

7. **Hybrid uncertainty: uncertain probabilistic profit.** The profit from a new project is a random variable  $x$  which is distributed exponentially:

$$P(x|\lambda) = 1 - e^{-\lambda x}, \quad x \geq 0 \quad (19)$$

The estimated value of  $\lambda$  is  $\tilde{\lambda}$ , but this estimate is highly uncertain:

$$\mathcal{U}(\alpha, \tilde{\lambda}) = \left\{ \lambda : \lambda > 0, |\lambda - \tilde{\lambda}| \leq \alpha \tilde{\lambda} \right\}, \quad \alpha \geq 0 \quad (20)$$

It is required that profit at least  $x_c$  occur with probability no less than  $P_c$ :

$$\text{Prob}(x \geq x_c | \lambda) \geq P_c \quad (21)$$

Derive an explicit algebraic expression for the robustness to uncertainty in  $\lambda$ .