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STOPPING GAMES FOR SYMMETRIC MARKOV PROCESSES

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Abstract: Let $\mathcal{E}$ be a Dirichlet form corresponding to a symmetric Markov process $M = \{Q, \mathcal{M}, x_t, P^x\}$ acting on a state space X. Let g and $h, g \leq h$, be quasi-continuous elements of the corresponding Dirichlet space $\mathcal{F}$, and ν a quasi-continuous solution of the variational inequality

$$\mathcal{E}_\alpha(\nu, u-\nu) \geq 0 \quad \text{for all } u \in \mathcal{F},\ g \leq u \leq h,$$

where $\alpha > 0$ and $\mathcal{E}_\alpha(u,\nu) = \mathcal{E}(u,\nu) + \alpha(u,\nu)$ for all $u, \nu \in \mathcal{F}$. It is shown in the paper that if $J_x(\tau,\sigma)$ is defined for all $x \in X$ and all stopping times τ and σ by

$$J_x(\tau,\sigma) = E^x(e^{-\alpha\tau\wedge\sigma}(I_{\tau\leq\alpha}h(x_t) + I_{t>\sigma}g(x_\sigma))),$$

then for quasi-every $x \in X$ we have

$$\nu(x) = \inf_\tau \sup_\sigma J_x(\tau,\sigma) = \sup_\sigma \inf_\tau J_x(\tau,\sigma).$$

Moreover, for quasi-every $x \in X$ the pair $(\hat\tau, \hat\sigma)$ such that

$$\hat\tau = \inf\{t \geq 0; h(x_t) = \nu(x_t)\},\ \ \hat\sigma = \inf\{t \geq 0; g(x_t) = \nu(x_t)\}$$

is the saddle point of the game

$$J_x(\hat\tau,\sigma) \leq J_x(\hat\tau,\hat\sigma) \leq J_x(\tau,\hat\sigma)$$

for all stopping times $\tau,\ \sigma$ and quasi-every $x \in X$.

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