Formula Sheet (it only includes formulas that **might** be useful for the exam. Formulas in the notes but not in here should be memorized)

$$(x_1 + x_2 + \cdots + x_k)^n = \sum_D \binom{n}{n_1 n_2 \cdots n_k} x_1^{n_1} x_2^{n_2} \cdots x_k^{n_k}$$

where

$$D = \left\{ (n_1, n_2, \ldots, n_k) : \sum_{j=1}^{k} n_i = n \right\}.$$

$$(x+y)^n = \sum_{r=0}^{n} \binom{n}{r} x^{n-r} y^r.$$

$$\sum_{x=0}^{\infty} ar^x = \frac{a}{1-r} \quad \text{if } |r| < 1.$$

$$\sum_{x=1}^{n} x = \frac{n(n+1)}{2} \qquad \sum_{x=1}^{n} x^2 = \frac{n(n+1)(2n+1)}{6}$$