Further Reading

Chapter 1


Two videotapes on the history of computing, produced by Gordon and Gwen Bell, including the following machines and their inventors: Harvard Mark-I, ENIAC, EDSAC, IAS machine, and many others.


A classic paper explaining computer hardware and software before the first stored-program computer was built. We quote extensively from it in Chapter 3. It simultaneously explained computers to the world and was a source of controversy because the first draft did not give credit to Eckert and Mauchly.


Two historians chronicle the dramatic story. The New York Times calls it well written and authoritative.


Contains a good description of the later history of computing: the integrated circuit and its impact, personal computers, UNIX, and the Internet.


A personal view of computing by one of the pioneers who worked with von Neumann.


These sections contain much more detail on the cost of integrated circuits and explain the reasons for the difference between price and cost.


These two papers describe the software and hardware of the landmark Alto.
Further Reading


A collection of essays that describe the people, software, computers, and laboratories involved in the first experimental and commercial computers. Most of the authors were personally involved in the projects. An excellent bibliography of early reports concludes this interesting book.


These five one-hour programs include rare footage and interviews with pioneers of the computer industry.


Short biographies of 31 computer pioneers.


A historian’s perspective on Atanasoff vs. Eckert and Mauchly.


A personal view of computing by one of the pioneers.

Chapter 2


A personal view of the history of representative or unusual microprocessors, from the Intel 4004 to the Patriot Scientific ShBoom!


This book describes the MIPS architecture in greater detail than Appendix A.


This book concentrates on the VAX, but also includes descriptions of the Intel 80x86, IBM 360, and CDC 6600.


The architecture history of the Intel from the 4004 to the 8086, according to the people who participated in the designs.


The Motorola 680x0 is the main focus of the book, but it covers the Intel 8086, Motorola 6809, TI 9900, and Zilog Z8000.
Further Reading

Chapter 3


This classic paper includes arguments against floating-point hardware.


Another good introduction to floating-point arithmetic by the same author, this time with emphasis on software.


A more advanced introduction to integer and floating-point arithmetic, with emphasis on hardware. It covers Sections 3.4–3.6 of this book in just 10 pages, leaving another 45 pages for advanced topics.


This survey is a source of stories on the importance of accurate arithmetic.


The title refers to silicon and is another source of stories illustrating the importance of accurate arithmetic.


What the 8087 floating-point architecture could have been.


A collection of memos related to floating point, including “Beastly numbers” (another less famous Pentium bug), “Notes on the IEEE floating point arithmetic” (including comments on how some features are atrophying), and “The baleful effects of computing benchmarks” (on the unhealthy preoccupation on speed versus correctness, accuracy, ease of use, flexibility, . . .).


A textbook aimed at seniors and first-year graduate students that explains fundamental principles of basic arithmetic, as well as complex operations such as logarithmic and trigonometric functions.


This computer pioneer’s recollections include the derivation of the standard hardware for multiply and divide developed by von Neumann.
Chapter 4

Describes the first major synthetic benchmark, Whetstone, and how it was created.

Describes some of the underlying principles in using different means to summarize performance results.

Describes the Livermore Loops—a set of Fortran kernel benchmarks.

Describes the difficulties of summarizing performance with just one number and argues for total execution time as the only consistent measure.

Describes the SPEC benchmark suite. For up-to-date information, see the SPEC Web page via a link at www.mkp.com/books_catalog/cod/links.htm.

Describes the Dhrystone benchmark and its construction.

Chapter 5

A basic Verilog tutorial is included on the CD. There are also many books both on Verilog and on digital design using Verilog.

Describes the design of the Data General Eclipse series that replaced the first DG machines such as the Nova. Kidder records the intimate interactions among architects, hardware designers, microcoders, and project management.

Good description of the VAX architecture and several different microprogrammed implementations.

Overview of microprogramming concepts.
Further Reading

Describes the microprogrammed control for the 360, the first microprogrammed commercial machine.

Intriguing biography with many stories about industry pioneers and the trials and successes in building early machines.

These two classic papers describe Wilkes’s proposal for microcode.

Chapter 6

A quantitative comparison of RISC and CISC written by scholars who argued for CISCs as well as built them; they conclude that MIPS is between 2 and 4 times faster than a VAX built with similar technology, with a mean of 2.7.

This entire issue is devoted to the topic of exploiting ILP. It contains papers on both the architecture and software and is a wonderful source for further references.

Chapters 3 and 4 go into considerably more detail about pipelined processors (over 200 pages), including superscalar processors and VLIW processors.

A comparison of deeply pipelined (also called superpipelined) and superscalar systems.

A formal text on pipelined control, with emphasis on underlying principles.

A short summary of a classic computer, which uses vectors of operations to remove pipeline stalls.

An early survey on branch prediction.
Further Reading

*Covers the difficulties in interrupting pipelined computers.*

*A classic book describing a classic computer, considered the first supercomputer.*

**Chapter 7**

*A classic paper that describes the first commercial computer to use a cache and its resulting performance.*

*A reference paper of cache miss rates for many cache sizes for the SPEC2000 benchmarks.*

*For more in-depth coverage of a variety of topics including protection, cache performance of out-of-order processors, virtually addressed caches, compiler optimizations, additional latency tolerance mechanisms, and cache coherency.*

*This classic paper is the first proposal for virtual memory.*

*This paper shows the difference between complexity analysis of an algorithm, instruction count performance, and memory hierarchy for four sorting algorithms.*

*A thorough exploration of multilevel memory hierarchies and their performance.*

*A paper describing the most elegant operating system ever invented.*

*The history of UNIX from one of its inventors.*

An operating systems textbook with a thorough discussion of virtual memory, processes and process management, and protection issues.

