

THE PUBLICATIONS AND WRITINGS OF HERBERT ROBBINS

Papers in Refereed Journals

- [1] (1937) On a class of recurrent sequences. *Bull. Amer. Math. Soc.* **43** 413–417.
- [2] (1939) A theorem on graphs, with an application to a problem of traffic control. *Amer. Math. Monthly* **46** 281–283.
- [3] (1941a) On the classification of the mappings of a 2-complex. *Trans. Amer. Math. Soc.* **49** 308–324.
- [4] (1943) A note on the Riemann integral. *Amer. Math. Monthly* **50** 617–618.
- [5] (1944a) Two properties of the function $\cos x$. *Bull. Amer. Math. Soc.* **50** 750–752.
- [6] (1944b) On distribution-free tolerance limits in random sampling. *Ann. Math. Statist.* **15** 214–216.
- [7] (1944c) On the measure of a random set. *Ann. Math. Statist.* **15** 70–74.
- [8] (1944d) On the expected values of two statistics. *Ann. Math. Statist.* **15** 321–323.
- [9] (1945) On the measure of a random set. II. *Ann. Math. Statist.* **16** 342–347.
- [10] (1946) On the $(C, 1)$ summability of certain random sequences. *Bull. Amer. Math. Soc.* **52** 699–703.
- [11] (1947) Complete convergence and the law of large numbers. *Proc. Nat. Acad. Sci. U.S.A.* **33** 25–31 (with P. L. Hsu).
- [12] (1948b) Convergence of distributions. *Ann. Math. Statist.* **19** 72–76.
- [13] (1948c) On the asymptotic distribution of the sum of a random number of random variables. *Proc. Nat. Acad. Sci. U.S.A.* **34** 162–163.
- [14] (1948d) The central limit theorem for dependent random variables. *Duke Math. J.* **15** 773–780 (with W. Hoeffding).
- [15] (1948e) The asymptotic distribution of the sum of a random number of random variables. *Bull. Amer. Math. Soc.* **54** 1151–1161.
- [16] (1948f) The distribution of a definite quadratic form. *Ann. Math. Statist.* **19** 266–270.
- [17] (1948g) Mixture of distributions. *Ann. Math. Statist.* **19** 360–369.
- [18] (1948h) The distribution of Student's t when the population means are unequal. *Ann. Math. Statist.* **19** 406–410.
- [19] (1949) Application of the method of mixtures to quadratic forms in normal variates. *Ann. Math. Statist.* **20** 552–560 (with E. J. G. Pitman).
- [20] (1950a) Competitive estimation (abstract). *Ann. Math. Statist.* **21** 311–312.
- [21] (1950b) A generalization of the method of maximum likelihood: Estimating a mixing distribution (abstract). *Ann. Math. Statist.* **21** 314–315.
- [22] (1950c) The problem of the greater mean. *Ann. Math. Statist.* **21** 469–487, **22** 310 (with R. R. Bahadur).
- [23] (1951a) Asymptotically subminimax solutions of compound decision problems. *Proc. Second Berkeley Symp. Math. Statist. Probab.* **1** 131–148. Univ. California Press, Berkeley.
- [24] (1951b) A stochastic approximation method. *Ann. Math. Statist.* **22** 400–407 (with S. Monro).
- [25] (1951c) Minimum variance estimation without regularity assumptions. *Ann. Math. Statist.* **22** 581–586 (with D. G. Chapman).
- [26] (1952a) Some aspects of the sequential design of experiments. *Bull. Amer. Math. Soc.* **58** 527–535.
- [27] (1952b) A note on gambling systems and birth statistics. *Amer. Math. Monthly* **59** 685–686.
- [28] (1953a) Ergodic property of the Brownian motion process. *Proc. Nat. Acad. Sci. U.S.A.* **39** 525–533 (with G. Kallianpur).
- [29] (1953b) On the equidistribution of sums of independent random variables. *Proc. Amer. Math. Soc.* **4** 786–799.

