

## Equidistant sampling for the maximum of a Brownian motion with drift on a finite horizon

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### Abstract

A Brownian motion observed at equidistant sampling points renders a random walk with normally distributed increments. For the difference between the expected maximum of the Brownian motion and its sampled version, an expansion is derived with coefficients in terms of the drift, the Riemann zeta function and the normal distribution function.

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Pages: 143-150

Published on: March 11, 2009

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### Bibliography

1. Abramowitz, M. and Stegun, I.A. (1970). Handbook of Mathematical Functions (9th printing), Dover, New York.
2. Asmussen, Søren; Glynn, Peter; Pitman, Jim. Discretization error in simulation of one-dimensional reflecting Brownian motion. *Ann. Appl. Probab.* 5 (1995), no. 4, 875--896. [MR1384357](#) (97e:65156)
3. Borwein, Jonathan M.; Bradley, David M.; Crandall, Richard E. Computational strategies for the Riemann zeta function. Numerical analysis in the 20th century, Vol. I, Approximation theory. *J. Comput. Appl. Math.* 121 (2000), no. 1-2, 247--296. [MR1780051](#) (2001h:11110)
4. Broadie, Mark; Glasserman, Paul; Kou, S. G. Connecting discrete and continuous path-dependent options. *Finance Stoch.* 3 (1999), no. 1, 55--82. [MR1805321](#) (2001k:91066)
5. de Bruijn, N. G. Asymptotic methods in analysis. Corrected reprint of the third edition. *Dover Publications, Inc., New York*, 1981. xii+200 pp. ISBN: 0-486-64221-6 [MR0671583](#) (83m:41028)
6. Calvin, James M. Average performance of passive algorithms for global optimization. *J. Math. Anal. Appl.* 191 (1995), no. 3, 608--617. [MR1325821](#) (95m:90110)
7. Chang, Joseph T.; Peres, Yuval. Ladder heights, Gaussian random walks and the Riemann zeta function. *Ann. Probab.* 25 (1997), no. 2, 787--802. [MR1434126](#) (98c:60086)
8. Chernoff, Herman. Sequential tests for the mean of a normal distribution. IV. (Discrete case) *Ann. Math. Statist.* 36 1965 55--68. [MR0170443](#) (30 #681)
9. Comtet, A. and Majumdar, S.N. (2005). Precise asymptotics for a random walker's maximum. *Journal of Statistical Mechanics: Theory and Experiment*, P06013. %
10. Erdelyi, A., Magnus, W., Oberhettinger, F. and Tricomi, F.G. (1953). Higher Transcendental Functions, Vol. I, McGraw-Hill, New York.
11. Janssen, A. J. E. M.; van Leeuwen, J. S. H. On Lerch's transcendent and the Gaussian random walk. *Ann. Appl. Probab.* 17 (2007), no. 2, 421--439. [MR2308331](#) (2008a:60115)
12. Janssen, A. J. E. M.; van Leeuwen, J. S. H. Cumulants of the maximum of the Gaussian random walk. *Stochastic Process. Appl.* 117 (2007), no. 12, 1928--1959. [MR2437736](#)
13. Janssen, A. J. E. M.; van Leeuwen, J. S. H. Back to the roots of the  $M/D/s$  queue and the works of Erlang, Crommelin and Pollaczek. *Statist. Neerlandica* 62 (2008), no. 3, 299--313. [MR2441855](#)
14. Janssen, A. J. E. M.; van Leeuwen, J. S. H.; Zwart, B. Corrected asymptotics for a multi-server queue in the Halfin-Whitt regime. *Queueing*

- Syst. 58 (2008), no. 4, 261--301. [MR2415323](#) (Review)
15. Jelenković, Predrag; Mandelbaum, Avishai; Momčilović, Petar. Heavy traffic limits for queues with many deterministic servers. *Queueing Syst.* 47 (2004), no. 1-2, 53--69. [MR2074672](#) (2005k:60286)
  16. Kingman, J. F. C. Spitzer's identity and its use in probability theory. *J. London Math. Soc.* 37 1962 309--316. [MR0143262](#) (26 #821)
  17. Kingman, J. F. C. The heavy traffic approximation in the theory of queues. (With discussion) 1965 *Proc. Sympos. Congestion Theory (Chapel Hill, N.C., 1964)* pp. 137--169 *Univ. North Carolina Press, Chapel Hill, N.C.* [MR0198566](#) (33 #6721)
  18. Pollaczek, F. (1931). Über zwei Formeln aus der Theorie des Wartens vor Schaltergruppen. *Elektrische Nachrichtentechnik* 8: 256-268.
  19. Siegmund, David. Sequential analysis. Tests and confidence intervals. Springer Series in Statistics. *Springer-Verlag, New York*, 1985. xi+272 pp. ISBN: 0-387-96134-8 [MR0799155](#) (87h:62145)
  20. Siegmund, D. (1985). Corrected Diffusion Approximations in Certain Random Walk Problems. Springer-Verlag, New York.
  21. Shreve, Steven E. Stochastic calculus for finance. II. Continuous-time models. Springer Finance. *Springer-Verlag, New York*, 2004. xx+550 pp. ISBN: 0-387-40101-6 [MR2057928](#) (2005c:91001)
  22. Spitzer, Frank. A combinatorial lemma and its application to probability theory. *Trans. Amer. Math. Soc.* 82 (1956), 323--339. [MR0079851](#) (18,156e)



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