STA 5364, Report 1

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Report 1.2

Suppose we are given a nonnegative random variable X with survival function $P(X > x)$. Consider Markov's inequality, that for nonnegative random variable X, then $P(X > \varepsilon) \leq \frac{\mathbb{E}[X]}{\varepsilon}$ for some $\varepsilon > 0$. Furthermore, then consider the corollary, such that

$$P(X > \varepsilon) \leq \frac{\mathbb{E}[X]}{\varepsilon} \implies P(X^r > \varepsilon^r) = P(X > \varepsilon) \leq \frac{\mathbb{E}[X^r]}{\varepsilon^r} = \frac{\mu^r}{\varepsilon^r},$$

where μ^r is the r^{th} moment of X, $r > 0$. Then, letting $\varepsilon = x$, we have that

$$P(X > x) = S(x) \leq \frac{\mu^r}{x^r}.$$

Since $S(x)$ is bounded above at 1 by definition, we then have that

$$S(x) \leq \begin{cases} \frac{\mu^r}{x^r}, & x^r \geq \mu^r \\ 1 & x^r < \mu^r. \end{cases}$$