- [30] (1953c) Ergodic theory of Markov chains admitting an infinite invariant measure. *Proc. Nat. Acad. Sci. U.S.A.* **39** 860–864 (with T. E. Harris).
- [31] (1954a) The sequence of sums of independent random variables. *Duke Math. J.* **21** 285–308 (with G. Kallianpur).
- [32] (1954b) Two-stage procedures for estimating the difference between means. *Biometrika* **41** 146–152 (with S. G. Ghurye).
- [33] (1954c) A note on information theory. *Proc. Inst. Radio Engrg.* **42** 1193.
- [34] (1954d) A remark on the joint distribution of cumulative sums. *Ann. Math. Statist.* **25** 614–616.
- [35] (1954e) A one-sided confidence interval for an unknown distribution function (abstract). *Ann. Math. Statist.* **25** 409.
- [36] (1955a) A remark on Stirling’s formula. *Amer. Math. Monthly* **62** 26–29.
- [37] (1955b) Asymptotic solutions of the compound decision problem for two completely specified distributions. *Ann. Math. Statist.* **26** 37–51 (with J. F. Hannan).
- [38] (1955c) The strong law of large numbers when the first moment does not exist. *Proc. Nat. Acad. Sci. U.S.A.* **41** 586–587 (with C. Derman).
- [39] (1956a) An empirical Bayes approach to statistics. *Proc. Third Berkeley Symp. Math. Statist. Probab.* **1** 157–163. Univ. California Press, Berkeley.
- [40] (1956b) A sequential decision problem with finite memory. *Proc. Nat. Acad. Sci. U.S.A.* **42** 920–923.
- [41] (1959a) Comments on a paper by James Albertson. *J. Biblical Literature* **78** 347–350.
- [42] (1961a) On sums of independent random variables with infinite moments and “fair” games. *Proc. Nat. Acad. Sci. U.S.A.* **47** 330–335 (with Y. S. Chow).
- [43] (1961b) A martingale system theorem and applications. *Proc. Fourth Berkeley Symp. Math. Statist. Probab.* **1** 93–104. Univ. California Press, Berkeley (with Y. S. Chow).
- [44] (1961c) Recurrent games and the Petersburg paradox. *Ann. Math. Statist.* **32** 187–194.
- [45] (1962a) A Bayes test of $p \leq 1/2$ versus $p > 1/2$. *Rep. Statist. Appl. Res. Un. Japan. Sci. Engrs.* **9** 39–60 (with S. Moriguti).
- [46] (1963a) On optimal stopping rules. *Z. Wahrsch. Verw. Gebiete* **2** 33–49 (with Y. S. Chow).
- [47] (1963b) A renewal theorem for random variables which are dependent or non-identically distributed. *Ann. Math. Statist.* **34** 390–395 (with Y. S. Chow).
- [48] (1963c) Some problems of optimal sampling strategy. *J. Math. Anal. Appl.* **6** 1–14 (with C. L. Mallows).
- [49] (1963d) The empirical Bayes approach to testing statistical hypotheses. *Rev. Internat. Statist. Inst.* **31** 195–208.
- [50] (1964a) The empirical Bayes approach to statistical decision problems. *Ann. Math. Statist.* **35** 1–20.
- [51] (1964b) On the “parking” problem. *Publ. Math. Inst. Hungar. Acad. Sci. Ser. A* **9** 209–225 (with A. Dvoretzky).
- [52] (1964c) Optimal selection based on relative rank—the “secretary problem.” *Israel J. Math.* **2** 81–90 (with Y. S. Chow, S. Moriguti and S. M. Samuels).
- [53] (1965a) On optimal stopping rules for S_n/n . *Illinois J. Math.* **9** 444–454 (with Y. S. Chow).
- [54] (1965b) Moments of randomly stopped sums. *Ann. Math. Statist.* **36** 789–799 (with Y. S. Chow and H. Teicher).
- [55] (1965c) On the asymptotic theory of fixed-width sequential confidence intervals for the mean. *Ann. Math. Statist.* **36** 457–462 (with Y. S. Chow).
- [56] (1966) An extension of a lemma of Wald. *J. Appl. Probability* **3** 272–273 (with E. Samuel).
- [57] (1967a) A class of optimal stopping problems. *Proc. Fifth Berkeley Symp. Math. Statist. Probab.* **1** 419–426. Univ. California Press, Berkeley (with Y. S. Chow).

