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Competitive pairing effects on interacting fermions: superconductivity, topology, and entanglement entropy JIANSHENG WU, Department of Physics, Hong Kong University of Science and Technology, CHING-KAI CHIU, Department of Physics and Astronomy, University of British Columbia, KUEI SUN, Department of Physics, University of Cincinnati,, HSIANG-HSUAN HUNG, Department of Physics, University of Texas at Austin — We study spin-half fermions in one-dimensional chain lattices in which we identify three triplet and one singlet channels independently tunable for the Cooper pairing. We conduct a comprehensive analysis on the model, including a mean-field treatment on a large-size case and an exact-diagonalization method on a finite-size case. We find that the competitive pairing effects can lead to singlet, triplet and mixed superconducting states in both cases. The mean-field Hamiltonian has Z_2 topological invariant for symmetry class DIII determined by these pairings. The tunability of our model makes it particularly interesting for studying the interaction effects on one-dimensional topological superconductors in search for Majorana fermions. Furthermore, we consider a two-dimensional interacting model, the mean-field Hamiltonian of which corresponds to a topological superconductors. Its topological order can be confirmed by length-independent entanglement entropy.

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