



# Index

Page numbers in italics refer to illustrations.

## A

- ABET (Accreditation Board for Engineering and Technology), 176
- Abran, Alain, 48
- Accidental properties, 38–39
- Accreditation. *See also* certification; licensing.
  - ABET (Accreditation Board for Engineering and Technology), 176
  - CEAB (Canadian Engineering Accreditation Board), 52
  - computer science programs, 176
  - computer science *versus* engineering, 181–182
  - CSAB (Computer Science Accreditation Board), 175–176
  - hospitals, 132
  - JCAHO (Joint Commission on Accreditation of Healthcare Organizations), 132
  - and professional maturity, 52, 56
  - sample course requirements, 180
  - university programs, 181–182
- Accreditation Board for Engineering and Technology (ABET), 176
- Adopter groups
  - decision-making styles, 216
  - early adopters, 106, 216
  - early majority, 106, 216
  - innovators, 106, 215–216
  - laggards, 106, 216
  - late majority, 106, 216
- Age of programmers
  - an aging population, 74
  - industry distribution, 69
  - staff seniority, 140
- Agricultural extension service, technology transfer, 221–223
- Albert, B., 21
- Alexander, Christopher, 174
- “The American Scholar,” 95–97
- Anthes, Gary H., xxi
- Apple Computer, certification, 188
- Ariane 5 rocket blows up, xvii

- Art  
 influence of engineering, 167–169  
*versus* science, software engineering,  
 29–35
- Australian Computer Society Software  
 Challenge, 108–109
- Awareness. *See* consciousness.
- B**
- B-2 bomber problems, xvii
- Bach, James, 76
- Bacon, Francis  
 on abilities and study, 175  
 on adversity, 103  
 on doubts and certainties, 77  
 on hope, 7  
 on innovation, 3  
 on knowledge, 123  
*Novum Organum*, 49–50  
 progress from errors, 47  
 on prudent questions, 49  
 on reading, 95  
 scientific method, 49–50, 57–58  
 on success, v  
 on superstition, 103  
 on a true son of Science, 83  
 on truth, 37
- Baggage handling system flaws, xvi
- Baines, Robin, 35
- Baker, F. Terry, 93
- Beck, Kent, 81
- Bersoff, Edward H., 225
- Block-moving analogy. *See* pyramid  
 analogy.
- Boddie, John, 86
- Boehm, Barry W.  
 “A Software Development Environment  
 for Improving Productivity,” 225  
 on improving productivity, 135  
 “Improving Software Productivity,”  
 21, 75  
*Software Cost Estimation with Cocomo*  
*II*, 122, 141  
*Software Engineering Economics*, 27, 141
- Boeing Company, 175–177
- Böhm, C., 40
- Boiler explosion, 166
- Books for software developers, 95–99
- Bostrom, R. P., 74–75
- Box, George, 123
- Bridge disaster, 166
- Briggs, Katherine, 62
- Britcher, Robert N., xxi
- Bronson, Po, 6, 74
- Brooks, Fred  
 disseminating good practices, 95  
 essence *versus* accident, 38–39  
 job specialization, 89  
*The Mythical Man-Month*, 5–6, 93, 225  
 “No Silver Bullets,” 21, 47, 99, 162  
 schedule pressures, 3–4  
 on scientists and engineers, 29  
 silver bullets, 38–39  
 software systems as dinosaurs, 3
- Brykczynski, Bill, 21, 75
- Budgets. *See also* costs.  
 average overrun, 116  
 coding phase of projects, 13  
 diseconomies of scale, 118–119
- Bureaucracy  
*versus* chaos, 24–27  
 and productivity, 24
- Burgess, Angela, 75
- Bush, Vannevar, 162
- Buzzwords, 17–18
- Bylinsky, Gene, 4–6, 75
- C**
- CAC (Computing Accreditation Com-  
 mission), 181
- California Gold Rush. *See* Gold Rush,  
 California.
- Canadian Engineering Accreditation  
 Board (CEAB), 52
- Cancellation of projects  
 costs of, xvii  
 factors affecting, 18  
 rates of cancellation, 13