- [58] (1967b) On values associated with a stochastic sequence. *Proc. Fifth Berkeley Symp. Math. Statist. Probab.* **1** 427–440. Univ. California Press, Berkeley (with Y. S. Chow).
- [59] (1967c) Finding the size of a finite population. *Ann. Math. Statist.* **38** 1392–1398 (with D. A. Darling).
- [60] (1967d) Some complements to Brouwer’s fixed point theorem. *Israel J. Math.* **5** 225–226.
- [61] (1967e) Iterated logarithm inequalities. *Proc. Nat. Acad. Sci. U.S.A.* **57** 1188–1192 (with D. A. Darling).
- [62] (1967f) Inequalities for the sequence of sample means. *Proc. Nat. Acad. Sci. U.S.A.* **57** 1577–1580 (with D. A. Darling).
- [63] (1967g) Confidence sequences for mean, variance, and median. *Proc. Nat. Acad. Sci. U.S.A.* **58** 66–68 (with D. A. Darling).
- [64] (1967h) A sequential analogue of the Behrens–Fisher problem. *Ann. Math. Statist.* **38** 1384–1391 (with G. Simons and N. Starr).
- [65] (1968a) A sequential procedure for selecting the largest of k means. *Ann. Math. Statist.* **39** 88–92 (with M. Sobel and N. Starr).
- [66] (1968b) Estimating the total probability of the unobserved outcomes of an experiment. *Ann. Math. Statist.* **39** 256–257.
- [67] (1968c) Some further remarks on inequalities for sample sums. *Proc. Nat. Acad. Sci. U.S.A.* **60** 1175–1182 (with D. A. Darling).
- [68] (1968d) The limiting distribution of the last time $s_n \geq n\varepsilon$. *Proc. Nat. Acad. Sci. U.S.A.* **61** 1228–1230 (with D. Siegmund and J. Wendel).
- [69] (1968e) Some nonparametric sequential tests with power one. *Proc. Nat. Acad. Sci. U.S.A.* **61** 804–809 (with D. A. Darling).
- [70] (1969a) Probability distributions related to the law of the iterated logarithm. *Proc. Nat. Acad. Sci. U.S.A.* **62** 11–13 (with D. Siegmund).
- [71] (1969b) Confidence sequences and interminable tests. *Bull. Internat. Statist. Inst.* **43** 379–387 (with D. Siegmund).
- [72] (1970a) Statistical methods related to the law of the iterated logarithm. *Ann. Math. Statist.* **41** 1397–1409.
- [73] (1970b) Boundary crossing probabilities for the Wiener process and sample sums. *Ann. Math. Statist.* **41** 1410–1429 (with D. Siegmund).
- [74] (1970c) Optimal stopping. *Amer. Math. Monthly* **77** 333–343.
- [75] (1972a) Reducing the number of inferior treatments in clinical trials. *Proc. Nat. Acad. Sci. U.S.A.* **69** 2993–2994 (with B. Flehinger, T. Louis and B. Singer).
- [76] (1972b) On the law of the iterated logarithm for maxima and minima. *Proc. Sixth Berkeley Symp. Math. Statist. Probab.* **3** 51–70. Univ. California Press, Berkeley (with D. Siegmund).
- [77] (1972c) A class of stopping rules for testing parametric hypotheses. *Proc. Sixth Berkeley Symp. Math. Statist. Probab.* **4** 37–41. Univ. California Press, Berkeley (with D. Siegmund).
- [78] (1973a) Statistical tests of power one and the integral representation of solutions of certain partial differential equations. *Bull. Inst. Math. Acad. Sinica* **1** 93–120 (with D. Siegmund).
- [79] (1973b) Mathematical probability in election challenges. *Columbia Law Rev.* **73** 241–248 (with M. O. Finkelstein).
- [80] (1974a) The expected sample size of some tests of power one. *Ann. Statist.* **2** 415–436 (with D. Siegmund).
- [81] (1974b) Sequential tests involving two populations. *J. Amer. Statist. Assoc.* **69** 132–139 (with D. Siegmund).

