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| Exercise 7 for May 2nd |
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Exercise. Let $(X_i)_{i \geq 1}$ be a sequence i.i.d. random variables with $\mathbb{E}[X_1] = 0$ and $\mathbb{P}(X_1 \geq u) \sim c/u^\beta$ as $u \rightarrow \infty$ with $\beta > 2$. Set $S_n = X_1 + \dots + X_n$. Let $(x_n)_{n \geq 1}$ be a sequence such that $\liminf_{n \rightarrow \infty} x_n/n > 0$. Obtain a limit theorem for $\max(X_1, \dots, X_n)$ under $\mathbb{P}(\cdot | S_n \geq x_n)$ as $n \rightarrow \infty$.