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CS 171 PS4

Problem 2 Solution

$$\text{R} = \sum_{k=1}^{m} \binom{m}{k} \sum_{i=1}^{m-k} \binom{m-k}{i}$$
$$\text{R} = \sum_{k=1}^{m} \binom{m}{k} 2^{m-k} - 1$$
$$\text{R} = \sum_{k=1}^{m} \binom{m}{k} 2^{m-k} - \sum_{k=1}^{m} \binom{m}{k}$$
$$\text{R} = \sum_{k=1}^{m} \binom{m}{k} 2^{m-k} - (2^m + 1)$$

Where

$$\sum_{i=1}^{n} \binom{n}{i} = 2^n - 1$$

Because

$$(1+x)^m = \sum_{i=1}^{m} \binom{m}{i} x^{m-i} + x^m,$$

Substitute x = 2

$$3^m = \sum_{i=1}^{m} \binom{m}{i} 2^{m-i} + 2^m$$

So we get

$$R = 3^m - 2^m - 2^m + 1 = 3^m - 2^{m+1} + 1$$