- [82] (1974c) A sequential test for two binomial populations. *Proc. Nat. Acad. Sci. U.S.A.* **71** 4435–4436.
- [83] (1975a) Sequential estimation of p with squared relative error loss. *Proc. Nat. Acad. Sci. U.S.A.* **72** 191–193 (with P. Cabilio).
- [84] (1975b) Wither mathematical statistics? *Suppl. Adv. in Appl. Probab.* **7** 116–121.
- [85] (1975c) The candidate problem with unknown population size. *J. Appl. Probability* **12** 692–701 (with W. T. Rasmussen).
- [86] (1976) Maximally dependent random variables. *Proc. Nat. Acad. Sci. U.S.A.* **73** 286–288 (with T. L. Lai).
- [87] (1977a) Prediction and estimation for the compound Poisson distribution. *Proc. Nat. Acad. Sci. U.S.A.* **74** 2670–2671.
- [88] (1977b) Strong consistency of least-squares estimates in regression models. *Proc. Nat. Acad. Sci. U.S.A.* **74** 2667–2669 (with T. L. Lai).
- [89] (1978a) A class of dependent random variables and their maxima. *Z. Wahrsch. Verw. Gebiete* **42** 89–111 (with T. L. Lai).
- [90] (1978b) Adaptive design in regression and control. *Proc. Nat. Acad. Sci. U.S.A.* **75** 586–587 (with T. L. Lai).
- [91] (1978c) Limit theorems for weighted sums and stochastic approximation processes. *Proc. Nat. Acad. Sci. U.S.A.* **75** 1068–1070 (with T. L. Lai).
- [92] (1978d) Strong consistency of least squares estimates in multiple regression. *Proc. Nat. Acad. Sci. U.S.A.* **75** 3034–3036 (with T. L. Lai and C. Z. Wei).
- [93] (1979a) Strong consistency of least squares estimates in multiple regression. II. *J. Multivariate Anal.* **9** 343–361 (with T. L. Lai and C. Z. Wei).
- [94] (1979b) Sequential rank and the Polya urn. *J. Appl. Probability* **16** 213–219 (with J. Whitehead).
- [95] (1979c) Adaptive design and stochastic approximation. *Ann. Statist.* **7** 1196–1221 (with T. L. Lai).
- [96] (1979d) Local convergence theorems for adaptive stochastic approximation schemes. *Proc. Nat. Acad. Sci. U.S.A.* **76** 3065–3067 (with T. L. Lai).
- [97] (1980a) Estimation and prediction for mixtures of the exponential distribution. *Proc. Nat. Acad. Sci. U.S.A.* **77** 2382–2383.
- [98] (1980b) Sequential medical trials. *Proc. Nat. Acad. Sci. U.S.A.* **77** 3135–3138 (with T. L. Lai, B. Levin and D. Siegmund).
- [99] (1980c) An empirical Bayes estimation problem. *Proc. Nat. Acad. Sci. U.S.A.* **77** 6988–6989.
- [100] (1981a) Consistency and asymptotic efficiency of slope estimates in stochastic approximation schemes. *Z. Wahrsch. Verw. Gebiete* **56** 329–360 (with T. L. Lai).
- [101] (1981b) Selecting the highest probability in binomial or multinomial trials. *Proc. Nat. Acad. Sci. U.S.A.* **78** 4663–4666 (with B. Levin).
- [102] (1982a) Iterated least squares in multiperiod control. *Adv. in Appl. Math.* **3** 50–73 (with T. L. Lai).
- [103] (1983a) Some thoughts on empirical Bayes estimation. *Ann. Statist.* **11** 713–723.
- [104] (1983b) A note on the underadjustment phenomenon. *Statist. Probab. Lett.* **1** 137–139 (with B. Levin).
- [105] (1983c) Adaptive choice of mean or median in estimating the center of a symmetric distribution. *Proc. Nat. Acad. Sci. U.S.A.* **80** 5803–5806 (with T. L. Lai and K. F. Yu).
- [106] (1983d) Urn models for regression analysis, with applications to employment discrimination studies. *Law Contemp. Problems* **46** 247–267 (with B. Levin).
- [107] (1984a) Some breakthroughs in statistical methodology. *College Math. J.* **15** 25–29.

