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CSCI 303: Algorithms, HW 6

Due: 3:30 pm, Wednesday, 10/17

1. Problem 1
   (42, 7), (42, 40), (57, 7), (57, 40), (83, 78), (83, 80), (83, 79), (86, 80), (86, 79), (86, 84), (89, 80), (89, 79), (89, 84), (80, 79), (91, 79), (91, 84)
   Inversions: 16

2. Problem 2

Original	42	57	7	40	83	78	86	89	80	91	79	84	Positions Moved
After $p = 1$	42	57	7	40	83	78	86	89	80	91	79	84	0
After $p = 2$	7	42	57	40	83	78	86	89	80	91	79	84	2
After $p = 3$	7	40	42	57	83	78	86	89	80	91	79	84	2
After $p = 4$	7	40	42	57	83	78	86	89	80	91	79	84	0
After $p = 5$	7	40	42	57	78	83	86	89	80	91	79	84	1
After $p = 6$	7	40	42	57	78	83	86	89	80	91	79	84	0
After $p = 7$	7	40	42	57	78	83	86	89	80	91	79	84	0
After $p = 8$	7	40	42	57	78	80	83	86	89	91	79	84	3
After $p = 9$	7	40	42	57	78	80	83	86	89	91	79	84	0
After $p = 10$	7	40	42	57	78	79	80	83	86	89	91	84	5
After $p = 11$	7	40	42	57	78	79	80	83	84	86	89	91	3

   The number of shifts required by insertion sort compared to the number of inversions in the original input are equal.

3. Problem 3

42	57	7	40	83	78	86	89	80	91	79	84	Shifts	Removed Inversions
42	57	7	40	83	78	86	89	80	91	79	84	0	0
42	57	7	40	83	84	86	89	80	91	79	78	1	3
42	57	7	40	91	84	86	89	80	83	79	78	2	1
42	57	7	89	91	84	86	40	80	83	79	78	3	1
42	57	86	89	91	84	7	40	80	83	79	78	4	2
42	91	86	89	83	84	7	40	80	57	79	78	6	3
91	89	86	80	83	84	7	40	42	57	79	78	9	4
89	83	86	80	79	84	7	40	42	57	78	91	13	13
86	83	84	80	79	78	7	40	42	57	89	91	16	10
84	83	78	80	79	57	7	40	42	86	89	91	19	12
83	80	78	42	79	57	7	40	84	86	89	91	22	11
80	79	78	42	40	57	7	83	84	86	89	91	25	8
79	42	78	7	40	57	80	83	84	86	89	91	28	9
78	42	57	7	40	79	80	83	84	86	89	91	30	5
57	42	40	7	78	79	80	83	84	86	89	91	32	4
42	7	40	57	78	79	80	83	84	86	89	91	34	4
40	7	42	57	78	79	80	83	84	86	89	91	35	2
7	40	42	57	78	79	80	83	84	86	89	91	36	1

The number of shifts required by heap sort is much greater than the total number of original inversions because it adds inversions as it goes through.

4. Problem 4

42	57	7	40	83	78	86	89	80	91	79	84	Ordering changes	Inversions removed
42	57	7	40	83	78	86	89	80	91	79	84	0	0
7	42	57	40	83	78	86	89	80	91	79	84	1	2
7	42	57	40	83	78	86	89	80	91	79	84	0	0
7	42	57	40	78	83	86	89	80	91	79	84	1	1
7	40	42	57	78	83	86	89	80	91	79	84	1	2
7	40	42	57	78	83	86	89	80	91	79	84	0	0
7	40	42	57	78	83	80	86	89	91	79	84	1	2
7	40	42	57	78	83	80	86	89	79	91	84	1	1
7	40	42	57	78	83	80	86	89	79	84	91	1	1
7	40	42	57	78	83	79	80	84	86	89	91	2	5
7	40	42	57	78	79	80	83	84	86	89	91	2	2

The number of re orderings is smaller than the number of inversions in the original array.