Assignment 3 Discussion  
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Based off the minimum number of comparisons for each threshold value from 8 to 16 we can conclude that the hybrid sort of quick and insertion is always has the least amount of comparisons. The least amount of comparisons with an array of size 50 seems to be the threshold of 10 for quick and insertion. The quick and insertion comparison line in the given graph shows that the number of comparisons doesn’t seem to increase or decrease based off of threshold value, while the other hybrid sorts seem to increase the amount of comparisons, with the exception of merge and insertion. We can account for quick and insertion having the least amount of comparisons because if you put all the numbers below a certain pivot on one side and compare the values they will be a little more in-order when the hybrid sort passes to the small sort, when compared to merge sort which just puts half the values on one side.

The bubble sort seems to have more comparisons with a larger threshold in comparison to insertion sort. In addition it seems to be that the optimal threshold value to get the least amount of comparisons it is a threshold value of 8. This makes sense because a lower threshold value means that you have to do least amount of comparisons with the small sort. With a higher threshold value we have to rely on the small sort to do more comparisons which is why it is a higher average than the other thresholds.

Another interesting thing to point out is that as the threshold increases the amount of comparisons for the merge and insertion seems to decrease, while all of the 3 other hybrid sorts have the amount of comparisons increase. I would guess the for smaller thresholds the amount of comparisons would also decrease.

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|  | Quick and Bubble | merge and insertion | quick and insertion | merge and bubble | Average | Max | Min |
| 8 | 341 | 795 | 294 | 296 | 431.5 | 795 | 294 |
| 9 | 577 | 828 | 256 | 338 | 499.75 | 828 | 256 |
| 10 | 694 | 739 | 196 | 340 | 492.25 | 739 | 196 |
| 11 | 628 | 726 | 252 | 397 | 500.75 | 726 | 252 |
| 12 | 657 | 755 | 205 | 581 | 549.5 | 755 | 205 |
| 13 | 911 | 697 | 222 | 638 | 617 | 911 | 222 |
| 14 | 972 | 785 | 257 | 545 | 639.75 | 972 | 257 |
| 15 | 938 | 672 | 220 | 532 | 590.5 | 938 | 220 |
| 16 | 1004 | 690 | 228 | 556 | 619.5 | 1004 | 228 |