NECESSARY AND SUFFICIENT CONDITIONS FOR
SYMMETRIC HOMOGENEOUS POLYNOMIAL
INEQUALITIES IN NONNEGATIVE REAL VARIABLES

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Abstract. Let \( f_n(x,y,z) \) be a symmetric homogeneous polynomial of degree \( n \). In this paper, we give the necessary and sufficient conditions to have \( f_n(x,y,z) \geq 0 \) for \( n \leq 6 \) and any nonnegative real numbers \( x,y,z \). In addition, we extend some results to \( n = 7 \) and \( n = 8 \), and then apply the proposed method to prove several elegant symmetric homogeneous polynomial inequalities of degree \( n, 4 \leq n \leq 8 \).

Keywords and phrases: Symmetric homogeneous inequality, necessity and sufficiency, nonnegative real variables.

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