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**Inna I Zakharevich\*** (zakh@math.uchicago.edu). *An investigation of small model categories.*

Model categories have been widely used since their introduction by Quillen in 1967, and although many techniques exist for constructing model categories the most fundamental question remains open: given a bicomplete category  $\mathcal{C}$  together with a subcategory  $\mathcal{W}$ , when does there exist a model structure on  $\mathcal{C}$  with  $\mathcal{W}$  as the subcategory of weak equivalences? This question is fundamentally important, as model categories do not generally arise naturally “in the wild”; instead, one generally has a category with a subcategory of weak equivalences, and must construct the model structure by hand. Although this question is very difficult in general, it turns out that when  $\mathcal{C}[\mathcal{W}^{-1}]$  is a preorder the question can often be answered. We present some techniques for dealing with this question in general and, in the case when  $\mathcal{C}$  is small, give necessary and sufficient conditions for the existence of a model structure. (Received September 11, 2014)