- [108] (1984b) Optimal sequential sampling from two populations. *Proc. Nat. Acad. Sci. U.S.A.* **81** 1284–1286 (with T. L. Lai).
- [109] (1984c) A probabilistic approach to tracing funds in the law of restitution. *Jurimetrics* **24** 65–77 (with M. O. Finkelstein).
- [110] (1985a) Linear empirical Bayes estimation of means and variances. *Proc. Nat. Acad. Sci. U.S.A.* **82** 1571–1574.
- [111] (1985b) Asymptotically efficient adaptive allocation rules. *Adv. in Appl. Math.* **6** 4–22 (with T. L. Lai).
- [112] (1987) Asymptotically minimax stochastic search strategies in the plane. *Proc. Nat. Acad. Sci. U.S.A.* **84** 2111–2112 (with S. P. Lalley).
- [113] (1988a) Estimating a treatment effect under biased sampling. *Proc. Nat. Acad. Sci. U.S.A.* **85** 3670–3672 (with C.-H. Zhang).
- [114] (1988b) Stochastic search in a convex region. *Probab. Theory Related Fields* **77** 99–116 (with S. P. Lalley).
- [115] (1989a) Estimating the superiority of a drug to a placebo when all and only those patients at risk are treated with the drug. *Proc. Nat. Acad. Sci. U.S.A.* **86** 3003–3005 (with C.-H. Zhang).
- [116] (1989b) Comment on “Who solved the secretary problem?” *Statist. Sci.* **4** 291.
- [117] (1991a) Estimating a multiplicative treatment effect under biased allocation. *Biometrika* **78** 349–354 (with C.-H. Zhang).
- [118] (1991b) Remarks on the secretary problem. *Amer. J. Math. Management Sci.* **11** 25–37.
- [119] (1995) Sequential choice from several populations. *Proc. Nat. Acad. Sci. U.S.A.* **92** 8584–8585 (with M. N. Katehakis).
- [120] (1996a) Clinical and prophylactic trials with assured new treatment for those at greater risk. I. A design proposal. *Amer. J. Public Health* **86** 691–695 (with M. O. Finkelstein and B. Levin).
- [121] (1996b) Clinical and prophylactic trials with assured new treatment for those at greater risk. II. Examples. *Amer. J. Public Health* **86** 696–705 (with M. O. Finkelstein and B. Levin).
- [122] (2000) Efficiency of the u, v method of estimation. *Proc. Nat. Acad. Sci. U.S.A.* **97** 12976–12979 (with C.-H. Zhang).
- [123] (2002) Mathematical aspects of estimating two treatment effects and a common variance in an assured allocation design. *J. Statist. Plann. Inference* **108** 255–262 (with B. Levin and C.-H. Zhang).

Book Review

- [124] (1978e) Review of *Adventures of a Mathematician* by S. M. Ulam. *Bull. Amer. Math. Soc.* **84** 107–109.

Papers in Proceedings Volumes

- [125] (1948a) Some remarks on the inequality of Tchebychef. In *Studies and Essays* (K. O. Friedrichs et al., eds.) 345–350. Interscience, New York.
- [126] (1957) The theory of probability. In *Insights into Modern Mathematics* (F. L. Wren, ed.) 336–371. National Council of Teachers of Mathematics, Washington, DC.
- [127] (1959b) Sequential estimation of the mean of a normal population. In *Probability and Statistics* (U. Grenander, ed.) 235–245. Almqvist and Wiksell, Stockholm.

