the tree will look like: normally don't keep the whole tree in mind and just remember a certain part. 3a is harder because it's bigger.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). Don't think 2 questions are similar. 4a is more difficult because the extra counter you have to remember besides operation.

5. Mental rotation is a lost easier because you can keep track of the entire thing when doing rotation. But for AVL there are more leaves to consider. Struggle with rotations that involve a lot of nodes. So, they are 2 different types of questions.

Post questionnaire for p11:

1. Strategy: counting the numbers of out of order pairs. 1b is easier because elements are closer to each other thus easier to read.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: directly check the 2 options that if any of them comply with BST properties. Intuitively, both 2 questions are at the same difficulty level.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4b is easier because the target tree has been provided so that only need to check compliance.
5. Mental rotation is easier because it's easier to visualize. Don't think it involves in same thinking procedure.

Post questionnaire for p12:

1. Strategy: Pick the first unordered number and do a linearly search to see where it should be. Swap 2 elements to see if it's ordered. 1b is easier because doing swaps in array is more familiar.
2. 2a is easier because answer and target looks so similar.
3. Strategy: normal AVL(BST) insertion method. Then check if it is balanced and finally all nodes. For this specific question, 3a is easier because it takes longer to check all nodes(more dense).
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4b is more difficult because the order of target is uncertain: for 4a, the resulting array should be ordered. But for 4b, you don't know what does the answer should look like you have to create a BST in your mind.
5. They are different problems. Mental rotation is easier because it takes less time.

Post questionnaire for p13:

1. Strategy: Pick the first unordered number and do a linearly search to see where it belongs to. Swap 2 elements to see if it's ordered. At about the same difficult level. 1a is easier to read, because of linked list looks more comprehensible.
2. Do it in my head. Check which one works with. 2B is harder because of larger rotation angles.
3. Strategy: normal AVL method. 3a has to check each node after insertion. 3b has to do AVL rotation. 3a is overwhelming because you have to check each node.
4. Strategy: zig-zaging path for 4a with internal counter. For 4b, keep track the relevance order of the tree and check if the candidate list comply with such an ordering.
5. Approach is different. Mental rotation is more intuitively, more make sense to me. AVL rotation is more mathy.

Post questionnaire for p14:

1. Strategy: Pick the first unordered number and do a linearly search to see where it belongs to. Swap 2 elements to see if it's ordered. At the same difficulty level.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. Difficulty in different ways, hard to compare.
4. Strategy: zig-zaging path for 4a, elimination method for 4b. 4a is harder.
5. AVL rotation is harder because it involves double rotations. Guess follow the same brain pattern when solving those 2 questions.

Post questionnaire for p15:

1. Do the swap in mind. Linear search the smallest element and swap it with the first element in the list. Do it recursively. 1a is slightly more obvious. Thus 1b is slightly harder.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. Then scan the tree to check random change.
4. Strategy: don't know how to solve merge list. Fail to do such question. For 4b, keep track the relevance order of the tree and check if the candidate list comply with such an ordering.
5. Didn't really think there is a correlation between AVL rotation and mental rotation.

Post questionnaire for p16:

1. Strategy: Greedy approach, finding a pair of out of order numbers and swap them to see if it's ordered. At about the same difficult level.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. Then scan the tree to check random change. 3b is more difficulty because it involves AVL rotations.
4. Strategy: zig-zaging path for 4a. elimination method for 4b. For 4b, keep track the relevance order of the tree and check if the candidate list comply with such an ordering.
5. Mental rotation is easier. Color and cube are natural to human being.

Post questionnaire for p17:

1. Strategy: Pick the first unordered number and do a linearly search to see where it belongs to. Swap 2 elements to see if it's ordered. At the same difficulty level.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. Then scan the tree to check random change. 3a is more difficulty because the tree is denser and larger.
4. Strategy: zig-zaging path for 4a, elimination method for 4b. 4b takes more time.
5. Mental rotation is easier, it's more natural to human being.

Post questionnaire for p18:

1. Strategy: Pick the first unordered number and do a linearly search to see where it belongs to. Swap 2 elements to see if it's ordered. 1a is easier because numbers are more spread out thus more obvious.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. 3a is a little bit harder because you have to check all nodes after insertion and rotation are done.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4a is easier because 2 lists are in the same format but 4b you have to transform from list to tree.
5. AVL is easier because I'm more familiar with AVL insertion. At first having a hard time struggling with mental rotation question.

Post questionnaire for p19:

1. Strategy: Pick the first unordered number and do a linearly search to see where it belongs to. Swap 2 elements to see if it's ordered. Basically think they are at the same difficulty level.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. Then scan the tree to check random change. 3a is easier because it doesn't involve in rotation.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 4a is harder because it's easy to lose the count.
5. Pretty different. 5a is easier because I'm more familiar with AVL, just stick with algorithm. But for 5b you have to manipulate shapes in space.

Post questionnaire for p20:

1. Strategy: counting the numbers of out of order pairs. 1b is easier because numbers are closer to each other.
2. Shifting angle decides difficulty level. 2b is slightly more difficulty than 2a.
3. Strategy: normal AVL method. 3a is harder because 3a is denser and larger. The smaller the tree, the easier the problem is.
4. Strategy: zig-zaging path for 4a (comparing 2 lists and counting internally), elimination method for 4b (Insert elements from 1 list into a tree). 2 different questions. Merging question is easier because I don't have to track a lot of information, just counting and pointing.
5. Mental rotation question is always easier: it is more straightforward and less more information to track.

Do participants agree on:

1. The classification of mental rotation based on angle difference? Ratio (ex. 10:40) that thought mental rotation and tree rotation were not similar at all.
2. Mental rotation and tree rotation are similar? Ratio (ex. 10:40) that mentioned no differences between varying angles in mental rotation tasks