- Capability levels, Construx program, 146–147, 152–156
- Capability Maturity Model for Software (SW-CMM). *See* SW-CMM.
- Cargo cult analogy, 23–27
- CEAB (Canadian Engineering Accreditation Board), 52
- Certification, individual. *See also* accreditation; licensing.
  - Apple Computer technologies, 188
  - benefits of, 188
  - Microsoft technologies, 188
  - Novell technologies, 188
  - overview, 187–188
  - professions in general, 54
  - software engineering, 56
  - voluntary nature of, 187
- Certification, organizations. *See also* accreditation; licensing.
  - professions in general, 55
  - software engineering, 57
- Chand, Donald R., 226
- Changeability of software, and requirements problems, 39
- Chaos *versus* bureaucracy, 24–27
- Cheyenne Mountain ATAMS project, 128
- Churchill, Winston, v
- CKAs (Construx Knowledge Areas), 144–146, 145–146, 152–156
- Clarke, Arthur C., 173
- Cocomo II estimation model, 136, 137
- Code of ethics
  - benefits of, 209–211
  - code-and-fix development, 210
  - death-march projects, 210
  - implications of, 207–209
  - knowledge stagnation, 210–211
  - low-ball bidding, 210
  - professions in general, 54–55
  - programmers, 205–209
  - software engineering, 57
- Code-and-fix development
  - code of ethics, 210
  - definition, 11
  - drawbacks, 11–15
  - “fool’s gold” appeal, 14–15
  - history of, 11–15
  - process management, 12
  - productivity erosion, 12, 12–13
  - thrashing (unproductive work), 12
- Cole, Andy, 6, 141
- Commercial stage of engineering profession, 170
- Commitment, programmer personality type, 66–68
- Commitment-oriented development, 23–27
- Communications factors, 136
- Community building, 83–86
- Compensation. *See* motivation; pay; rewards.
- Competency-level capability, 147
- Complexity of software, requirements problems, 38–39
- Computer programming. *See* programming.
- Computer Science Accreditation Board (CSAB), 175–176
- Computer science program accreditation, 176
- Computer science *versus* software engineering, 29–35, 175–177. *See also* software engineering.
- Computing Accreditation Commission (CAC), 181
- Con I (pioneer mentality), 77, 78
- Con II (gray flannel suit mentality), 77, 78–79
- Con III (enlightened independence mentality), 77, 79
- Consciousness. *See also* teamwork.
  - Con I (pioneer mentality), 77, 78
  - Con II (gray flannel suit mentality), 77, 78–79
  - Con III (enlightened independence mentality), 77, 79
- Constantine, Larry
  - Australian Computer Society Software Challenge, 108–109

- Constantine, Larry (*cont.*)  
*Constantine on Peopleware*, 226  
 “Re: Architecture,” 110  
*Structured Design*, 226  
 on structured design, 40, 84, 224  
 “Under Pressure,” 110
- Construx Knowledge Areas (CKAs),  
 144–146, 145–146, 152–156
- Construx professional development program. *See* professional development, Construx program.
- Construx Web site, xxi
- Continuing professional education (CPE),  
 184–185
- Conway, M.E., 134
- Conway’s Law, 125
- Core competencies of software engineers,  
 44–47
- Costs. *See also* budgets.  
 cancelled projects, xvii  
 defect correction, 12  
 influence of requirements analysts, 136  
 overruns, and requirements problems,  
 18  
 quality tradeoffs, 15, 15–16  
 of software flexibility, 20
- Course requirements, 184
- CPE (continuing professional education),  
 184–185
- Craft stage of engineering profession,  
 169–170
- Creativity  
 process management *versus* individual  
 empowerment, 26–27  
 and SW-CMM, 129–130
- CSAB (Computer Science Accreditation  
 Board), 175–176
- Curtis, Bill, 21, 136, 141
- Customers. *See* adopter groups.
- D**
- Davis, Alan M., 162
- de Saint Exupéry, Antoine, 65
- Death-march projects, code of ethics, 210
- Defect management  
 costs, 12  
 failure factors, 13, 15–16  
 IBM study, 16  
 percentage of project time, 67  
 and productivity, 16  
 and project success, 15–16
- Defined level of SW-CMM, 124–125
- Degrees. *See also* accreditation; certification; education; licensing; professional development; training.  
 course requirements, 183  
 CPE (continuing professional education), 184–185  
*versus* demand, 70  
 distribution among developers, 68  
 earning power, 88–89  
 graduate programs, 179–181  
 McMaster University, 182–184  
 modeled on traditional engineering  
 programs, 185–186  
 occupational development path,  
 177–179, 178  
 rates among developers, 30  
 R.I.T., 180, 182–184  
 software aspect *versus* engineering,  
 182–184  
 software engineering *versus* computer  
 science, 30–35  
 trends in, 176, 177  
 undergraduate programs, 179–181
- DeMarco, Tom  
 “Certification or Decertification,” 204  
 comparison of programmer skill levels,  
 135  
*Peopleware: Productive Projects and  
 Teams*, 134, 212  
 “Programmer Performance and the  
 Effects of the Workplace,” 141, 162, 225  
 software requirements analysis, 40
- Denver International Airport baggage  
 handling system flaws, xvi
- Designers. *See* software designers.
- Designing software. *See* software design.

