

THE CROSSING NUMBER OF CARTESIAN PRODUCT OF 5-WHEEL WITH ANY TREE

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Abstract

In this paper, we establish the crossing number of join product of 5-wheel with n isolated vertices. In addition, the exact values for the crossing numbers of Cartesian products of the wheels of order at most five with any tree T are given.

Keywords: drawing, crossing number, join product, Cartesian product.

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REFERENCES

- [1] J.A. Bondy and U.S.R. Murty, *Graph Theory with Applications* (North-Holland, NewYork-Amsterdam-Oxford, 1982).
- [2] D. Bokal, *On the crossing numbers of Cartesian products with paths*, J. Combin. Theory Ser. B **97** (2007) 381–384.
doi:10.1016/j.jctb.2006.06.003
- [3] D. Bokal, *On the crossing numbers of Cartesian products with trees*, J. Graph Theory **56** (2007) 287–300.
doi:10.1002/jgt.20258
- [4] Z. Ding and Y. Huang, *The crossing numbers of join of some graphs with n isolated vertices*, Discuss. Math. Graph Theory **38** (2018) 899–909.
doi:10.7151/dmgt.2048
- [5] P. Erdős and R.K. Guy, *Crossing number problems*, Amer. Math. Monthly **80** (1973) 52–58.
doi:10.1080/00029890.1973.11993230

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- [6] M.R. Garey and D.S. Johnson, *Crossing number is NP-complete*, SIAM J. Algebr. Discrete Methods **4** (1983) 312–316.
doi:10.1137/0604033
- [7] P.T. Ho, *The crossing number of $K_{1,m,n}$* , Discrete Math. **308** (2008) 5996–6002.
doi:10.1016/j.disc.2007.11.023
- [8] Y. Huang and T. Zhao, *The crossing number of $K_{1,4,n}$* , Discrete Math. **308** (2008) 1634–1638.
doi:10.1016/j.disc.2006.12.002
- [9] S. Jendroľ and M. Ščerbová, *On the crossing numbers of $S_m \square P_n$ and $S_m \square C_n$* , Časopis Pro Pěst. Mat. **107** (1982) 225–230.
- [10] D.J. Kleitman, *The crossing number of $K_{5,n}$* , J. Combin. Theory **9** (1970) 315–323.
doi:10.1016/S0021-9800(70)80087-4
- [11] M. Klešč, *The crossing numbers of products of path and stars with 4-vertex graphs*, J. Graph Theory **18** (1994) 605–614.
doi:10.1002/jgt.3190180608
- [12] M. Klešč, *The join of graphs and crossing numbers*, Electron. Notes Discrete Math. **28** (2007) 349–355.
doi:10.1016/j.endm.2007.01.049
- [13] M. Klešč, *The crossing numbers of join of the special graph on six vertices with path and cycle*, Discrete Math. **310** (2010) 1475–1481.
doi:10.1016/j.disc.2009.08.018
- [14] M. Klešč and Š. Schrötter, *The crossing numbers of join products of paths with graphs of order four*, Discuss. Math. Graph Theory **31** (2011) 321–331.
doi:10.7151/dmgt.1548
- [15] M. Klešč and Š. Schrötter, *The crossing numbers of join of paths and cycles with two graphs of order five*, Lecture Notes in Comput. Sci. **7125** (2012) 160–167.
doi:10.1007/978-3-642-28212-6_15
- [16] M. Klešč, J. Petrillová and M. Valo, *On the crossing numbers of Cartesian products of wheels and trees*, Discuss. Math. Graph Theory **37** (2017) 399–413.
doi:10.7151/dmgt.1957
- [17] Z. Ma and J. Cai, *The Crossing Number of $W_5 \times S_n$* , Acta Math. Appl. Sin. **31** (2008) 616–623, in Chinese.
- [18] H. Mei and Y. Huang, *The crossing number of $K_{1,5,n}$* , International J. Math. Combin. **39** (2002) 1–6.
- [19] K. Zarankiewicz, *On a problem of P. Turán concerning graphs*, Fund. Math. **41** (1955) 137–145.
doi:10.4064/fm-41-1-137-145

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