Title: Factors that Affect the Optimal Amount of Central Control in Complex Systems

Speaker: Professor Daniel Solow

Abstract: *Complex systems* are systems whose behavior results from highly nonlinear interactions among their constituent components, referred to here as *agents*. These systems are often multi-leveled and are evolving over time by adapting to their environment through feedback mechanisms. Examples include, human and animal societies, business organizations, the military, and the internet. While there is a significant amount of work dealing with self-organization—and its associated emergent properties—this talk focuses on one role of central organization. Specifically, four factors are conjectured to be key in determining the optimal amount of central control. To validate this hypothesis, these factors are represented as controllable parameters in a mathematical model. For different combinations of parameter values, the optimal amount of central control is found, either analytically or by computer simulation. The model is shown to provide results that match well with the level of control found across a broad spectrum of specific complex systems. This model also provides general guidelines as to when various combinations of these factors suggest that low, moderate, or high levels of control are desirable. These results indicate that all of these factors, though not exhaustive, should be considered carefully when attempting to determine the amount of control that is best for a system.