COMPUTER SCIENCE BIBLIOGRAPHY

The following list of references is intended to give some suggestions about where to look for more information about topics mentioned in my lectures this winter (and some that I didn't get to). It comes with no guarantees at all; it's just a list of sources that I've found useful.

In the course of the year, a number of people have also asked me about references for various elementary topics in numerical analysis. I have therefore added a brief numerical analysis bibliography; I hope the juxtaposition doesn't foster the misconception that numerical analysis is a branch of - or the same as - computer science.

I've marked with an asterisk those works available in the IHES library.

Oscar Lanford
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0. GENERAL

There are many introductory textbooks giving an overview of computer science. My favorite, by far, is :

* A. Tanenbaum, Structured Computer Organization, Prentice Hall (1976).

Note, in particular, the very extensive suggestions for further reading. I have also found the September 1977 issue of Scientific American* (devoted to microelectronics) very helpful, particularly for an introduction to hardware which complements Tanenbaum's emphasis on high-level organization and software.

1. SOLID STATE PHYSICS

* R. Peierls, Quantum Theory of Solids, Oxford (1955)

N.W. Ashcroft and N.D. Mermin, Solid State Physics, Holt, Reinhart, Winston (1976).

Chapter 29 of Ashcroft/Mermin contains the best discussion

I've seen of the non-equilibrium properties of p-n junctions (although I have not succeeded in figuring out what n_c^o and p_v^o on p.603 ought to mean). Unfortunately, neither Peierls nor Ashcroft/Mermin discusses the specific physics underlying the operation of either bipolar or field effect transistors. For this, one should look at a textbook on solid state device physics, but I don't know one to recommend.

2. ELECTRONICS

* J. Millman, Micro-Electronics, McGraw-Hill (1977)

A textbook on practical electronics intended for undergraduate engineers and physical science majors. There are a number of such books; this one is thorough and reasonably up to date. It also contains a certain amount of discussion of medium scale circuitry (memory chips, counters, etc.).

* C. Mead and L. Conway, Introduction to VLSI Systems, Addison-Wesley (1980).

A remarkable book covering a broad range of material. Its main point is a discussion of the techniques used in designing large scale integrated circuits. It includes a rather complete practical discussion of NMOS technology, of the forseeable development and ultimate limitations of that technology, and of selected topics in digital system design and computer architecture.

3. DIGITAL SYSTEM DESIGN

The systematic process by which complicated devices - including computers - are built up out of elementary building blocks like logic gates and storage cells.

* F.J. Hill and G.R. Peterson, Introduction to Switching Theory and Logical Design, 2nd ed., Wiley (1974).

* ———— Digital Systems, Hardware Organization and Design, 2nd ed., Wiley (1978).

T.R. Blakeslee, Digital Design with Standard MSI and LSI, Wiley (1975)

The two Hill/Peterson books together give a systematic - if not complete - treatment of the subject. The Blakeslee book was written to explain to practicing digital systems designers the implications for their craft of the availability of chips providing complicated but specialized circuits at low cost; it contains a lot of interesting information about the kinds of integrated circuits available commercially.

4. COMPUTER ARCHITECTURE

Tanenbaum is quite good here, if a little schematic. The classic text is :

C.G. Bell and A. Newell, Computer Structures : Readings and Examples, McGraw Hill (1971),

which develops a formalism for the precise description of computer architecture and uses it to discuss a number of real computers. The January 1978 issue of Communications of the Association for Computing Machinery (CACM) contains articles discussing the architectures of several recently-designed computers. I found the article on the CRAY-I particularly intriguing.

In my opinion an important part of learning about computer architecture is to study the architecture of a particular machine in detail. About the only complete source is manufacturers' manuals, e.g.

IBM System/370 Principles of Operation, IBM (revised periodically)

5. OPERATING SYSTEMS

Again, Tanenbaum is a good place to start. There are several books, none of which I'm really familiar with, on the problems faced by the constructors of operating systems. One which has a good reputation is :

J.J. Donovan, Systems Programming, McGraw Hill (1972).

For a discussion - by its designers - of a particularly successful small operating system, see

D.M. Ritchie and K. Thompson, The UNIX Time-sharing system, Bell System Technical Journal, 57 # 6, pt.2, 1905-1930.

6. PROGRAMMING LANGUAGES

* M. Elson, Concepts of Programming Languages, Science Research Associates (1973)

* A.V. Aho and J.D. Ullman, Principles of Compiler Design, Addison-Wesley (1977)

These two books overlap hardly at all. Elson discusses the design of programming languages from the point of view of how they appear to the user. Aho/Ullman is a practical discussion of the techniques used in compiler design.

7. PERIODICALS

Electronics is, roughly, the Physics Today of the electronic engineering community. It isn't very scholarly. but it's an excellent source of up-to-date information about current technology. Datamation discusses computers and peripherals from the point of view of the user. CACM seems to be the principal scholarly computer science journal.

NUMERICAL ANALYSIS

General Texts

* J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, Springer (1980)

Seems, on superficial examination, to be a good general textbook covering much of numerical analysis. A little on the encyclopedic side, but has the advantage that it is written at a somewhat higher level of mathematical sophistication than a typical undergraduate textbook.

G. Dahlquist and A. Björck, Numerical Methods, Prentice Hall (1974)

An idiosyncratic book. Written, in principle, for a beginning course, and uses only elementary mathematics, but assumes a very high level of intelligence and attentiveness on the part of the reader. Full of insightful comments about computational strategy that are appreciated only after years of experience.

B. Wendroff, Theoretical Numerical Analysis, Academic Press (1966)

Not systematic, but written at a fairly high mathematical level and with an interesting choice of topics.

* G.E. Forsythe, M.A. Malcolm and C.B. Moler, Computer Methods for Mathematical Computation, Prentice-Hall (1977)

Unusual organization; built around a careful discussion of half-a-dozen high quality subroutines for standard tasks - inverting matrices, solving ordinary differential equations, etc. Suitable for a very elementary course, but will also repay study at a more advanced level.

S.D. Conte and C. de Boor, Elementary Numerical Analysis, an Algorithmic Approach, 2^{nd} ed., McGraw Hill (1979)

The book which I have found most satisfactory as a text for an undergraduate course.

SPECIALIZED TREATISES (all highly recommended)

Error analysis :

J.H. Wilkinson, Rounding Errors in Algebraic Processes, Wiley (1963)

Linear algebra (inverting matrices) :

G.E. Forsythe and C.B. Moler, Computer Solution of Linear Algebraic Systems, Prentice Hall (1967)

Linear algebra (eigenvalues) :

J.H. Wilkinson, The Algebraic Eigenvalue Problem, Oxford (1965)

*J.H. Wilkinson and C. Reinsch, Handbook for Automatic Computation : Vol.II, Linear Algebra, Springer (1971)

B.T. Smith et.al., Matrix Eigensystem Routines - EISPACK Guide, Lecture Notes in Computer Science, 6, Springer (1976).

Ordinary differential equations :

*C.W. Gear, Numerical Initial Value Problems in Ordinary Differential Equations, Prentice Hall (1971).

(The ultimate reference on the mathematical analysis of numerical methods for ordinary differential equations is :

H.J. Stetter, Analysis of Discretization Methods for Ordinary Differential Equations, Springer (1973).

This book is, however, entirely theoretical and extremely hard to read.)

The numerical solution of partial differential equations is a large and very important topic. I'm unfortunately not familiar enough with the literature to know what to recommend.