

# Algorithms

## Assignment: Sorting Networks

Name: .....

Id: .....

Grade

Good Luck!

1. (a) Construct an *efficient* sorting network for  $n = 5$  inputs. Try to minimize the size and the depth.

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- (b) What is the complexity of your construction?

size \_\_\_\_\_ depth \_\_\_\_\_

2. The following is a sorting algorithm:

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for  $i = 1$  to  $n - 1$ 
  for  $j = n$  downto  $i + 1$ 
    if  $A[j] < A[j - 1]$  then  $A[j] \leftrightarrow A[j - 1]$ 

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- (a) Construct a sorting network that follows the above code for  $n = 8$ .

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- (b) What is the exact complexity of what you constructed for  $n = 8$ ?

size \_\_\_\_\_ depth \_\_\_\_\_

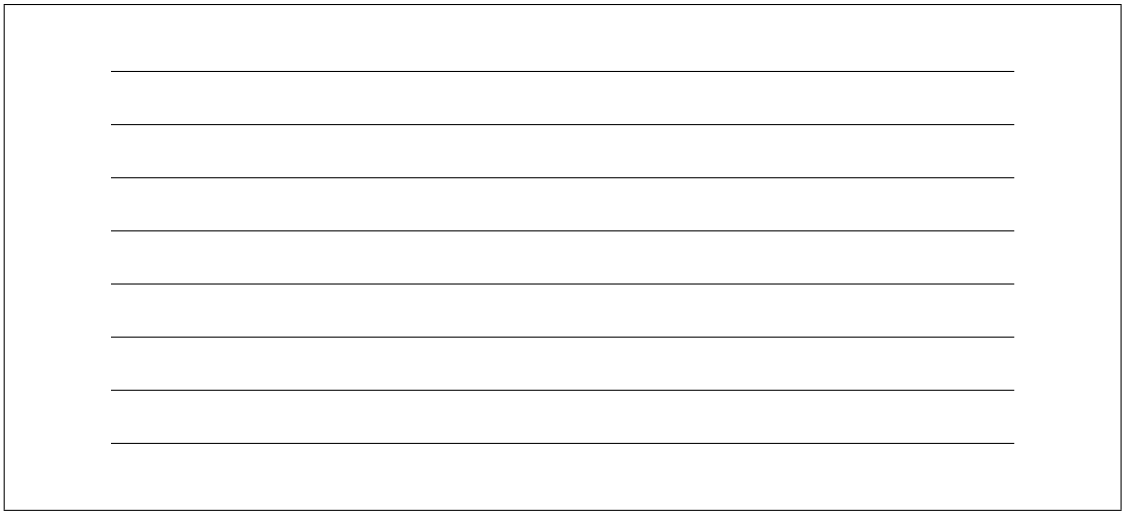
- (c) What is the exact complexity of a similar network for  $n = 13$ ?

size \_\_\_\_\_ depth \_\_\_\_\_

- (d) What is the exact complexity of a similar network for  $n$  as a function of  $n$ ?

size \_\_\_\_\_ depth \_\_\_\_\_

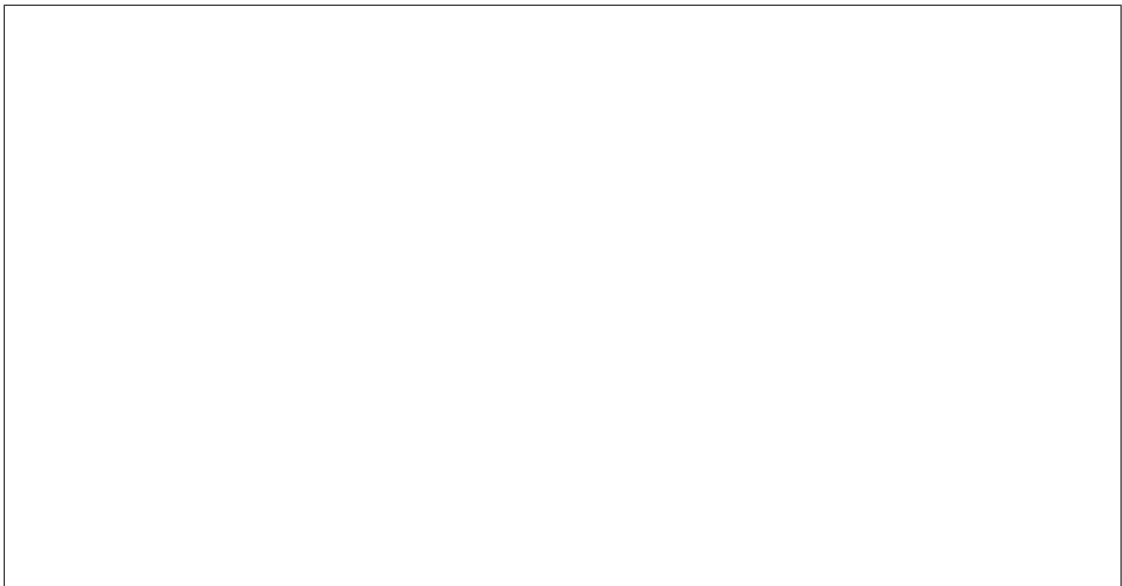
3. (a) Construct an *efficient* network that finds the first and second among 8 inputs. Try to minimize the size and the depth.



- (b) What is the complexity of your construction?

size \_\_\_\_\_ depth \_\_\_\_\_

- (c) Describe how to construct an *efficient* network that finds the first and second among  $n > 1$  inputs. Try to minimize the size and the depth.



- (d) What is the complexity of your construction?

size \_\_\_\_\_ depth \_\_\_\_\_

4. Prove or disprove the following claim: “*If we add a comparator to a sorting network the new network is also a sorting network.*” If you prove this claim, write a short but convincing proof. If you disprove the claim, construct a counter-example.



5. Construct a network the depth of which is larger than the maximum number of comparators on any of its lines. Try to find a small as possible such network.

