

# Minimum entropy of graphs with given size

Stijn Cambie \* 

*Department of Computer Science, KU Leuven Campus Kulak-Kortrijk,  
8500 Kortrijk, Belgium*

Matteo Mazzamurro † 

*School of Physical and Chemical Sciences, Queen Mary University of London,  
E1 4NS, London, United Kingdom*

Received 12 June 2022, accepted 5 January 2024, published online 6 October 2025

---

## Abstract

The first degree-based graph entropy of a graph is the Shannon entropy of its degree sequence. Its correct interpretation as a measure of uniformity of the degree sequence requires the determination of its extremal values given natural constraints. In this paper, we prove that the graphs with given size that minimize the first degree-based graph entropy are precisely the colex graphs.

*Keywords:* Graph entropy.

*Math. Subj. Class. (2020):* 05C35, 68R10, 94A17

---

---

\*Corresponding author. A tiny fraction of this research was supported by the UK Research and Innovation Future Leaders Fellowship MR/S016325/1. By publication, Warwick University hasn't concluded on relocation costs.

†This paper was partly funded by the EPSRC Center for Doctoral Training in Urban Science and Progress (EP/L016400/1) and EPSRC DTP (EP/N509796/1).

*E-mail addresses:* [stijn.cambie@hotmail.com](mailto:stijn.cambie@hotmail.com) (Stijn Cambie), [m.mazzamurro@qmul.ac.uk](mailto:m.mazzamurro@qmul.ac.uk) (Matteo Mazzamurro)

# Minimalna entropija grafov dane velikosti

Stijn Cambie \* *Department of Computer Science, KU Leuven Campus Kulak-Kortrijk,  
8500 Kortrijk, Belgium*Matteo Mazzamurro † *School of Physical and Chemical Sciences, Queen Mary University of London,  
E1 4NS, London, United Kingdom*

Prejeto 12. junija 2022, sprejeto 5. januarja 2024, objavljeno na spletu 6. oktobra 2025

---

## Povzetek

Prva entropija grafa, osnovana na stopnjah vozlišč, je Shannonova entropija zaporedja stopenj vozlišč. Njena pravilna interpretacija kot merilo uniformnosti zaporedja stopenj vozlišč zahteva določitev njenih ekstremalnih vrednosti ob upoštevanju naravnih omejitev. V tem članku dokažemo, da so grafi dane velikosti, ki imajo minimalno prvo entropijo, osnovano na stopnjah vozlišč, natanko koleks (koleksikografski) grafi.

*Ključne besede: Entropija grafov.**Math. Subj. Class. (2020): 05C35, 68R10, 94A17*

---

---

\*Korespondenčni avtor. Majhen del te raziskave je bil podprt s strani UK Research and Innovation Future Leaders Fellowship MR/S016325/1. Ob času objave Univerza v Warwicku še ni sprejela odločitev glede stroškov selitve.

†Ta članek je bil delno financiran s strani EPSRC Center for Doctoral Training in Urban Science and Progress (EP/L016400/1) ter EPSRC DTP (EP/N509796/1).

*E-poštna naslova:* [stijn.cambie@hotmail.com](mailto:stijn.cambie@hotmail.com) (Stijn Cambie), [m.mazzamurro@qmul.ac.uk](mailto:m.mazzamurro@qmul.ac.uk) (Matteo Mazzamurro)