

Feedback — Elementary Sorts

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You submitted this quiz on **Sun 13 Sep 2015 4:20 PM EDT**. You got a score of **1.80** out of **3.00**. You can [attempt again](#), if you'd like.

To specify an array or sequence of values in an answer, separate the values in the sequence by whitespace. For example, if the question asks for the first ten powers of two (starting at 1), then the following answer is acceptable:

1 2 4 8 16 32 64 128 256 512

If you wish to discuss a particular question and answer in the forums, please post the entire question and answer, including the seed (which can be used by the course staff to uniquely identify the question) and the explanation (which contains the correct answer).

Question 1

(seed = 866565)

Give the array that results after the first 4 exchanges when selection sorting the following array:

69 64 38 84 86 83 24 79 59 97

Your answer should be a sequence of 10 integers, separated by whitespace.

You entered:

24 38 59 64 84 86 83 69 79 97

Your Answer	Score	Explanation
24 38 59 64 84 86 83 69 79 97	✖ 0.00	
Total	0.00 / 1.00	

Question Explanation

The correct answer is: 24 38 59 64 86 83 69 79 84 97

Here is the array after each exchange:

```

69 64 38 84 86 83 24 79 59 97
1: 24 64 38 84 86 83 69 79 59 97
2: 24 38 64 84 86 83 69 79 59 97
3: 24 38 59 84 86 83 69 79 64 97
4: 24 38 59 64 86 83 69 79 84 97

```

Question 2

(seed = 518236)

The column on the left contains an input array of 16 strings to be sorted; the column on the right contains the strings in sorted order; each of the other 6 columns contains the array at some intermediate step during either insertion sort, selection sort, or shellsort (with different columns potentially corresponding to different algorithms).

STYX	ABBA	INXS	CARS	BECK	CARS	ABBA	ABBA
MUSE	BECK	MUSE	DIDO	LIVE	DIDO	BECK	BECK
SADE	CARS	ABBA	KISS	ABBA	LIVE	CARS	CARS
CARS	CHER	CARS	LIVE	CARS	MUSE	CHER	CHER
DIDO	DIDO	DIDO	MUSE	DIDO	SADE	DIDO	DIDO
LIVE	FUEL	LIVE	SADE	MUSE	STYX	FUEL	FUEL
TOTO	INXS	TOTO	STYX	TOOL	TOTO	INXS	INXS
KISS	KISS	KISS	TOTO	CHER	KISS	KISS	KISS
FUEL	LIVE	FUEL	FUEL	FUEL	FUEL	LIVE	LIVE
PINK	PINK	PINK	PINK	PINK	PINK	MUSE	MUSE

TOOL	TOOL	TOOL	TOOL	TOTO	TOOL	TOOL	PINK
CHER	SADE	CHER	CHER	KISS	CHER	SADE	SADE
BECK	MUSE	BECK	BECK	INXS	BECK	PINK	STYX
INXS	TOTO	STYX	INXS	STYX	INXS	TOTO	TOOL
UB40	UB40	UB40	UB40	UB40	UB40	UB40	TOTO
ABBA	STYX	SADE	ABBA	SADE	ABBA	STYX	UB40
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0	?	?	?	?	?	?	4

Match up each column with the corresponding sorting algorithm from the given list:

- 0. Original input
- 1. Insertion sort
- 2. Selection sort
- 3. Shellsort ($3x + 1$ increments)
- 4. Sorted

You should use each choice at least once. Your answer should be a sequence of 8 integers between 0 and 4 (starting with 0 and ending with 4), separated by whitespace.

Hint: think about algorithm invariants. Do not trace code.

You entered:

0 2 3 1 3 1 2 4

Your Answer		Score	Explanation
0	✓	0.12	
2	✓	0.12	
3	✓	0.12	
1	✓	0.12	
3	✓	0.12	
1	✓	0.12	
2	✓	0.12	

4  0.12

Total 1.00 / 1.00

Question Explanation

The correct answer is: 0 2 3 1 3 1 2 4


- 0: Original input
- 2: Selection sort after 8 iterations
- 3: Shellsort after 13-sorting
- 1: Insertion sort after 8 iterations
- 3: Shellsort after 4-sorting
- 1: Insertion sort after 6 iterations
- 2: Selection sort after 10 iterations
- 4: Sorted

Question 3

(seed = 193209)

Which of the following statements about elementary sorting algorithms are true? Check all that apply. Unless otherwise specified, assume that the sorting implementations are the ones from the lectures.

Your Answer	Score	Explanation
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<input type="checkbox"/> The number of compares to Shellsort (with Knuth's $3x+1$ increments) an array of length N depends	 0.20	The number of compares to Shellsort the array { 1, 2, 3 } is 2; the number of compares to Shellsort the array { 3, 2, 1 } is three.
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only on
N (and n
ot on th
e items
in the a
rray).



0.20

The total number of compares becomes linearithmic (but number of exchanges is still quadratic). This is still a worthwhile improvement.

Suppose
that we
modify i
nsertion
sort to
use bina
ry searc
h to loc
ate the
position
within t
he first
i-1 entr
ies of t
he array
into whi
ch entry
i should
be inser
ted. The
n, the n
umber of
compares
to inser
tion sor
t an arr
ay of N
elements
is $\sim N \lg N$ in t
he worst
case.





0.20

Consider the array $\{ N, 2, 3, 4, \dots, 1 \}$, which has $2N-3$ inversions. Exchanging N and 1 results in the array $\{ 1, 2, 3, \dots, N \}$, which has zero inversions.

Let a[]
be an ar
ray cont
aining N

distinct
keys with
 $N \geq 4$.
Then, exchanging
two items
can decrease
the number
of inversions
by strictly
more than
 N .

-
- ☐  0.20 Consider element $i > 0$. How many of the items $a[0], a[1], \dots, a[i-1]$ is $a[i]$ inverted with? If $a[i] = 1$ (which happens with probability $1/2$), then the number is 0. If $a[i] = 0$ (which happens with probability $1/2$), then we expect half of the i previous elements to be 1s, so the expected number is $i/2$. So, the expected number of inversions is $1/2(0/2 + 1/2 + 2/2 + 3/2 + \dots + (N-1)/2) \sim N^2/8$. Thus, the expected number of compares is $\sim 1/8 N^2$.
-
- ☒  0.00 Consider element $i > 0$. How many of the items $a[0], a[1], \dots, a[i-1]$ is $a[i]$ inverted with? If $a[i] = 1$ (which happens with probability $1/2$), then the number is 0. If $a[i] = 0$ (which happens with probability $1/2$), then we expect half of the i previous elements to be 1s, so the expected number is $i/2$. So, the expected number of inversions is $1/2(0/2 + 1/2 + 2/2 + 3/2 + \dots + (N-1)/2) \sim N^2/8$. Thus, the expected number of compares is $\sim 1/8 N^2$.
-

formly r
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der is ~
 $1/4 N^2$.

Total	0.80 /
	1.00

Question Explanation