- Developers. *See* software developers.
- Diaz, Michale, 122
- Diffusing innovation. *See* technology transfer.
- Dijkstra, Edsger, 40
- Dinosaur analogy, 3
- Disasters, engineering, 166
- Disasters, software, xvi–xvii
- Diseconomies of scale, 118–119
- Documentation, and productivity, 24
- Doland, Jerry T., 226
- Duncan, W.R., 48
- E**
- E (Extroversion) personality type, 62
- EAC (Engineering Accreditation Commission), 180, 181
- Early adopters, 106, 216
- Early majority, 106, 216
- Economics of gold rush software development, 107–108
- Edison, Thomas, 65
- Education. *See also* accreditation; certification; degrees; licensing; professional development; training.  
 linking to licensing, xix  
 professions, in general, 52  
 professions, software engineering, 56  
 typical patterns, 68–71  
 university computer science curricula, 175–177
- Effectiveness of organizations, distribution, 112, 112–113, 113
- Emerson, Ralph Waldo, 95–97
- Employment. *See* jobs.
- Empowerment *versus* process management, 26–27. *See also* commitment-oriented development.
- Engineering. *See also* software engineering.  
 definition, 32  
 disasters, 166  
 as a profession. *See* professions, engineering.  
*versus* science, 30–35
- Engineering Accreditation Commission (EAC), 180, 181
- Enlightened independence (Con III), 77, 79
- Essential properties, 38–39
- Essential system properties, 38–39
- Eveland, J.D., 226
- Exams, licensing, 200, 201
- Experts, required knowledge, 37
- Extroversion (E) personality type, 62
- F**
- F (Feeling) personality type, 62
- FAA Advanced Automation System budget overrun, xvi
- Fagan, M.E., 225
- Failure factors. *See also* code-and-fix development; fools' gold; personnel factors; requirements problems; success factors.  
 cancellation factors, 18  
 cancellation rates, 13  
 defect management, 13, 15–16  
 experience level of requirements analysts, 136  
 process management, 13  
 schedule pressures, 3–4
- February 29 ignored by software, 166
- Feeling (F) personality type, 62
- Ferry dock crashes, xvii
- Fetzer, Daniel T., 122
- Feynman, Richard, 23
- Fishman, Charles, 21, 75, 134, 162, xxii
- Flexible software, illusion of, 18–20
- Florman, Samuel C., 167, 173, 204, 212
- Flowe, Robert M., 122
- Fool's gold. *See also* failure factors.  
 buzzwords, 17–18  
 code-and-fix development, 14–15  
 definition, 7  
 extravagant productivity claims, 16–18  
 illusion of software flexibility, 18–20  
 shortening schedules, 16  
 silver bullets, 16–18
- Ford, Gary, 52, 58, 186, 203

Fortran, 4–5  
 Frailey, Dennis, 186  
 Frosch, Robert, 4, 5–6

**G**

Gender of programmers, 68  
 Gibbs, Norman E., 52, 58, 186, 203  
 Gibbs, W. Wayt, 134, 162, xxi  
 Gilb, Tom, 40, 224–225  
 Glass, Robert L., 17, 21, 75, 174, xxi  
 Gold Rush, California, 104  
 Gold rush, software development  
   characteristics of, 104  
   economics of, 107–108  
   post-rush customers, 106–107  
   post-rush development, 105–107  
   prospects for success, 104–105, 109  
   scaling up/down, 108–109  
 Graduate programs, 179–181  
 Grant, E.E., 140  
 Gray flannel suit mentality (Con II), 77,  
   78–79

