

# Generalized product-type probability approximations and bounds of higher order

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Approximating and bounding the probability of the realization of multiple events, which are not independent of each other are a problem with great interest in many fields.

In [2], [3], and [4] the authors introduced respectively the concepts of the cherry tree, multitree, and hypermultitree and the so-called  $m$ -regular hypergraphs to the calculation of bounds of the probabilities of the union of events.

Apart from these types of probability bounds, Block et. al. [1] proposed product type bounds. In this paper, we give more general product-type approximations of the probability of the union or intersection of events by using the characteristic random variables assigned to the events, and cherry tree graphs. Moreover, conditions under which these approximations are lower (upper) bounds will be also given.

## References

- [1] Block, Henry W., Timothy Costigan, and Allan R. Sampson. "Second order Bonferroni-type, product-type and setwise probability inequalities." Lecture Notes-Monograph Series (1991): 74-94.
- [2] Bukszár, Jozsef. "Hypermultitrees and sharp Bonferroni inequalities." Mathematical Inequalities and Applications, 6 (4) 727743 (2003)
- [3] Bukszár, József, and Tamás Szántai. "Probability bounds given by hypercherry trees." Optimization Methods and Software 17.3 (2002): 409-422
- [4] Kovács, Gergely, and Béla Vizvári. "A generalization of Hunter's bound to hypergraphs." Annals of Operations Research (2018): 1-7.