

From dgh@dgh Tue Nov 27 13:10:55 1990

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Subject: Floating-Point Indoctrination Lecture Notes and Handouts

There are some extra copies of some of the notes and some of the handouts. These are located in MTV12-285. Feel free to come and check what's available if you are missing any. Please take only items on the desk with no names written on them (the "free" boxes) as other stuff is intended for other people. After that the remainder will be made available to numeric-sun and then to the outside indoctrinees.

I am in the process of preparing a final set of notes for distribution. They should be ready in a week or two.

The following is the cumulative index of what was passed out in 1988, as near as I can tell:

Cumulative handouts for Sun Microsystems Floating-Point Indoctrination lectures; except as noted, by W. Kahan, 1988. The contents of set 6 were completely reprinted in later sets.

## 1. Set 1

### 1.1. ADMINISTRIVIA

1.1.1. Computer System Support for Scientific and Engineering Computation, 11 April, 6 pp.

1.1.2. Examples of Plausible Projects, 5 May, 2 pp.

### 1.2. FORMAL LECTURE NOTES

1.2.1. Lecture 1 - May 3, Ma, 11 May, 8 pp.

1.2.2. Lecture 2 - May 5, Freedman and Ma, 23 May, 20 pp.

1.2.3. Lecture 3 - May 10, Wilkie and Ma, 23 May, 8 pp.

1.2.4. Lecture 4 - May 12, Ma, 18 May, 9 pp.

### 1.3. COPIES OF OVERHEAD TRANSPARENCIES

1.3.1. 3 and 5 May - Five Frightening Facts, 6 pp.

1.3.2. 10 May - Radix or Base, 19 pp.

1.3.3. 12 May - Pending Assignments, 5 pp.

1.3.4. 17 May - Conventional Floating-Point Formats, 13 pp.

1.3.5. 19 May - The Classical model of Roundoff, 7 pp.

### 1.4. UNPUBLISHED RESEARCH AND CLASS NOTES

1.4.1. Machine-independent Algorithms for floor and ceil, 3 May, 5 pp.

1.4.2. Accurate Singular Values and Vectors of an Upper Triangular 2-by-2 Matrix, with Demmel, 27 April, 6 pp.

1.4.3. Roundoff in Polynomial Evaluation, 18 October 1986, 6 pp.

### 1.5. REPRINTS OF PUBLISHED WORK

1.5.1. A Proposed Radix- and Word-length-independent Standard for Floating-point Arithmetic, Cody et. al., IEEE Micro, August 1984, 16 pp.

## 1.6. OTHER HANDOUTS

1.6.1. Comments on Floating-point Indoctrination Syllabus,  
Thacher, 18 April, 3 pp.

1.6.2. Letter from Prof. Kulisch, 10 May, 4 pp.

## 2. Set 2

### 2.1. FORMAL LECTURE NOTES

2.1.1. Page 3 of Lecture 3 - May 10, Wilkie and Ma, 23 May,  
1 PP.

### 2.2. COPIES OF OVERHEAD TRANSPARENCIES

2.2.1. 24 May - How Often at Best can  $\text{SQRT}(x*x) = \text{ABS}(x)$  ?,  
12 pp.

2.2.2. 26 May - By How Much Must q Exceed p to Guarantee, 8  
pp.

