

Title: Exponential function and Mayer expansion

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Abstract: The unifying topic of this thesis is cluster expansion in statistical physics. It is divided into three chapters. In the first one we present the necessary mathematical apparatus — selected topics from combinatorics, graph theory and theory of generating functions. The second one is an introduction to cluster expansion and abstract polymer model. Finally, in the third chapter we show a new resummation method for partition function of hard-core repulsive abstract polymer model. In this resummation we make use of cancellations of terms in partition function to rewrite the sum of clusters to a sum of *quilted* clusters, or alternatively as a sum of *bunches*. The methods we use in this final chapter are original and may lead to some new results.

Keywords: binomial and multinomial formula; power series; inclusion-exclusion principle; cluster expansion.