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On the Density of Quadratic Fields with Group of Units in Non-Maximal Orders

For a quadratic number field $K = \mathbf{Q}(\sqrt{d})$ we explore how often $\mathcal{O}_K$ has its group of units in a sub-order $\mathcal{O}$. In particular, when $d \equiv 1 \pmod 4$, we find a lower bound on the lower density of the square-free d such that $\mathbf{Z}[\frac{1+\sqrt{d}}{2}]^\times \neq \mathbf{Z}[\sqrt{d}]^\times$.