### 2.3. UNPUBLISHED RESEARCH AND CLASS NOTES

2.3.1. Calculating Area and Angle of a Needle-like Triangle,  
23 September 1986, 3 pp.

2.3.2. Frexp/ldexp vs. Logb/scalb, 23 May, 6 pp.

## 2.4. OTHER HANDOUTS

2.4.1. Implementation of Algorithms Part I, 1973, approx.  
200 pp.

## 3. Set 3

### 3.1. UNPUBLISHED RESEARCH AND CLASS NOTES

3.1.1. The Error-Analyst's Quandary, 1972, 5 pp.

### 3.2. REPRINTS OF PUBLISHED WORK

3.2.1. Interval Arithmetic Options in the Proposed IEEE  
Floating-Point Arithmetic Standard, 1980, 16 pp.

3.2.2. FORTRAN-SC, Bleher, Rump, Kulisch, Metzger, Ullrich,  
Walter, 1987, 18 pp.

3.2.3. The Arithmetic of the Digital Computer, Kulisch and  
Miranker, 1986, 40 pp.

## 4. Set 4

4.1. FORMAL LECTURE NOTES

4.1.1. Lecture 7A - 24 May, Goldberg, 31 May, 4 pp.

4.2. COPIES OF OVERHEAD TRANSPARENCIES

4.2.1. Comparison of Multi-word Integer Add/Subtract, 27 May, 19 pp.

4.3. UNPUBLISHED RESEARCH AND CLASS NOTES

4.3.1. A More Complete Interval Arithmetic, 1968, 48 pp.

4.3.2. Can You Count on your Calculator?, with Parlett, 1977, 30 pp.

4.3.3. The Last Example on Gradual Underflow, Hough, 1980, 1 p.

4.3.4. On Alleged Mathematical Optimality, 1986, 6 pp.

4.3.5. Multi-Step Gradual Rounding, Corinna Lee, 10 pp.

4.4. REPRINTS OF PUBLISHED MATERIAL

4.4.1. A Survey of Error Analysis, 1971, 26 pp.

4.4.2. Applications of the Proposed IEEE 754 Standard, Hough, 1981, 5 pp.

4.4.3. Mathematics Written in Sand, 1983, 15 pp.

4.4.4. Anomalies in the IBM ACRITH Package, 1985, 10 pp.

5. Set 5

5.1. ERRATA

5.1.1. Set 2: page 9-3 from Implementation of Algorithms Part I, missing from some copies.

5.1.2. Set 4: corrections to Anomalies in the IBM ACRITH PACKAGE.

5.2. FORMAL LECTURE NOTES

5.2.1. Lecture 7B - 24 May, Ng, 10 June, 10 pp.

5.3. COPIES OF OVERHEAD TRANSPARENCIES

5.3.1. Lecture 11 - 7 June, Kulisch, 23 pp.

5.4. UNPUBLISHED RESEARCH AND CLASS NOTES

5.4.1. 7094-II System Support for Numerical Analysis, 1966, 52 pp.

5.4.2. Literature on Scientific Computation, Kulisch, 2 June, 4 pp.

5.4.3. An Experiment with ACRITH, with Tang, 9 June, 6 pp.

5.4.4. Transcendental Functions using Cordic, Valerio, pre-print 10 June, 7 pp.

#### 5.5. REPRINTS OF PUBLISHED WORK

5.5.1. How Reliable are Results of Computers?, Rump, 1983, 4 pp.

5.5.2. Arithmetic for Vector Processors, Kirchner and Kulisch, 1987, 14 pp.

5.5.3. Fortran - SC, Kulisch, 17 pp.

#### 5.6. OTHER HANDOUTS

5.6.1. GAMM Resolution on Computer Arithmetic, Kulisch, 1 pp.

5.6.2. Teubner Book Announcements, Kulisch, 3 pp.

5.6.3. Announcement for International Symposium on Computer Arithmetic and Self-Validating Numerical Methods, Ullrich, 1 pp.

