

# Worksheet 17 Solution

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## Question 1

a. We need to determine  $|\mathcal{I}_n|$ .

The problem tells that the values in inputs are either 1 or 0, and we know  $\mathcal{I}_n$  represents all possible inputs of size  $n$  containing binary values.

After watching lecture videos, and reading notes, I do not yet understand the details of how to evaluate the  $\mathcal{I}_n$ , but from the pattern below

$[0], [1], [1, 0], [0, 1], [1, 1], [0, 0], [0, 0, 0], [0, 0, 1], [0, 1, 0], [1, 0, 0], [1, 1, 0], [1, 0, 1], [0, 1, 1], [1, 1, 1]$

we can see the inputs of size 1 have 2 different inputs, the inputs of size 2 have 4 different inputs, and the inputs of size 3 have 8 different inputs.

Using this pattern, I can make an educated guess that  $|\mathcal{I}_n| = 2^n$ .

### Notes:

- The idea of average-case analysis is that some data structures and algorithms have poor worst-case performance but perform well in vast majority of others.
- Average-case analysis looks at running time on sets of inputs
- Average case:  $AVG_{func}(n) = avg\{\text{runtime of func}(x) \mid x \in \mathcal{I}_n\}$
- Worst case:  $WC_{func}(n) = max\{\text{runtime of func}(x) \mid x \in \mathcal{I}_n\}$