**H**

Half-lives of products, 37, 40  
 Hayes, Will, 226  
 Hecker, Daniel E., 75  
 Herbsleb, James  
   *Benefits of CMM Based Software Process  
   Improvement*, xxi  
   “Benefits of CMM Based Software  
   Process Improvement,” 121–122  
   ROI for process improvements, 111  
   “Software Quality and the Capability  
   Maturity Model,” 110, 134  
   SW-CMM implementation, 131  
 Heroes, programmer personality type,  
   72–73  
 Hero-oriented development. *See* commit-  
   ment-oriented development.  
 Hoben, S., 21  
 Human factors. *See* personnel factors.  
 Humphrey, Watts, 111, 121, 225  
 Hutchings, Edward, 27

**I**

I (Introversion) personality type, 62  
 IBM  
   OS/360, staff-years of development  
     effort, 4  
   prima donnas *versus* team players, 73  
   process management, 24  
   productivity, and defect rates, 16  
 IEEE (Institute of Electrical and Electron-  
   ics Engineers), software engineer  
   certification, 188  
 Individual empowerment *versus* process  
   management, 26–27. *See also* com-  
   mitment-oriented development.  
 Initial level of SW-CMM, 124  
 Innovators, 106, 215–216  
 Internet time, 5  
 Introductory-level capability, 147  
 Introversion (I) personality type, 62  
 Intuition (N) personality type, 62  
 Invisibility of software, requirements  
   problems, 39  
 Iran Air Flight 655, 166  
 Iron ring ceremony, 202–203  
 IRS software modernization debacle, xvi

**J**

J (Judging) personality type, 62  
 Jacopini, G., 40  
 James Fenimore Cooper Syndrome, 97–99  
 JCAHO (Joint Commission on Accredita-  
   tion of Healthcare Organizations),  
   132  
 Job specialization  
   by company size, 91  
   emerging categories, 89–90, 90  
   productivity, 89  
   surgical team approach, 89  
   in teams, 92  
 Jobs  
   degrees *versus* demand, 70  
   desirability of, 62  
   prospects, 71–72  
   stratification, 87–89, 90

- Johnson, Jim, 21, 122  
 Johnson Space Flight Center, 130  
 Joint Commission on Accreditation of Healthcare Organizations (JCAHO), 132  
 Jones, Capers  
   *Applied Software Measurement*, 21, 75  
   *Assessment and Control of Software Risks*, 5, 21–22, 93, 122, 174, 224  
   “Gaps in Programming Education,” 186  
   in-house training for engineers, 175  
   job specialization, 90  
   *Patterns of Software Systems Failure and Success*, 21, 93, 122, 134, xxii  
   *Programming Productivity*, 21, 75  
   ROI for better software practices, 111  
   *Software Assessments, Benchmarks, and Best Practices*, 121  
 Judging (J) personality type, 62
- K**
- Kaiser, K.M., 74–75  
 Kaner, Cem, 58, 203–204  
 Kennedy, Ken, 203–204  
 King, Jeff, 122  
 Knight, John C., 203–204  
 Knowledge areas, Construx program, 144–146. *See also* SWEBOK.  
 Knowledge stagnation, code of ethics, 210–211  
 Knuth, Donald, 47  
 Krantz, Les, 74–75  
 Krasner, Herb, 122  
 Kruchten, Philippe, 81  
 Kuhn, Thomas, 172, 174
- L**
- Laggards, 106, 216  
 Lakhapal, B., 76  
 Landis, Linda C., 226  
 Late majority, 106, 216  
 Lawlis, Dr. Patricia K., 122  
 Leadership-level capability, 147
- Lederer, Albert L., 22  
 Level 12 recognition, 159  
 Leveson, Nancy, 203–204  
 Licensing. *See also* accreditation; certification.  
   arguments against, 191–197  
   benefits of, 198–199  
   bootstrapping, 197–198  
   controversy about, xix  
   effects on developer pool, 195, 196  
   exams, 200, 201  
   iron ring ceremony, 202–203  
   linking to education, xix  
   and malpractice, 198  
   overview, 188–190  
   paths to a license, 200–202  
   professions in general, 54  
   qualifying, 200  
 Life expectancy of products, 37, 40  
 Lister, Timothy, 134–135, 141, 162, 212, 225  
 Liu, Y., 21  
 Lord Kelvin, 110  
 Low-ball bidding, code of ethics, 210  
 Lowell, Bill, 75  
 Lyons, Michael L., 74
- M**
- Magic, distinguishing from technology, 173  
 Maginnis, Terri, 87  
 Malec, H., 21  
 Malpractice, 198  
 Man Thinking *versus* thinker, 96–97  
 Managed level of SW-CMM, 125  
 Management processes. *See* process management.  
 Mariner I, loss of, 166  
 Marshall, James, 103  
 Mastery-level capability, 147  
 Maturation of engineering disciplines, 169–170  
 Maturity characteristics  
   professions in general, 52–55  
   software engineering, 56–57