### 6. Set 6

#### 6.1. OVERHEAD TRANSPARENCIES

6.1.1. Transcendental Approximations using Cordic, Valerio, 14 June, 27 pp.

6.1.2. The Cydra 5, Anderson, 21 June, 35 pp.

#### 6.2. UNPUBLISHED RESEARCH AND CLASS NOTES

6.2.1. Gaussian Elimination with Extra-Precise Accumulation of Products, 1983, 18 pp.

6.2.2. Handling Arithmetic Exceptions, May 1987, 16 pp.

6.2.3. Compiler support for floating-point computation, Farnum, August 1987, 13 pp.

6.2.4. Transcendental Approximations Using Cordic, Valerio, 14 June, 14 pp.

6.2.5. Some Observations about the 80960 Floating-Point Architecture, Valerio, 14 June, 7 pp.

#### 6.3. REPRINTS OF PUBLICATIONS

6.3.1. Numerical Linear Algebra, 1966, 25 pp.

6.3.2. The Probability that a Numerical Analysis Problem is Difficult (extracts), Demmel, April, 14 pp.

6.3.3. Compiler Support for Floating-point Computation, Farnum, April, 9 pp.

### 7. Set 7

#### 7.1. FORMAL LECTURE NOTES

7.1.1. Lecture 5 - 17 May, Ng, 24 June, 14 pp.

- 7.1.2. Lecture 6a - 19 May, Wilkie, 20 June, 7 pp.
- 7.1.3. Lecture 6b - 19 May, Mueller, 24 June, 9 pp.
- 7.1.4. Lecture 7a - 24 May, Goldberg, 24 June, 4 pp.
- 7.1.5. Lecture 7b - 24 May, Ng, 24 June, 10 pp.
- 7.1.6. Lecture 9 - 31 May, Goldberg, 13 pp.
- 7.1.7. Lecture 10 - 2 June, Goldberg, 7 pp.

## 7.2. UNPUBLISHED RESEARCH AND CLASS NOTES

- 7.2.1. Checking Whether Floating-Point Division is Correctly Rounded, April 1987, 16 pp.

- 7.2.2. Implementation of Algorithms - Part II, 1973, approximately 180 pp.

## 8. Set 8

### 8.1. FORMAL LECTURE NOTES

- 8.1.1. Guest Lecture 13 by Valerio - 14 June, Goldberg, 6 July, 18 pp.

- 8.1.2. Lecture 14 - 16 June, Goldberg, 6 July, 4 pp.

- 8.1.3. Guest Lecture 15 by Anderson - 21 June, Goldberg, 6 July, 2 pp.

### 8.2. OVERHEAD TRANSPARENCIES

- 8.2.1. Z := x+y in D.P., 7 July, 6 pp.

### 8.3. UNPUBLISHED RESEARCH AND CLASS NOTES

- 8.3.1. On Alleged Mathematical Optimality, 8 January 1986, 3 pp.

- 8.3.2. SQRT [in software], with Ng, 6 May 1986, 11 pp.

- 8.3.3. Rational Arithmetic in Floating Point, 20 September 1986, 9 pp.

- 8.3.4. Calculating Area and Angle of a Needle-Like Triangle, 23 September 1986, 3 pp.

- 8.3.5. A Distillation Program, 7 February 1987, 1 p.

- 8.3.6. Frexp/ldexp vs. logb/scalb, 23 May 1988, 7 pp.

### 8.4. REPRINTS OF PUBLICATIONS

- 8.4.1. The Near Orthogonality of Syntax, Semantics, and Diagnostics, with Coonen, 1982, 6 pp.

- 8.4.2. Excerpts from HP-15C Advanced Functions Handbook, 1982, 32 pp.

- 8.4.3. Excerpts from System V Interface Definition, AT&T, 1986, 17 pp.

### 8.5. MISCELLANY

- 8.5.1. SunOS 4.0 3M man pages, 1988, 26 pp.
- 8.5.2. SunOS 4.0 (3) man pages relating to floating point, 1988, 21 pp.
- 8.5.3. Fortran 1.1 (8) man pages relating to floating point, 1988, 8 pp.
- 8.5.4. SunOS 4.0 /usr/include files relating to floating point, 1988, 15 pp.

## 9. Set 9

### 9.1. FORMAL LECTURE NOTES

- 9.1.1. Lecture 12 - 9 June, Goldberg, 11 July, 6 pp.
- 9.1.2. Lecture 16 - 23 June, Goldberg, 11 July, 25 pp.

### 9.2. OVERHEAD TRANSPARENCIES

- 9.2.1. 25 Years with Mathematical Software, Moler, 30 June, 52 pp.
- 9.2.2. Some Puzzles in Exception Handling, Kahan, 12 July, 3 pp.
- 9.2.3. Pyramid Floating-Point Exceptions, Thrash and Drottar, 11 July, 2 pp.
- 9.2.4. float finvaliderr and transcendental functions, Zuras, 12 July, 5 pp.
- 9.2.5. IEEE Exception Handling - SunOS 4.0 and Fortran 1.1, Hough, 11 July, 7 pp.

