Sequencing Problems

Many operational problems in manufacturing, service and distribution require the sequencing of various types of activities or items. Examples include a production facility in which chassis must be sequenced through an assembly line, an express mail service where parcels and letters must be routed for delivery, and a utility company that must schedule repair work. In general, problems in this class are easily formulated as mathematical programs but, with a few exceptions owing to special structure, are difficult to solve. In this section, we introduce a robust dynamic programming formulation that can be used to tackle a number of such problems. In most cases, however, the size of the state space is an exponential function of the number of items being sequenced. In practical instances, the success of the DP approach may depend on our ability to reduce the number of states that must be explored in the search for the optimum. One way to do this is to impose precedence requirements on the items to be sequenced; a second way is to introduce the logic of branch and bound within a dynamic programming algorithm. Single Machine Scheduling.

saddle point" of a two-variable function f(x,y) is a point (x*, y*) such that x* maximizes f(x,y*) over x while y* minimizes f(x*,y) over y. If you plot such a function in 3d, with x and y on the two horizontal axes and the values f(x,y) on the vertical axis, it will look like a saddle locally around (x*,y*). In application to zero-sum games, if x and y represent the (possibly mixed) strategies of players 1 and 2 respectively and f(x,y) represents the (expected) payoff of player 1 (which is the negative of player 2's payoff), a saddle point is a Nash equilibrium of the game, whether neither player can improve his payoff given his opponent's strategy. The Minimax Theorem establishes that in zero-sum games with finitely many actions and mixed strategies, a Nash equilibrium (=saddle point) exists, and that such points include precisely those strategy pairs in which each player's strategy maximizes his worst-case payoff against possible strategies of his opponent.

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