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Compensatory interactions to stabilize multiple steady states or mitigate the effects of multiple deregulations in biological networks GANG YANG, Pennsylvania State University, COLIN CAMPBELL, Washington College, RKA ALBERT , Pennsylvania State University — Complex diseases can be modeled as damage to intra-cellular networks that results in abnormal cell behaviors. Network-based dynamic models such as Boolean models have been employed to model a variety of biological systems including those corresponding to disease. Previous work designed compensatory interactions to stabilize an attractor of a Boolean network after single node damage [BMC system Biology 8:53]. We generalize this method to a multi-node damage scenario and to the simultaneous stabilization of multiple steady state attractors. We presents three key results. First, we use analytical and computational methods to study how network structure and regulatory logic affect the resilience of the network's steady states to single node perturbation. Second, we present an algorithm to design compensatory interventions to stabilize a steady state of the network after double node damage and evaluate it on random Boolean networks and two intra-cellular network models relevant to cancer. Third, we apply the algorithm on stabilizing two steady states simultaneously after a single node damage and discuss the emerging situations and their corresponding frequencies. We also apply the algorithm to the biological examples.

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