

Northern Michigan University (Marquette Co, MI)

CS422-01-25W: Algorithms (Andrew A. Poe)
Quiz 4

Name: _____
Friday 14 February 2025 9:00 A.M. EST

Time: 15 minutes

Demonstrate how the Shell Sort (as we described it in class) would work on the following array of characters:

I N F L U E N Z A

How many passes through the array will Shell Sort make in this case? How many swaps will it make?

We say that Shell Sort is $n \lg^2 n$ because it makes about $\lg^2 n$ passes through the array. Could we make it an $n \lg n$ sort by only making $\lg n$ passes? Explain your answer.

There are 9 elements in the array, so choosing gaps containing no prime factor besides 2 and 3: 8 6 4 3 2 1

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8:  I N F L U E N Z A
    ^               ^
    1               1

    A N F L U E N Z I    1 swap
6:                               no swaps

    ^       ^ ^       ^
    1       2 1       2
    A E F L I N N Z U    2 swaps

3:                               0 swaps

2:                               0 swaps

1:       ^ ^       ^ ^
    1 1       2 2

    A E F I L N N U Z    2 swaps
```

6 passes total, 5 swaps. By using this pattern for gaps, we guarantee that no element will swap more than once per pass. But other patterns for gaps do not guarantee this, and so if you decrease the number of passes, it may take much longer to go through each pass as you might have to swap the same element many times. Some gap patterns are fast in practice, but have some very bad cases that potentially could take much longer.