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Q3 — P1

X_m = location of taxi after m tr[illegible]

x_0 = initial location

θ_i = expected profit.

$$= \sum_{j=1} \{\alpha + \beta|j-i|\} \times \left(\frac{1-\lambda}{k-1}\right)$$

don't include i.

$$\theta_i = (1-\lambda)\alpha \quad \beta\left[\frac{(k-i)(k-i+1)}{2} + \frac{i(i-1)}{2}\right]$$

$$\left.\begin{array}{c|ccccc} i\backslash j & 1 & 2 & 3 & \cdots & k \\ 1 & \lambda & \frac{1-\lambda}{k-1} & \cdots & & \\ 2 & \frac{1-\lambda}{k-1} & \lambda & & & \\ 3 & & & \ddots & & \\ 4 & & & & & \\ \vdots & & & & \ddots & \\ k & & & & & \lambda \end{array}\right\}$$

if i is reached

transition prob matrix.

now ~~[illegible]~~ we construct a distribution.

$$\text{long run profit} = \lim_{n\to\infty} \frac{1}{m} \sum_{m=1}^{m} Y_m$$

$$\boxed{Y_m = \sum_{i=1}^{k} \theta_i \, \pi(x_{m-1} = i)}$$

$$\text{long run profit} = \lim_{n\to\infty} \frac{1}{m} \sum_{m=1}^{m} \left\{ \sum_{i=1}^{k} \theta_i \, \pi(x_{m-1} = i) \right\}$$

$$\boxed{\text{long run profit} = \sum_{i=1}^{k} \theta_i \pi_i} \quad \text{where } \pi_i = \frac{1}{E[T_{ii}]}$$

$$\boxed{\sum_{i=1}^{k} \pi_i = 1}$$

$$\lambda \pi_i + \sum_{j \neq i}^{k} \pi_j \left(\frac{1-\lambda}{k-1} \right) = \pi_i$$ this will give π_i s

$$\boxed{\pi_i = 1/k}$$ since all π_i s are equal.

$\therefore$ log num profit $= \sum_{i=1}^{k} \theta_i \pi_i$

$= \frac{1}{k} \sum_{i=1}^{k} \theta_i$ also ~~since~~ $\boxed{\sum_{i=1}^{k} \theta_i = 1}$

$$\boxed{\text{log num profit} = \frac{1}{k}}$$