

COMMENTS ON CONCRETE MATHEMATICS (2E) BINOMIAL COEFFICIENTS

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1. CONVENTIONS

- Use variable z that indicates complex value in generating functions.
- Give particular names to binomial identities, for example *absorption identity*
- Give particular names to generating functions to remember them easily
- Use subscript indices for generating functions that are powers of some value t , for clarity. Example: $A_t(z) = (1 + z)^t$ for binomial coefficients.

2. IMPORTANT BINOMIAL IDENTITIES

3. IMPORTANT GENERATING FUNCTIONS

Identity 3.1. *Binomial coefficient*

$$\binom{r}{n} = [z]^n (1 + z)^r$$

Identity 3.2. *Shifted binomial coefficient for fixed m*

$$\binom{r}{m+n} = [z]^n \frac{(1+z)^r}{z^m}$$

Identity 3.3. *Binomial coefficient of multiset*

$$A_k(z) = \sum_{n=0}^{\infty} \binom{n}{k} z^n = \frac{z^k}{(1-z)^{k+1}}$$

Then

$$\binom{t}{k} = [z]^t \frac{z^k}{(1-z)^{k+1}}$$

Version: Local-0.1.0