

Reductions

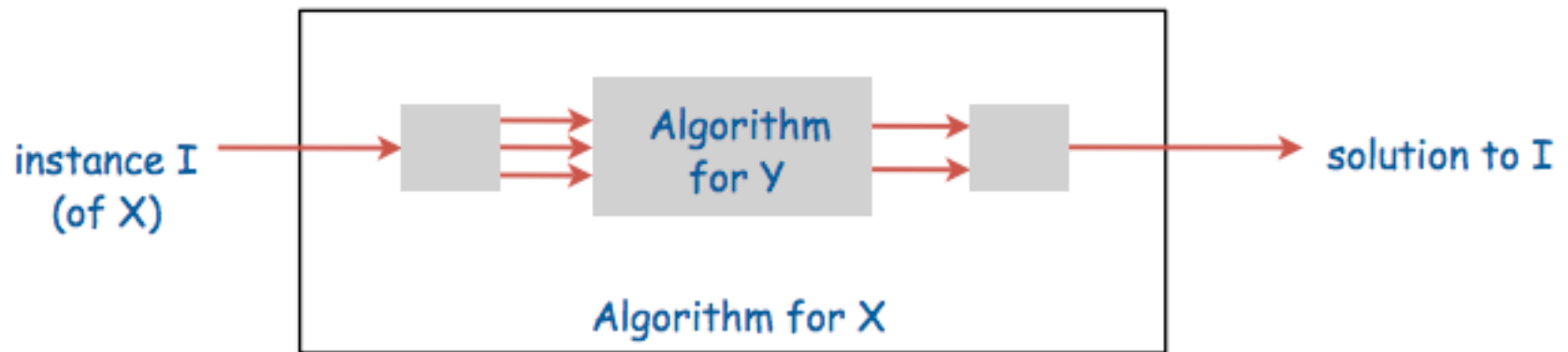
Problem 1: Given a list of values $X = \{x_1, x_2, \dots, x_n\}$, return the list in sorted order.

Problem 2: Given two lists of values $X = \{x_1, x_2, \dots, x_n\}$, and $Y = \{y_1, y_2, \dots, y_n\}$, return a pairing of all the elements in X and Y such that the least element of X is paired with the least element of Y and so on.

Describe how we can use a solution for Problem 1 to solve Problem 2. What is the cost of your algorithm?

Reductions

Definition: Problem X reduces to problem Y if you can use an algorithm that solves Y to help solve X .



Draw the picture for the previous example and describe exactly what is contained in the two smaller gray boxes.

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Can you come up with an algorithm for Problem 1 that uses Problem 2? (Reduce Sorting to Pairing)

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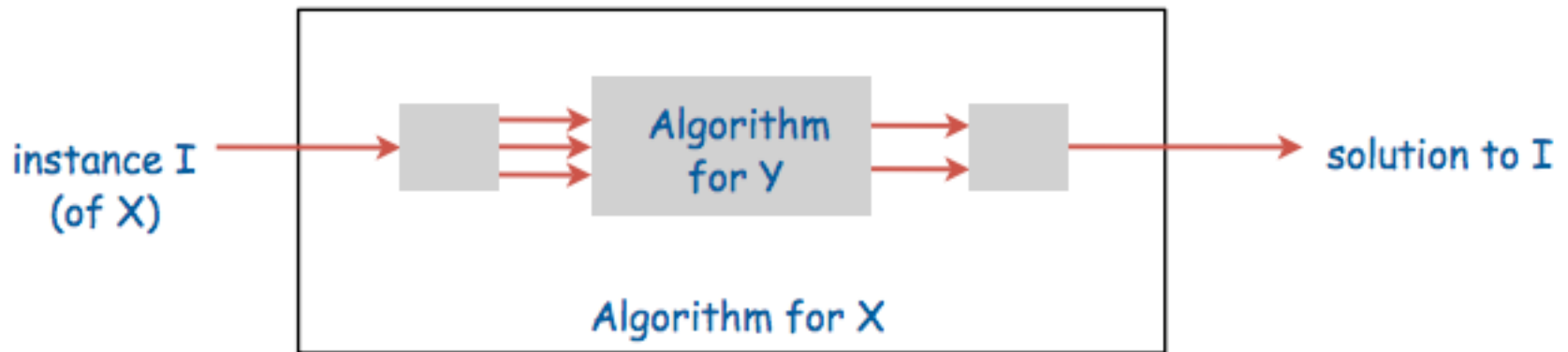
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What does your reduction tell you about the lower bound for Pairing? Is it possible to find a $O(n)$ pairing algorithm?

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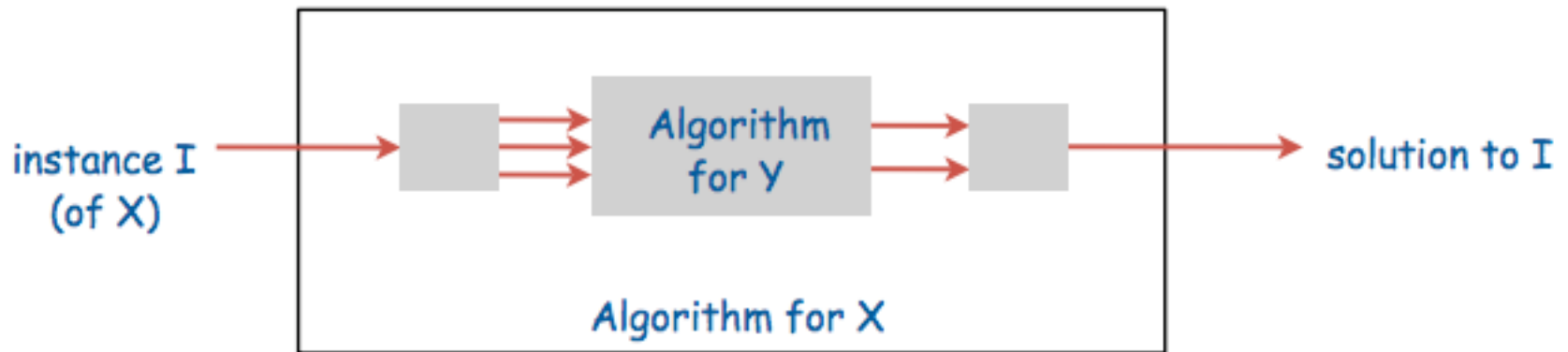
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If we know that X has a large time complexity and we have this reduction, what does this tell you about the time complexity of Y ?

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If we know that Y has a large time complexity and we have this reduction, what does this tell you about the time complexity of X ?