- Maturity levels of professions, 55–56
- MBTI (Meyers-Briggs Type Indicator), 62–64
- McCalla, Gord, 204
- McConnell, Steve  
*After the Gold Rush*, xxii  
 “How to Read a Technical Article,” 162  
*Rapid Development*, 162  
*Software Project Survival Guide*, 21, 81, 162
- McCue, Gerald M., 76
- McFarlan, F.W., 225
- McMaster University, 182–184
- Meeson, Reginald, 21, 75
- Meetings, and productivity, 24
- Mentoring program, 157
- Metzger, Philip, 84, 86
- Meyers, Isabel Briggs, 62
- Meyers-Briggs Type Indicator (MBTI), 62–64
- Microsoft. *See also* Windows NT.  
 acquisition of Vermeer Technology, 108  
 certification, 188  
 importance of senior staff, 140  
 morale, 139  
 motivation, 139  
 non-monetary rewards, 139  
 process management, 25  
 The Velvet Sweatshop, 139  
 work environment, 139
- Mills, Harlen D., 21, 75, 93, 122, 204, xxii
- Money. *See* budgets; costs; pay.
- Moore, Geoffrey, 226
- Morale  
 Microsoft, 139  
 and SW-CMM, 129–130
- Motivation. *See also* pay; rewards.  
 effects on productivity, 24  
 Microsoft, 139  
 personnel factor, 138–139
- Moving-the-block analogy. *See* pyramid analogy.
- Myers, Glenford, 40, 225
- N**
- N (Intuition) personality type, 62
- NASA  
 Johnson Space Flight Center, 130  
 Software Engineering Lab, 118–119
- Neumann, Peter G., 173, xxii
- Non-monetary rewards, 139
- Novell, certification, 188
- Novum Organum*, 49–50
- Nuseibeh, Bashar, xxii
- O**
- Occupational development path, 177–179, 178
- Oldham, Leon G., 134
- Olsen, Neil C., 121
- Optimizing level of SW-CMM, 125
- Organizational process improvement.  
*See* process improvement; SEI; SW-CMM.
- Organizations  
 development styles. *See* process management.  
 effectiveness, distribution, 112, 112–113, 113  
 SW-CMM assessment, 131–132  
 SW-CMM levels, 124–125
- Organizations, certification. *See also* accreditation; licensing.  
 professions in general, 55  
 software engineering, 57
- OS/360, staff-years of development effort, 4
- Overtime, 3
- P**
- P (Perceiving) personality type, 62
- Page-Jones, Meilir, 224, 226
- Parking fee miscalculation, 166
- Parnas, David, 32–33, 41, 182  
 “Designing Software for Ease of Extension and Contraction,” 225  
 “Licensing Software Engineers in Canada,” 204



- “On ICSE’s ‘Most Influential’ Papers,” 99
- “On the Criteria to Be Used in Decomposing Systems into Modules,” 225
- on promising software engineering ideas, 213
- “Software Engineering: An Unconsummated Marriage,” 35
- software engineering credentials, 32–33, 182
- “Software Engineering Programmes Are Not Computer Science Programmes,” 35
- SWEBOK (Software Engineering Body of Knowledge), 41
- Pay. *See also* motivation; rewards.
  - earning power of degrees, 88–89
  - salary structure, 158
- PDL (Professional Development Ladder). *See also* professional development, Construx program.
  - benefits of, 160–161
  - career progression, 150–152, 151–152
  - for experienced engineers, 159
  - level requirements, 148
  - outside of Construx, 161–162
  - overview, 148
  - Transitional Level 12, 159
- PDPs (Professional Development Plans), 157
- Perceiving (P) personality type, 62
- Personality types
  - designers, 64–66
  - MBTI (Meyers-Briggs Type Indicator), 62–64
  - programmers, 62–66
- Personnel factors
  - Cocomo II estimation model, 136, 137
  - communications factors, 136
  - experience level of requirements analysts, 136
  - individual productivity differences, 135–137
  - low-productivity programmers, 137–138
  - motivation, 138–139
  - non-monetary rewards, 139
  - personnel continuity, 136
  - staff seniority, 140
  - work environment, 138
- Pillars of Hercules, 50
- Pioneer mentality (Con I), 77, 78
- Pitterman, Bill, xxi
- Planning. *See* process management.
- Plaques, professional development, 158
- Pony Express analogy, 61
- Practices, improving. *See* process improvement.
- Prasad, Jayesh, 22
- Pressman, Roger S., 162
- Prima donna programmers, 73
- Principles, teamwork, 77, 79
- Process improvement. *See also* SEI; SW-CMM; technology transfer.
  - benefits of, 113–115, 114–115
  - diseconomies of scale, 118–119
  - disseminating improvements, 95
  - NASA’s Software Engineering Lab, 118–119
  - organizational effectiveness, distribution, 112, 112–113, 113
  - project estimation, 116–119, 117
  - responsibility for, 119
  - ROI (return on investment), 111, 113–116, 116, 120
  - self-evaluation questions, 120–121
  - in small organizations, 109
  - state of the practice, 112–113
- Process management. *See also* programming; projects; software development; software engineering.
  - bureaucracy *versus* chaos, 24–27
  - code-and-fix development, 12
  - versus* empowerment, 26–27. *See also* commitment-oriented development.
  - IBM, 24
  - versus* individual empowerment, 26–27
  - Microsoft, 25
  - misuse of, 24–27

