

## ON SEQUENTIAL HEURISTIC METHODS FOR THE MAXIMUM INDEPENDENT SET PROBLEM

NGOC C. LÊ

*Faculty of Mathematics and Computer Science  
Technische Universität Bergakademie Freiberg  
School of Applied Mathematics and Informatics  
Hanoi University of Science and Technology*

**e-mail:** lechingoc@yahoo.com

CHRISTOPH BRAUSE AND INGO SCHIERMEYER

*Faculty of Mathematics and Computer Science  
Technische Universität Bergakademie Freiberg*

**e-mail:** brause@math.tu-freiberg.de  
ingo.schiermeyer@tu-freiberg.de

### Abstract

We consider sequential heuristics methods for the Maximum Independent Set (MIS) problem. Three classical algorithms, VO [11], MIN [12], or MAX [6], are revisited. We combine Algorithm MIN with the  $\alpha$ -redundant vertex technique [3]. Induced forbidden subgraph sets, under which the algorithms give maximum independent sets, are described. The Caro-Wei bound [4, 14] is verified and performance of the algorithms on some special graphs is considered.

**Keywords:** maximum independent set, heuristic, MIN, MAX, VO, vertex ordering.

**2010 Mathematics Subject Classification:** 05C69, 05C85.

### REFERENCES

- [1] V.E. Alekseev and V.V. Lozin, *Augmenting graphs for independent sets*, *Discrete Appl. Math.* **145** (2004) 3–10.  
doi:10.1016/j.dam.2003.09.003

- [2] P. Borowiecki, F. Göring, J. Harant and D. Rautenbach, *The potential of greed for independence*, J. Graph Theory **71** (2012) 245–259.  
doi:10.1002/jgt.20644
- [3] A. Brandstädt and V.V. Lozin, *A note on  $\alpha$ -redundant vertices in graphs*, Discrete Appl. Math. **108** (2001) 301–308.  
doi:10.1016/S0166-218X(00)00239-0
- [4] Y. Caro, *New results on the independence*, Technical Report, Tel-Aviv University (1979).
- [5] M.U. Gerber and V.V. Lozin, *On the stable set problem in special  $P_5$ -free graphs*, Discrete Appl. Math. **125** (2003) 215–224.  
doi:10.1016/S0166-218X(01)00321-3
- [6] J.R. Griggs, *Lower bounds on the independence number in terms of the degrees*, J. Combin. Theory Ser. B **34** (1983) 22–39.  
doi:10.1016/0095-8956(83)90003-5
- [7] J. Harant, Z. Ryjáček and I. Schiermeyer, *Forbidden subgraphs and MIN-algorithm for independence number*, Discrete Math. **256** (2002) 193–201.  
doi:10.1016/S0012-365X(02)00571-X
- [8] N.C. Lê, C. Brause and I. Schiermeyer, *New sufficient conditions for  $\alpha$ -redundant vertices*, Discrete Math. **338** (2015) 1674–1680.  
doi:10.1016/j.disc.2014.07.002
- [9] N.C. Lê, C. Brause and I. Schiermeyer, *Extending the Max Algorithm for maximum independent set*, Discuss. Math. Graph Theory **35** (2015) 365–386.  
doi:10.7151/dmgt.1811
- [10] V.V. Lozin and D. Rautenbach, *Some results on graphs without long induced paths*, Inform. Process. Lett. **88** (2003) 167–171.  
doi:10.1016/j.ipl.2003.07.004
- [11] N.V.R. Mahadev and B.A. Reed, *A note on vertex orders for stability number*, J. Graph Theory **30** (1999) 113–120.  
doi:10.1002/(SICI)1097-0118(199902)30:2<113::AID-JGT5>3.0.CO;2-#
- [12] O. Murphy, *Lower bounds on the stability number of graphs computed in terms of degrees*, Discrete Math. **90** (1991) 207–211.  
doi:10.1016/0012-365X(91)90357-8
- [13] D.J. Rose, R.E. Tarjan and G.S. Lueker, *Algorithmic aspects of vertex elimination of graphs*, SIAM J. Comput. **5** (1976) 266–283.  
doi:10.1137/0205021
- [14] V.K. Wei, *A lower bound on the stability number of a simple graph*, Technical Report, Bell Laboratories (1981).
- [15] I.E. Zverovich, *Minimum degree algorithms for stability number*, Discrete Appl. Math. **132** (2004) 211–216.  
doi:10.1016/S0166-218X(03)00402-5

Received 29 December 2015  
Revised 1 February 2017  
Accepted 1 February 2017