Mathematical Model of the Parking Problem

In our problem we have two functions that effect the value of a parking lot, the capacity and distance of a lot from a desired building, and the population of buildings near the lot.

Definitions

Valuable Lot - a lot that has a high probability of having open spots and is closer to the desired building.
Desired Building - a building that is the destination of a student

Postulates

Postulate I - "The further away a lot is from the desired building, the less valuable it is. Similarly, the closer a lot is, the more valuable it is."
Postulate II - "The more people there are in a building, the less valuable nearby lots are. Similarly, the less people, the more valuable nearby lots are."
Postulate III - "A desired building makes lots close to it more valuable."

Defining the Value of a Lot

Let Γ_n denote the value of lot n.

Γ_n is large when a lot is close to a desired building and has a high probability of having open parking spots.
Γ_n is small when a lot is far away from a desired building and has a low probability of having open parking spots.

Probability of a Lot Having Open Spots

Let $\beta_n(P_n)$ be the probability at time t for lot n to have open spots.

$\beta_n(P_n)$ is low when buildings close to lot n are heavily populated.

$\beta_n(P_n)$ is high when buildings close to lot n are sparsely populated.
P_n - this is the population of buildings around lot n

$$P_n = \Sigma P_B$$

where P_B is the population individual buildings near lot n

Let C_n denote the capacity of a parking lot n.

$$\Gamma_n = 0 \text{ when } P_n \geq C_n$$

Mathematically Fitting the Postulates

From the postulates we can assum Γ_n is a function of distance and time.

$$\Rightarrow \Gamma_n = \Gamma_n(\boldsymbol{r}, t)$$

From Postulate I

$$\lim_{r \to \infty} \Gamma_n(\boldsymbol{r}, t) = 0$$

$$\lim_{r \to 0} \Gamma_n(\boldsymbol{r}, t) \to \infty$$