- [128] (1959c) Probability. In *Spectrum: The World of Science* (R. Ginger, ed.) 100–114. Holt, New York.
- [129] (1960) A statistical screening problem. In *Contributions to Probability and Statistics* (I. Olkin et al., eds.) 352–357. Stanford Univ. Press.
- [130] (1962b) Some numerical results on a compound decision problem. In *Recent Developments in Information and Decision Processes* (R. E. Machol and P. Gray, eds.) 52–62. Macmillan, New York.
- [131] (1962c) Testing statistical hypotheses; the compound approach. In *Recent Developments in Information and Decision Processes* (R. E. Machol and P. Gray, eds.) 63–70. Macmillan, New York (with E. Samuel).
- [132] (1963e) A new approach to a classical statistical decision problem. In *Induction: Some Current Issues* (H. E. Kyburg, Jr. and E. Nagel, eds.) 101–110. Wesleyan Univ. Press, Middletown, CT.
- [133] (1968f) Iterated logarithm inequalities and related statistical procedures. In *Mathematics of the Decision Sciences* (G. B. Dantzig and A. F. Veinott, eds.) 267–279. Amer. Math. Soc., Providence, RI (with D. Siegmund).
- [134] (1970d) Sequential estimation of an integer mean. In *Scientists at Work* (T. Dalenius et al., eds.) 205–210. Almqvist and Wiksell, Uppsala.
- [135] (1971a) A convergence theorem for non-negative almost supermartingales and some applications. In *Optimizing Methods in Statistics* (J. Rustagi, ed.) 233–257. Academic Press, New York (with D. Siegmund).
- [136] (1971b) Simultaneous estimation of large numbers of extreme quantiles. IBM Research RC3621. IBM, Yorktown Heights, NY (with A. S. Goodman and P. A. W. Lewis).
- [137] (1974d) The statistical mode of thought. In *The Heritage of Copernicus* (J. Neyman, ed.) 419–432. MIT Press.
- [138] (1974e) Sequential estimation of p in Bernoulli trials. In *Studies in Probability and Statistics* (E. J. Williams, ed.) 103–107. Jerusalem Acad. Press (with D. Siegmund).
- [139] (1977c) Sequential decision about a normal mean. In *Statistical Decision Theory and Related Topics II* (S. S. Gupta, ed.) 213–221. Academic Press, New York (with T. L. Lai and D. Siegmund).
- [140] (1980d) Some estimation problems for the compound Poisson distribution. In *Asymptotic Theory of Statistical Tests and Estimation* (I. M. Chakravarti, ed.) 251–257. Academic Press, New York.
- [141] (1982b) Adaptive design and the multi-period control problem. In *Statistical Decision Theory and Related Topics III* (S. S. Gupta, ed.) 2 103–120. Academic Press, New York (with T. L. Lai).
- [142] (1982c) Estimating many variances. In *Statistical Decision Theory and Related Topics III* (S. S. Gupta, ed.) 2 251–261. Academic Press, New York.
- [143] (1983e) Sequential design of comparative clinical trials. In *Recent Advances in Statistics: Papers in Honor of Herman Chernoff on His Sixtieth Birthday* (M. H. Rizvi, J. S. Rustagi and D. Siegmund, eds.) 51–68. Academic Press, New York (with T. L. Lai and D. Siegmund).
- [144] (1984d) Asymptotically optimal allocation of treatments in sequential experiments. In *Design of Experiments: Ranking and Selection* (T. Santner and A. Tamhane, eds.) 127–142. Dekker, New York (with T. L. Lai).
- [145] (1986a) Maximum likelihood estimation in regression with uniform errors. In *Adaptive Statistical Procedures and Related Topics* (J. Van Ryzin, ed.) 365–385. IMS Hayward, CA (with C.-H. Zhang).

- [146] (1986b) Comments on “The probability of reversal in contested elections.” In *Statistics and the Law* (M. H. DeGroot, S. E. Fienberg and J. B. Kadane, eds.) 412–414. Wiley, New York.
- [147] (1988c) Stochastic search in a square and on a torus. In *Statistical Decision Theory and Related Topics IV* (S. S. Gupta and J. O. Berger, eds.) **2** 145–162. Springer, New York (with S. P. Lalley).
- [148] (1988d) The u, v method of estimation. In *Statistical Decision Theory and Related Topics IV* (S. S. Gupta and J. O. Berger, eds.) **1** 265–270. Springer, New York.
- [149] (1989c) Uniformly ergodic search in a disk. In *Search Theory* (D. and G. Chudnovsky, eds.) 131–151. Dekker, New York (with S. P. Lalley).

Books

- [150] (1941b) *What is Mathematics?* Oxford Univ. Press, New York (with R. Courant).
- [151] (1971c) *Great Expectations: The Theory of Optimal Stopping*. Houghton Mifflin, Boston (with Y. S. Chow and D. Siegmund).
- [152] (1975d) *Introduction to Statistics*. Science Research Associates, Palo Alto, CA (with J. Van Ryzin).