### 9.3. UNPUBLISHED RESEARCH AND CLASS NOTES

- 9.3.1. Conserving Confluence Curbs Ill-Condition, 1972, 60 pp.
- 9.3.2. Elementary Functions from Kernels, 1985, 5 pp.
- 9.3.3. To Solve a Real Cubic Equation, 1986, 20 pp.
- 9.3.4. A Portable Floating-Point Environment, Barnett, May 1987, 20 pp.
- 9.3.5. Solving Sparse Linear Systems with Sparse Backward Error, Arioli, Demmel, and Duff, February, 30 pp.
- 9.3.6. Algorithms for Extended-Precision Elementary Transcendental Functions, McDonald, 24 June, 22 pp.

### 9.4. MISCELLANY

- 9.4.1. Some current publication abstracts, Hough, 4 pp.

## 10. Set 10

### 10.1. ADMINISTRATION

- 10.1.1. Abstract for 28 July Lecture, 14 July, 1 p.

### 10.2. OVERHEAD TRANSPARENCIES

10.2.1. Weitek Business..., Stanley and Torban, 14 July, 29 pp.

10.2.2. IBM S/370 Floating Point Format, Breed, 14 July, 6 pp.

10.2.3. Floating Arithmetic on 4.3/RT, Breed, 14 July, 1 p.

10.2.4. Vax Floating Point, Killian, 14 July, 3 pp.

10.2.5. MIPS Floating Point Architecture, 14 July, 4 pp.

#### 10.3. UNPUBLISHED RESEARCH AND CLASS NOTES

10.3.1. No Period Two Implies Convergence, 1979, 69 pp.

10.3.2. Roundoff in Polynomial Evaluation, 1986, 7 pp.

10.3.3. Accurate Singular Values of an Upper Triangular x-by-2 Matrix, with Demmel, 27 April, 7 pp.

#### 10.4. REPRINTS OF PUBLICATIONS

10.4.1. Underflow and the Reliability of Numerical Software, Demmel, 1984, 33 pp.

### 11. Set 11

#### 11.1. UNPUBLISHED RESEARCH AND CLASS NOTES

11.1.1. Language Specifications for SANE Pascal Numerics, J W Thomas, 1985, 11 pp.

11.1.2. Elementary Inequalities among Elementary Functions, 1985, 3 pp.

11.1.3. Elementary Functions from Kernels, 1985, 3 pp.

11.1.4. Apple Numerics Manual, Second Edition (excerpts), 18 pp.

11.1.5. Additional Floating-Point Indoctrination Exercises, Hough, 21 July, 6 pp.

#### 11.2. REPRINTS OF PUBLICATIONS

11.2.1. New Developments in PASCAL-SC (abstract), Bohlender, Ullrich, von Gudenberg, SIGPLAN August 1988, 1 p.

### 12. Set 12

#### 12.1. OVERHEAD TRANSPARENCIES

12.1.1. SANE Standard Apple Numerics Environment, Clayton Lewis, 14 July, 8 pp.

12.1.2. Floating-Point Arithmetic Exceptions, 26 July, 13 pp.

## 12.2. UNPUBLISHED RESEARCH AND CLASS NOTES

12.2.1. Larry Breed's Experiment, 25 July, 1 p.

## 12.3. REPRINTS OF PUBLICATIONS

12.3.1. Micro-Analysis of the Titan's Operation Pipe  
(abstract), Sanguinetti, June, 1 p.

## 12.4. MISCELLANY

12.4.1. Letter and announcement on Scientific Computation  
with Automatic Result Verification, Kulisch, 12 July, 3 pp.

12.4.2. Rationally biased rounding can be beneficial,  
Matula and Kornerup, 22 July, 2 pp.

## 13. Set 13

## 13.1. ERRATA

13.1.1. Missing page D.18 from Contributions to a Proposed  
Standard, Coonen, 1984, 1 p.

## 13.2. FORMAL LECTURE NOTES

13.2.1. Guest Lecture 15 by Anderson - 21 June, Yang, 10  