The classic survey paper on caches. This paper defined the terminology for the field and has served as a reference for many computer designers.

A popular book that explains the role of Xerox PARC in laying the foundation for today’s computing, which Xerox did not substantially benefit from.

An operating system textbook with a good discussion of virtual memory.

The first, classic paper on caches.

Chapter 8

Describes the I/O system architecture and devices in IBM’s early computers.

A widely referenced short tutorial that outlives the startup company for which the author worked.

A tutorial covering disk arrays and the advantages of such an organization.

One of the first papers to categorize, quantify, and publish reasons for failures. It is still widely quoted.

A description of transaction processing, including discussions of benchmarking and performance evaluation.

Chapter 7 focuses on storage, including an extensive discussion of RAID technologies and dependability. Chapter 8 focuses on networks.

*A classic paper that describes the ARPANET.*


*The paper that introduced standard definitions of dependability, reliability, and availability.*


*This is a good overview of key concepts in bus design with some examples from DEC machines.*


*This project estimates the amount of information in the world from all possible sources.*


*A classic paper that describes the Ethernet network.*


*Another classic that notes how building powerful coprocessors can be a never-ending cycle.*


Oppenheimer, D., A. Ganapathi, and D. Patterson [2003]. “Why do Internet services fail, and what can be done about it?” 4th Usenix Symposium on Internet Technologies and Systems, March 26–28, Seattle, WA.

*A recent update on Gray’s classic paper, this time focused on Internet sites.*


*A classic paper that advocates arrays of smaller disks and introduces RAID levels.*


*A classic paper that defines the end-to-end argument.*


*Describes the development of important ideas in I/O.*


*Describes a simple program to automatically deduce key parameters of disks.*
Chapter 9

Almasi, G. S., and A. Gottlieb [1989]. Highly Parallel Computing, Benjamin/Cummings, Redwood City, CA.
A textbook covering parallel computers.

Written in response to the claims of the Illiac IV, this three-page article describes Amdahl’s law and gives the classic reply to arguments for abandoning the current form of computing.

A text that gives the principles of parallel programming.

Classic survey paper of shared-bus cache coherence protocols.

How a world record sort was performed on a cluster, including architecture critique of the workstation and network interface. By April 1, 1997, they pushed the record to 8.6 GB in 1 minute and 2.2 seconds to sort 100 MB.

Distinguishes shared address and nonshared address multiprocessors based on microprocessors.

A textbook on parallel computers.

Chronicles the sad story of the Illiac IV: four times the cost and less than one-tenth the performance of original goals.

Classic article showing SISD/SIMD/MISD/MIMD classifications.

A more in-depth coverage of a variety of multiprocessor and cluster topics, including programs and measurements.

Hord, R. M. [1982]. The Illiac-IV, the First Supercomputer, Computer Science Press, Rockville, MD.
A historical accounting of the Illiac IV project.

Another textbook covering parallel computers.


Examination of a vector architecture for the MIPS instruction set in media and signal processing.


Certainly the earliest reference on multiprocessors, this mathematician made this comment while translating papers on Babbage’s mechanical computer.


An entertaining book that advocates clusters and is critical of NUMA multiprocessors.


A tutorial article on a parallel processor connected via a hypertree. The Cosmic Cube is the ancestor of the Intel supercomputers.


Recollections of the beginnings of parallel processing by the architect of the Illiac IV.

### Appendix A


A complete, detailed, and engaging introduction to the MIPS instruction set and assembly language programming on these machines.

Detailed documentation on the MIPS32 architecture is available on the Web:


Slightly dated and lacking in coverage of modern architectures, but still the standard reference on compilers.
Appendix B

A thorough book on logic design using Verilog.

A general text on logic design.

A general text on logic design.
The law was intended to protect children from obscenity on the Internet, but many Internet users argued that its language was too vague and it violated the rights of free speech. Protesters against the law turned their web pages black and displayed blue ribbon icons downloaded from the Electronic Frontier Foundation. February 8, 1996, is more commonly known as "black Thursday." IBM computer Deep Blue beat chess master Garry Kasparov in two chess matches for the first time on February 2, 1996. Computer pioneer Gordon Bell hosts this two-part program on the evolution of electronic computing from its pre-World War II origins through the development of the first commercial computers. His narration traces the development of the stored program computer architecture which remains the foundation of today's modern computers. In Part 1 The builders of the first five computer machines: the Bell Labs Model 1, the Zuse Z1-3, the Atanasoff-Berry Computer, the Harvard Mark 1 and the IBM SSEC tell their stories. Catalog Number: 102645565 Lot Number: X3169.2005. Tags: Computer, History, Museum, Gord Artifact Details. Title. Computer Pioneers and Pioneer Computers. Catalog Number. 102645565. 1996. Publisher. Computer History Museum. Duration. 01:47:00. Gordon Bell hosts this two-part program on the evolution of electronic computing from its pre-WWII origins through the development of the first commercial computers. His narration traces the development of the stored program computer architecture which remains the foundation of today's computers. View Part 1 online at http://www.youtube.com/computerhistory#p/u/55/qundvme1Tik View Part 2 online at http://www.youtube.com/computerhistory#p/u/53/wsirYCAocZk.