- Grandparent: 0. Numerical Evaluation of Special Functions[1]
- Parent: 5. Functions of Two or More Variables[2]
- Previous: 5.5. Hypergeometric and Confluent Hypergeometric Functions[3]
- Next: 5.7. Incomplete Gamma Functions, Generalized Exponential Integrals[4]

Press here[5] to get the full document in PostScript format.
Press here[6] to get this subdocument in PostScript format.

NUMERICAL EVALUATION OF SPECIAL FUNCTIONS

D. W. LOZIER AND F. W. J. OLVER

ABSTRACT. This document is an excerpt from the current hypertext version of an article that appeared in Walter Gautschi (ed.), *Mathematics of Computation 1943–1993: A Half-Century of Computational Mathematics*, Proceedings of Symposia in Applied Mathematics 48, American Mathematical Society, Providence, RI 02940, 1994. The symposium was held at the University of British Columbia August 9–13, 1993, in honor of the fiftieth anniversary of the journal *Mathematics of Computation*.

The original abstract follows.

Higher transcendental functions continue to play varied and important roles in investigations by engineers, mathematicians, scientists and statisticians. The purpose of this paper is to assist in locating useful approximations and software for the numerical generation of these functions, and to offer some suggestions for future developments in this field.

5.6. Incomplete Bessel Functions, Incomplete Beta Function. This section includes F–, t– and von Mises' distribution functions.

5.6.1. *Incomplete Bessel Functions.*

Software Packages: [**Hil77**, Fortran].

5.6.2. *Incomplete Beta Function.*

Software Packages: [**DM92**, Fortran], [**Dor68**, Algol], [**Gau64**, Algol], [**Hil70a**, Algol], [**Lev69**, Fortran], [**MB73a**, Fortran], [**Mor69**, Algol], [**Phi90**, Basic].

Intermediate Libraries: [**Bak92**], [**Mos89**], [**ULI90**].

Comprehensive Libraries: **IMSL**, **NAG**, **Numerical Recipes**, **Scientific Desk**, **SLATEC**.

Interactive Systems: **Mathematica**.

5.6.3. *Inverse Incomplete Beta Function.*

Algorithms: [**MB73b**].

Software Packages: [**AS93a**, Fortran], [**Hil70b**, Algol].

Intermediate Libraries: [**Mos89**], [**ULI90**].

---

[1] /nesf/Sect0/Sect0.html
[2] /nesf/Sect5/Sect5.html
[3] /nesf/Sect5-5/Sect5-5.html
[4] /nesf/Sect5-7/Sect5-7.html
[5] ftp://gams.nist.gov/pub/lozier/nesf/Paper.ps.Z
[6] ftp://gams.nist.gov/pub/lozier/nesf/Sect5-6.ps.Z

1991 *Mathematics Subject Classification.* Primary 65D20; Secondary 33-00.

The research of the second author has been supported by NSF Grant CCR 89-14933.

Comprehensive Libraries: **IMSL**, **NAG**, **Scientific Desk**.

Interactive Systems: **Maple**, **Mathematica**.

5.6.4. *Articles.* [**AS93b**], [**DJ67**], [**OM68**], [**Tem92b**].

References

[AS93a] R. W. Abernathy and R. P. Smith, *Algorithm 724. Program to calculate F–percentiles*, ACM Trans. Math. Software **19** (1993), 481–483.

[AS93b] R. W. Abernathy and R. P. Smith, *Applying series expansion to the inverse beta distribution to find percentiles of the F–distribution*, ACM Trans. Math. Software **19** (1993), 474–480.

[Bak92] L. Baker, *C mathematical function handbook*, McGraw-Hill, Inc., New York, 1992, includes diskette.

[DJ67] A. R. DiDonato and M. P. Jarnagin, *The efficient calculation of the incomplete beta-function ratio for half-integer values of the parameters a, b*, Math. Comp. **21** (1967), 652–662.

[DM92] A. R. DiDonato and A. H. Morris, Jr., *Algorithm 708. Significant digit computation of the incomplete beta function ratios*, ACM Trans. Math. Software **18** (1992), 360–373.

[Dor68] E. Dorrer, *Algorithm 322. F–distribution*, Comm. ACM **11** (1968), 116–117, for certification see same journal v. 12 (1969), p. 39.

[Gau64] W. Gautschi, *Algorithm 222. Incomplete beta function ratios*, Comm. ACM **7** (1964), 143–144, for certification see same journal v. 7 (1964), p. 244.

[Hil70a] G. W. Hill, *Algorithm 395. Student's t–distribution*, Comm. ACM **13** (1970), 617–619, for remarks see ACM Trans. Math. Software v. 5 (1979), pp. 238–239, v. 7 (1981), pp. 247–249.

[Hil70b] G. W. Hill, *Algorithm 396. Student's t–quantiles*, Comm. ACM **13** (1970), 619–620, for remarks see ACM Trans. Math. Software v. 5 (1979), pp. 238–239, v. 7 (1981), pp. 250–251.

[Hil77] G. W. Hill, *Algorithm 518. Incomplete Bessel function I_0: The von Mises distribution*, ACM Trans. Math. Software **3** (1977), 279–284.

[Lev69] D. A. Levine, *Algorithm 344. Student's t–distribution*, Comm. ACM **12** (1969), 37–38, for remarks see same journal v. 13 (1970), pp. 124 and 449.

[MB73a] K. L. Majumder and G. P. Bhattacharjee, *Algorithm AS 63. The incomplete beta integral*, Appl. Statist. **22** (1973), 409–411, for remark see same journal v. 26 (1977), pp. 111–114.

[MB73b] K. L. Majumder and G. P. Bhattacharjee, *Algorithm AS 64. Inverse of the incomplete beta function ratio*, Appl. Statist. **22** (1973), 411–414, for remarks and corrections see same journal v. 26 (1977), pp. 111–114, v. 39 (1990), pp. 309–310, v. 40 (1991), p. 236.

[Mor69] J. Morris, *Algorithm 346. F–test probabilities*, Comm. ACM **12** (1969), 184–185, for remark see ACM Trans. Math. Software v. 14 (1988), pp. 288–289.

[Mos89] S. L. B. Moshier, *Methods and programs for mathematical functions*, Ellis Horwood Limited, Chichester, 1989, separate diskette.

[OM68] D. Osborn and R. Madey, *The incomplete beta function and its ratio to the complete beta function*, Math. Comp. **22** (1968), 159–162.

[Phi90] H. N. Phien, *A note on the computation of the incomplete beta function*, Adv. Engrg. Software **12** (1990), 39–44.

[Tem92] N. M. Temme, *Asymptotic inversion of the incomplete beta function*, J. Comput. Appl. Math. **41** (1992), 145–157.

[ULI90] *Mathematical function library for Microsoft–C*, United Laboratories, Inc., John Wiley &Sons, 1990, includes diskettes. Edition also exists in Fortran (1989).

Applied and Computational Mathematics Division, National Institute of Standards and Technology, Gaithersburg, Md 20899

E-mail address: dlozier@nist.gov

INSTITUTE FOR PHYSICAL SCIENCE AND TECHNOLOGY, UNIVERSITY OF MARYLAND, COLLEGE PARK, MD 20742
E-mail address: *olver@bessel.umd.edu*