pp.

13.2.2. Guest Lecture 18 by Moler - 30 June, Goldberg, 6  
pp.

## 13.3. OVERHEAD TRANSPARENCIES

13.3.1. Is Floating-Point Arithmetic a Moral Issue?, 28  
July, 25 pp.

## 13.4. UNPUBLISHED RESEARCH AND CLASS NOTES

13.4.1. Superlinear Convergence of a Remes Algorithm, 1981,  
11 pp.

13.4.2. To Test Whether Binary Floating-Point Multiplica-  
tion is Correctly Rounded, 13 July, 5 pp.

13.4.3. Rationally Biased Rounding can be Beneficial,  
Matula and Kornerup, 22 July, 3 pp.

13.4.4. Larry Breed's Experiment, 25 July, 1 p.

13.4.5. portable exp.c, Mueller, 27 July, 2 pp.

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13.4.6. Specifications for Exponentiation, 27 July, 1 p.

13.4.7. Jean-Michel Muller's Example, 28 July, 1 p.

13.4.8. Note's on Kahan's A Distillation Program, Yuval, 26 August, 1 p.

13.5. REPRINTS OF PUBLICATIONS

13.5.1. Rationally Biased Arithmetic, Ferguson and Matula, 1985, 9 pp.

13.5.2. Finite Precision Lexicographic Continued Fraction Number Systems, Kornerup and Matula, 8 pp.

13.5.3. Review of Numerical Recipes, Isaacson, 1 p.

13.5.4. Review of Numerical Recipes, Shampine, 4 p.

13.5.5. Some publication abstracts, Hough, 11 pp.

13.6. MISCELLANY

13.6.1. The Minisupercomputer, Vollaro, 4 pp.

13.6.2. Cydra 5 Directed Dataflow Architecture, Anderson, 21 June, 13 pp.

13.6.3. Cydra 5 Performance Briefs, Anderson, 21 June, 18 pp.

13.6.4. Comments on Proposed ANSI C Standard (Jan 88 draft) with X3J11 responses, Hough, 15 August, 39 pp.

13.6.5. Excerpts from Proposed ANSI C Standard (May 88 draft) and Rationale, 13 May, 44 pp.

13.6.6. Comments on Proposed ANSI C Standard (May 88 draft), Hough, 29 August, 15 pp.

14. Set 14

15. Miscellaneous items distributed with handouts

15.1. Other

15.1.1. Contributions to a Proposed Standard, Ph D Thesis, Coonen, April 1984.

15.1.2. Lecture video #1

15.1.3. Lecture video #7

15.2. Manufacturer's specifications

15.2.1. SPARC V8 review draft, 5 July 1988.

15.2.2. FPV A Floating-Point Validation Package User's Guide, May 1986. Manual, NAG.

15.2.3. ATT WE 32206 Math Acceleration Unit Information Manual, May 1987.

15.2.4. Analog Devices ADSP3212/3222 64-bit IEEE FP chip set, August 1987.

15.2.5. Analog Devices DSPatch #7, March 1988.

- 15.2.6. Analog Devices DSPpatch #8, June 1988.
- 15.2.7. Analog Devices DSP Products Databook, 1987.
- 15.2.8. Advanced Micro Devices 29C327 User's Manual, 1988.
- 15.2.9. Intel 80287 Support Library Reference Manual, 1985.
- 15.2.10. Intel 80387 Programmer's Reference Manual, 1987.
- 15.2.11. Intel 80960KB Programmer's Reference Manual, 1988.
- 15.2.12. National Semiconductor NS32580 Floating-Point Controller, April 1988.
- 15.2.13. Weitek 1164/1165 Preliminary Data, July 1986.
- 15.2.14. Weitek 3164/3364 Advance Data, April 1988.
- 15.2.15. Weitek 3167 Floating-Point Coprocessor, June 1988.