



Grade 7/8 Math Circles
November 11, 2020
Algorithms - Problem Set

1. Give an example of when you have used an algorithm in your own life.
2. Write a set of steps (an algorithm) on how to subtract (with borrowing) so someone who does not know how to subtract by borrowing can learn.
3. Sort the following list of numbers using selection sort.

9 67 32 74 85 11

4. Sort the following list of numbers using insertion sort.

12 43 68 95 7 21

5. Sort the following list of numbers using bubble sort.







41 84 14 79 26 53

6. Think about the Selection Sort algorithm.
 - (a) What guarantees that the end result will be a properly sorted list?
 - (b) What would we have to change about the selection sort algorithm to get the list in descending order?
7. Sort the following list using selection sort, insertion sort, and bubble sort.

25 13 6 9 1 38

- (a) How many steps did the selection sort take?
(Each time you compare a number to the current smallest and each time you move a number is a step)
 - (b) How many steps did the insertion sort take?
(Each time you move a number and each time you compare it to the numbers in the sorted list till it is in the right spot is a step)
 - (c) How many steps did the bubble sort take?
(The comparison of each pair is a step whether you swap them or not)
 - (d) Which of these methods is the most efficient or the fastest?
8. As humans, we can quickly observe that the following list is sorted and does not need to be sorted any further. However, computers can't see this and given this list, they will still complete the steps to any of the sorting algorithms. Go through the following list using **merge sort** as a computer would.

3 8 15 26 27 49

9. Sort the following dice using the algorithm specified below:    
- Make sure the show which colour each die is.
- (a) Use insertion sort.
 - (b) Use bubble sort.
 - (c) You probably noticed that there were two repeated elements in this list. We say a sorting algorithm is **stable** if repeated elements stay in the same order before and after a list is sorted. Which of the two algorithms we just looked at are stable?
(Which algorithms resulted in a sorted list where  is before  ?)
10. Sort the following letters in alphabetical order using the algorithms specified below.

M A T H I S F U N

- (a) Use insertion sort.
- (b) Use bubble sort.

11. Based on the following steps showing a list of 3 digit numbers being sorted with an algorithm called **Radix Sort**, write the down what you think the algorithm is.

365 502 560 299 101 462 401 902

365 502 560 299 101 462 401 902

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560 101 401 502 462 902 365 299

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560 101 401 502 462 902 365 299

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101 401 502 902 560 462 365 299

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101 299 365 401 462 502 560 902