# List extensions of majority edge colourings

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A *majority edge colouring* of a graph $G$ is a colouring of the edges of $G$ such that for each vertex $v$ of $G$, at most half the edges incident with $v$ have the same colour. More generally, for a natural number $k \geq 2$, a $1/k$*-majority edge-colouring* of a graph is a colouring of the edges of $G$ such that for every colour $c$ and every vertex $v$ of $G$ at most $1/k$ of the edges incident with $v$ have the colour $c$. This notion was introduced in 2023 by Bock, Kalinowski, Pardey, Pilśniak, Rautenbach and Woźniak [1].

We investigate possible list extensions of generalised majority edge colourings. In particular, given a graph $G$, a list assignment $L$ and a *majority tolerance* $\alpha \in (0, 1)$, an $\alpha$*-majority* $L$*-colouring* of $G$ is a colouring $\omega : E \to C$ from the given lists such that for every $v \in V$ and each $c \in C$, the number of edges coloured $c$ which are incident with $v$ does not exceed $\alpha \cdot d(v)$. We discuss some restrictions necessary to extend this notion to a more general setting with diversified $\alpha = \alpha(c)$ majority tolerances for distinct colours $c \in C$. In particular, for any list assignment $L : E \to 2^C$ with $\sum_{c \in L(e)} \alpha(c) \geq 1 + \varepsilon$ and $|L(e)| \leq \ell$ for each edge $e$, we show that there exists an $\alpha$-majority $L$-colouring of $G$, provided that $\delta(G) = \Omega(\ell^2 \varepsilon^{-2})$.

## References

[1] F. Bock, R. Kalinowski, J. Pardey, M. Pilśniak, D. Rautenbach, M. Woźniak, Majority Edge-Colorings of Graphs, *Electron. J. Combin.* 30(1) (2023), #P1.42.

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[3] P. Pękała, J. Przybyło, On list extensions of the majority edge colourings, arXiv:2502.12688 (2025).