- Process management (*cont.*)  
 and project failure, 13  
 and project success, 13–14, 14
- Productivity  
 bureaucratic organizations, 24  
 code-and-fix development, 12–13  
 and defect rates, IBM study, 16  
 erosion, code-and-fix development, 12,  
 12–13  
 extravagant claims, 16–18  
 individual motivation and, 24  
 individual programmer differences,  
 135–137  
 job specialization, 89  
 largest single contributor to, 24, 73  
 low-productivity programmers,  
 137–138  
 meetings and, 24  
 project documentation and, 24  
 team cohesiveness and, 73
- Professional development. *See also* skills  
 development.  
 basic steps, 53  
 occupational development path,  
 177–179, 178  
 professions, in general, 54  
 professions, software engineering, 56
- Professional development, Construx  
 program. *See also* PDL.  
 capability levels, 146–147, 152–156  
 career progressions, 143  
 CKAs (Construx Knowledge Areas),  
 144–146, 145–146, 152–156  
 competency-level capability, 147  
 introductory-level capability, 147  
 knowledge areas, 144–146  
 leadership-level capability, 147  
 level 12 recognition, 159  
 mastery-level capability, 147  
 mentoring program, 157  
 objectives, 144  
 PDPs (Professional Development  
 Plans), 157  
 professional development plaques, 158  
 salary structure, 158  
 SEDGs (Software Engineering Discus-  
 sion Groups), 159  
 structural and cultural reinforcements,  
 156–159  
 training program, 158
- Professional Development Ladder (PDL).  
*See* PDL.
- Professional Development Plans (PDPs),  
 157
- Professional development plaques, 158
- Professional engineering stage of engi-  
 neering profession, 170
- Professional societies. *See also* entries for  
*specific societies.*  
 professions, in general, 54  
 professions, software engineering, 57  
 value of, 85–86
- Professions, engineering  
 commercial stage, 170  
 craft stage, 169–170  
 distinguishing from magic, 173  
 influence on art, 167–169  
 maturation of disciplines, 169–170  
 need for, 165–167  
 professional engineering stage, 170  
 Reims Cathedral *versus* Sydney Opera  
 House, 167–169, 168  
 science of software development,  
 171–172
- Professions, in general  
 accreditation, 52  
 certification, individual, 54  
 certification, organizational, 55  
 characteristics of, 51–52  
 codes of ethics, 54–55  
 definition, 51–52  
 initial education, 52  
 licensing, 54  
 maturity characteristics, 52–55  
 maturity levels, 55–56  
 professional development, 54  
 professional societies, 54  
 skills development, 53–54

