

A Theorem a Day Keeps the Doctor Away

Generic maximin model :
$$z^* = \max_{x \in X} \min_{s \in S(x)} \{f(x, s) : \text{const}(x, s), \forall s \in S(x)\}$$

IGDT robustness model :
$$\hat{\alpha}(q) = \max_{\alpha \geq 0} \{\alpha : r_c \leq r(q, u), \forall u \in U(\alpha, \tilde{u})\}, q \in Q$$

Here $\text{const}(x, s)$ denotes a list of *constraints* imposed on (x, s) pairs.

THEOREM *IGDT robustness model is a simple maximin model.*

PROOF.

We show that a sequence of simple valid instantiations transforms the generic maximin model into the IGDT robustness model:

No.	Instantiation	Resulting maximin model
		$\max_{x \in X} \min_{s \in S(x)} \{f(x, s) : \text{const}(x, s), \forall s \in S(x)\}$
1	$x \leftarrow \alpha, X \leftarrow [0, \infty)$	$\max_{\alpha \geq 0} \min_{s \in S(\alpha)} \{f(\alpha, s) : \text{const}(\alpha, s), \forall s \in S(\alpha)\}$
2	$s \leftarrow u, S(\alpha) \leftarrow U(\alpha, \tilde{u})$	$\max_{\alpha \geq 0} \min_{u \in U(\alpha, \tilde{u})} \{f(\alpha, u) : \text{const}(\alpha, u), \forall u \in U(\alpha, \tilde{u})\}$
3	$f(\alpha, u) \leftarrow \alpha$	$\max_{\alpha \geq 0} \{\alpha : \text{const}(\alpha, u), \forall u \in U(\alpha, \tilde{u})\}$
4	$\text{const}(\alpha, u) \leftarrow r_c \leq r(q, u)$	$\max_{\alpha \geq 0} \{\alpha : r_c \leq r(q, u), \forall u \in U(\alpha, \tilde{u})\}$

QED