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[Home](#)

[Short Bio](#)

[Vita](#)

[Academic](#)

[Tree](#)

[Research](#)

[Publications](#)

[Students](#)

[Courses](#)

[MS&E121](#)

[MS&E321](#)

[MS&E322](#)

[MS&E323](#)

Tail Asymptotics for the Maximum of Perturbed Random Walk

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- [AramanG06.pdf](#)

Consider a random walk $S = (S_n : n \geq 0)$ that is “perturbed” by a stationary sequence $(\xi_n : n \geq 0)$ to produce the process $(S_n + \xi_n : n \geq 0)$. This paper is concerned with computing the distribution of the all-time maximum $M_\infty = \max \{S_k + \xi_k : k \geq 0\}$ of perturbed random walk with a negative drift. Such a maximum arises in several different applications settings, including production systems, communications networks and insurance risk. Our main results describe asymptotics for $P(M_\infty > x)$ as $x \rightarrow \infty$. The tail asymptotics depend greatly on whether the ξ_n ’s are light-tailed or heavy-tailed. In the light-tailed setting, the tail asymptotic is closely related to the Cramér–Lundberg asymptotic for standard random walk.