The Parking Lot Problem

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Assumptions: N drivers all have the same preferred arrival time, $t = T$ in a parking lot of size K. The value of finding a spot is v, and a player has cost w per period for arriving early, so the loss from arriving early is $L(t) = w(T - t)$. All the players arriving in the period t' when the lot fills have an equal probability p of getting a spot. The cost of increasing the parking lot size is c per spot with linear costs (or $C(K)$ more generally).

In the first best, if $N > K$ all N players arrive at T and K of them park in the parking lot.

Define the *indifference arrival time* as $t^* \equiv T - v/w.$, so a player parking then has a payoff of zero. Assume t^* and T are even multiples of Δ so they are feasible.

Full Observability: A player observes all arrivals up through period $t - \Delta$ before he makes his own decision at t.

Unobservability: No player observes any other player's arrival.

Proposition 1. Under either full observability or unobservability, as the time grid becomes infinitely fine and there are more drivers than parking spots ($N > K$),the players fully dissipate rents from the parking lot in any equilibrium.

In other words, if you build a parking lot slightly too small, you would do better not to build one at all.

Figure 2. Welfare from a Parking Lot of Size K when the Number of Drivers Is N=50
with No Uncertainty; c=1, w=1, and v=5