- Professions, software engineering  
 accreditation, 56  
 areas needing improvement, 57–58  
 certification, individual, 56  
 certification, organizational, 57  
 codes of ethics, 57  
 initial education, 56  
 licensing, 56  
 maturity characteristics, 56–57  
 maturity levels, 56–57  
 professional development, 56  
 professional societies, 57  
 skills development, 56
- Programmers. *See* software developers.
- Programming. *See also* computer science;  
 process management; projects; soft-  
 ware development; software engi-  
 neering.  
 automatic, 4–5  
 Fortran, 4–5  
 languages, 4–5  
*versus* software engineering, 32–35
- Project managers, control of project  
 factors, 119
- Projects. *See also* failure factors; process  
 management; productivity; program-  
 ming; software development; soft-  
 ware engineering; success factors.  
 documentation, and productivity, 24  
 estimation, 116–119, 117  
 failure rate, xvii  
 reusable artifacts, 172  
 software *versus* physical engineering, 34
- Pyramid analogy, 7–11, 16–18
- Q**
- Quebec City bridge disaster, 166
- R**
- Raghavan, Sridhar A., 226  
 Randall, Richard L., 134  
 Raymond, E.S., 75  
 Reich, Charles, 77, 81  
 Reifer, Donald J., 122
- Reims Cathedral *versus* Sydney Opera  
 House, 167–169, 168
- Repeatable level of SW-CMM, 124
- Requirements analysts, influence on  
 project cost, 136
- Requirements problems  
 changeability of software, 39  
 complexity of software, 38–39  
 cost and schedule overruns, 18  
 essential system properties, 38–39  
 illusion of software flexibility, 18–20  
 invisibility of software, 39  
 and project failure, 4
- Return on investment (ROI), process  
 improvement, 111, 113–116, 116, 120
- Rewards  
 non-monetary, Microsoft, 139  
 professional development plaques, 158
- Rich, Charles, 6
- Risk management  
 SW-CMM, 128  
 technology transfer, 219–221
- R.I.T. (Rochester Institute of Technology),  
 180, 182–184
- Rochester Institute of Technology (R.I.T.).  
*See* R.I.T. (Rochester Institute of  
 Technology).
- Rogers, Everett M., 106–107, 110, 215–216,  
 222, 226
- ROI (return on investment), process  
 improvement, 111, 113–116, 116, 120
- Rules, teamwork, 77, 78–79
- Rush, Gary, 225
- S**
- S (Sensing) personality type, 62
- Sackman, H., 140
- Salaries. *See* motivation; pay; rewards.
- Schedules  
 overruns, and requirements prob-  
 lems, 18  
 and project failure, 3–4  
 quality tradeoffs, 15, 15–16  
 shortening, “fool’s gold” appeal, 16

- Science of software development, 171–172  
 “Science of the artificial,” 171  
 Science *versus* engineering, 30–35  
 Scientific method, 49–50, 57–58  
 Seattle ferry dock crashes, xvii  
 SEDGs (Software Engineering Discussion Groups), 159  
 SEI (Software Engineering Institute), 124, 127, 222. *See also* process improvement; SW-CMM.  
 Self-reliance, teamwork, 77, 78  
 Senior staff, importance of, 140  
 Sensing (S) personality type, 62  
 Shaw, Mary, 47, 174, 226  
 Shooting down of civilian airliner, 166  
 Silver Bullet Syndrome, 17  
 Silver bullets, 16–18  
 Simon, Herbert, 171, 174  
 Simons, Barbara, 203–204  
 Skills development. *See also* professional development.  
   professions, in general, 53–54  
   professions, software engineering, 56  
 Societies. *See* professional societies.  
 Software Configuration Management competency, 45  
 Software Construction competency, 44  
 Software Design competency, 44  
 Software designers, personality types, 64–66  
 Software developers. *See also* software development; software engineering.  
   age, 69, 74  
   code of ethics, 205–209  
   commitment, 66–68  
   core competencies, 44–47  
   education, 68–71  
   gender, 68  
   heroes, 72–73  
   individual productivity differences, 135–137  
   MBTI (Meyers-Briggs Type Indicator), 62–64  
   prima donnas *versus* team players, 73  
   stereotypes of, 61–68  
 Software development. *See also* process management; programming; projects; software engineering.  
   commitment oriented, 23–27  
   historical perspective, 3–5  
   Internet time, 5  
   process oriented, 23–27  
   stable core, 39–47  
 Software engineering. *See also* computer science; engineering; process management; programming; projects; software developers; software development.  
   art or science, 29–35  
   basic elements of, 44  
   *versus* computer programming, 32–35  
   *versus* computer science, 29–35  
   as a profession. *See* professions, software engineering.  
   science *versus* engineering, 30–35  
   sources of knowledge, 45  
 Software Engineering Discussion Groups (SEDGs), 159  
 Software Engineering Institute (SEI). *See* SEI.  
 Software Engineering Management competency, 46  
 Software Engineering Process competency, 46  
 Software Engineering Tools and Methods competency, 46  
 Software Engineering’s Body of Knowledge (SWEBOK). *See* SWEBOK.  
 Software flexibility, illusion of, 18–20  
 Software Maintenance competency, 45  
 Software practices, improving. *See* process improvement.  
 Software projects. *See* projects.  
 Software Quality competency, 45–46  
 Software Requirements competency, 44  
 Software systems as dinosaurs, 3  
 Software Testing competency, 45  
 Sommerville, Ian, 162  
 Specialization. *See* job specialization.

