

## 1 The problem

Use generating functions to prove that

$$\sum_k \binom{l}{m+k} \binom{s+k}{n} (-1)^k = (-1)^{l+m} \binom{s-m}{n-l} \quad (1)$$

First, get rid of  $n$  in the problem itself for the sake of clarity. Let be  $n = t$

$$\sum_k \binom{l}{m+k} \binom{s+k}{t} (-1)^k = (-1)^{l+m} \binom{s-m}{t-l}$$

Let's use the identity

$$\binom{m}{n} = [x^n](1+x)^m$$