- Stable core of software development
    - knowledge, 39–47
  - Staff seniority, 140
  - Stallman, R.M., 75
  - Stereotypes of programmer personality
    - type, 61–68
  - Stevens, Wayne, 40
  - Stratification of jobs, 87–89, 90. *See also* job specialization.
  - Success factors. *See also* failure factors; personnel factors.
    - defect management, 15–16
    - early defect correction, 15–16
    - early process management, 13–14, 14
    - experience level of requirements analysts, 136
    - SW-CMM, 131
  - Surgical team approach to specialization, 89
  - SW-CMM (Capability Maturity Model for Software). *See also* process improvement; SEI.
    - Cheyenne Mountain ATAMS project, 128
    - defined level, 124–125
    - effects on creativity and morale, 129–130
    - initial level, 124
    - managed level, 125
    - NASA's Johnson Space Flight Center, 130
    - optimizing level, 125
    - as organizational assessment tool, 131–132
    - organizational levels, 124–125
    - organizations using, 128–129
    - overview, 124–125
    - progress made under, 125–127, 126
    - repeatable level, 124
    - risk management, 128
    - substance *versus* form, 133
    - success factors, 131
  - SWEBOK (Software Engineering's Body of Knowledge)
    - categories of knowledge, 43
    - essential difficulties, 43–44
    - history of, 42–43
  - Sydney Opera House *versus* Reims Cathedral, 167–169
- T**
- T (Thinking) personality type, 62
  - Tackett, Buford D., III, 134, xxi
  - Tar pit analogy, 3
  - Teamwork. *See also* consciousness.
    - building community, 83–86
    - job specialization, 92
    - prima donnas *versus* team players, 73
    - principles, 77, 79
    - and productivity, 73
    - rules, 77, 78–79
    - self-reliance, 77, 78
    - surgical team approach, 89
  - Technical reviews, effects on quality, 15–16
  - Technology transfer
    - adoption sequence, 217, 219
    - agricultural extension service, 221–223
    - reasons for caution, 217–218
    - risk management, 219–221
  - Technology transfer, adopter groups
    - decision-making styles, 216
    - early adopters, 106, 216
    - early majority, 106, 216
    - innovators, 106, 215–216
    - laggards, 106, 216
    - late majority, 106, 216
  - Testing, effects on quality, 15–16
  - Texas boiler explosion, 166
  - Thinker *versus* Man Thinking, 96–97
  - Thinking (T) personality type, 62
  - Thomsett, Rob, 74
  - Thordahl, James B., 122
  - Thrashing (unproductive work), 12
  - Training. *See also* accreditation; certification; degrees; education; licensing; professional development; skills development.
    - Construx program, 158
    - in-house, 175

Transitional Level 12, 159  
Tripp, Leonard, 48  
Twain, Mark, 97–99

**U**

Undergraduate programs, 179–181  
USS Vincennes, 166

**V**

Van Doren, Buddy, 134, xxi  
van Solingen, Rini, 111, 121–122  
van Vliet, Hans, xxi  
Vardi, Moshe Y., 203–204  
The Velvet Sweatshop, 139  
Vermeer Technology, acquisition by  
    Microsoft, 108  
Vosburgh, J., 21

**W**

Waligora, Sharon R., 226  
Waters, Richard C., 6  
Wheeler, David, 21, 75  
White, John, 203–204

Wiener, Lauren Ruth, xxii

**Windows NT**

    programmer commitment, 67  
    staff-years of development effort, 4  
    working environment, 67

Wirth, Niklaus, 84

Wolverton, R., 21

**Work environment**

    effects of, 138  
    Microsoft, 139  
    overtime, 3

Writing for software developers, 95–99

**X**

Xerox, and computing gold rush, 107

**Y**

Y2K problem, xix  
Yourdon, Ed, 84, 224, 226, xxii

**Z**

Zachary, Pascal, 6, 67, 75  
Zubrow, Dave, 226