# **Core Programming**

## **Core Programming: Reference-1**

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# **Data Structure**

## **Data Structure: Reference-1**

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# **Algorithm**

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| 07 | Relationship Between the Turning Machine and RAM Models |
| 08 | Pidgin ALGOL – A High-Level Language |
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| 12 | Trees |
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| 15 | Balancing |
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| 29 | Optimal Binary Search Trees |
| 30 | A Simple Disjoint-Set Union Algorithm |
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| 32 | Applications and Extensions of the UNION-FIND Algorithm |
| 33 | Balanced Tree Schemes |
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| 67 | Greatest Common Divisors and Euclid’s Algorithm |
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| 359 | Parallel Evaluation of Query Plans – Topics 4 |
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# **Software Engineering**

## **Software Engineering: Reference-1**

|  |  |
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| 05 | Software Development Projects – Topics 2 |
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| 33 | Project Estimation Techniques – Topics 3 |
| 35 | Empirical Estimation Techniques – Topics 2 |
| 38 | COCOMO – A Heuristic Estimation Technique – Topics 4 |
| 43 | Halstead’s Software Science – An Analytical Technique – Topics 5 |
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| 106 | UML Diagrams |
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| 152 | Software Documentation – Topics 2 |
| 156 | Testing – Topics 4 |
| 159 | Black-box Testing – Topics 3 |
| 167 | White-Box Testing – Topics 8 |
| 169 | Debugging – Topics 2 |
| 171 | Program Analysis Tools – Topics 2 |
| 172 | Integration Testing – Topics 1 |
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| 185 | Statistical Testing – Topics 1 |
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| 188 | Software Quality Management System – Topics 2 |
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| 204 | Case Environment – Topics 1 |
| 208 | CASE Support in Software Life Cycle – Topics 4 |
| 215 | Other Characteristics of Case Tools – Topics 7 |
| 216 | Towards Second Generation CASE Tool |
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| 222 | Estimation of Maintenance Cost |
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|  | **Software Reuse** |
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| 224 | Why Almost No Reuse So Far? |
| 225 | Basic Issues in any Reuse Program |
| 230 | A Reuse Approach – Topics 5 |
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| 233 | Client-Server Architectures |
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| 05 | Software Engineering |
| 06 | The Software Process |
| 08 | Software Engineering Practice – Topics 2 |
| 09 | Software Myths |
| 10 | How It All Starts |
|  | Summary |
|  | Problems and Points to Ponder |
|  | **Part-1: The Software Process** |
|  | **Process Models** |
| 13 | A Generic Process Model – Topics 3 |
| 14 | Process Assessment and Improvement |
| 19 | Prescriptive Process Models – Topics 5 |
| 22 | Specialized Process Models – Topics 3 |
| 24 | The Unified Process – Topics 2 |
| 26 | Personal and Team Process Models – Topics 2 |
| 27 | Process Technology |
| 28 | Product and Process |
|  | Summary |
|  | **Agile Development** |
| 29 | What is Agility |
| 30 | Agility and the Cost of Change |
| 33 | What Is an Agile Process – Topics 3 |
| 37 | Extreme Programming (XP) – Topics 4 |
| 45 | Other Agile Process Models – Topics 8 |
| 46 | A Tool Set for the Agile Process |
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|  | **Part-2: Modeling** |
|  | **Principles That Guide Practice** |
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| 49 | Core Principles – Topics 2 |
| 54 | Principles That Guide Each Framework Activity – Topics 5 |
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|  | **Understanding Requirements** |
| 55 | Requirements Engineering |
| 59 | Establishing the Groundwork – Topics 4 |
| 63 | Eliciting Requirements – Topics 4 |
| 64 | Developing Use Cases |
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| 67 | Negotiating Requirements |
| 68 | Validating Requirements |
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|  | **Requirements Modeling: Scenarios, Information, and Analysis Classes** |
| 72 | Requirements Analysis – Topics 4 |
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| 77 | UML Models That Supplement the Use Case – Topics 2 |
| 80 | Data Modeling Concepts – Topics 3 |
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|  | **Requirements Modeling: Flow, Behavior, Patterns, and WebApps** |
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| 93 | Creating a Behavioral Model – Topics 2 |
| 95 | Patterns for Requirements Modeling – Topics 2 |
| 103 | Requirements Modeling for WebApps – Topics 8 |
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| 106 | The Design Process – Topics 2 |
| 118 | Design Concepts – Topics 12 |
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|  | **Architectural Design** |
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| 128 | Architectural Genres |
| 131 | Architectural Styles – Topics 3 |
| 135 | Architectural Design – Topics 4 |
| 138 | Assessing Alternative Architectural Designs – Topics 3 |
| 140 | Architectural Mapping Using Data Flow – Topics 2 |
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|  | **Component-Level Design** |
| 143 | What is a Component – Topics 3 |
| 147 | Designing Class-Based Components – Topics 4 |
| 148 | Conducting Component-Level Design |
| 150 | Component-Level Design for WebApps – Topics 2 |
| 153 | Designing Traditional components – Topics 3 |
| 157 | Component-Based Development – Topics 4 |
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|  | **User Interface Design** |
| 160 | The Golden Rules – Topics 3 |
| 162 | User Interface Analysis and Design – Topics 2 |
| 166 | Interface Analysis – Topics 4 |
| 169 | Interface Design Steps – Topics 3 |
| 171 | WebApp Interface Design – Topics 2 |
| 172 | Design Evaluation |
|  | Summary |
|  | **Pattern-Based Design** |
| 176 | Design Patterns – Topics 4 |
| 181 | Pattern-Based Software Design – Topics 5 |
| 182 | Architectural Patterns |
| 183 | Component-Level Design Patterns |
| 184 | User Interface Design Patterns |
| 186 | WebApp Design Patterns – Topics 2 |
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|  | **WebApp Design** |
| 187 | WebApp Design Quality |
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| 189 | A Design Pyramid for WebApps |
| 190 | WebApp Interface Design |
| 192 | Aesthetic Design – Topics 2 |
| 194 | Content Design – Topics 2 |
| 196 | Architecture Design – Topics 2 |
| 198 | Navigation Design – Topics 2 |
| 199 | Component-Level Design |
| 202 | Object-Oriented Hypermedia Design Method (OOHDM) – Topics 3 |
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|  | **Part-3: Quality Management** |
|  | **Quality Concepts** |
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| 208 | Software Quality – Topics 5 |
| 214 | The Software Quality Dilemma – Topics 6 |
| 218 | Achieving Software Quality – Topics 4 |
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|  | **Review Techniques** |
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| 220 | Defect Amplification and Removal |
| 222 | Review Metrics and Their Use – Topics 2 |
| 223 | Reviews: A formality Spectrum |
| 224 | Informal Reviews |
| 228 | Formal Technical Reviews – Topics 4 |
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|  | **Software Quality Assurance** |
| 229 | Background Issues |
| 230 | Elements of Software Quality Assurance |
| 232 | SQA Tasks, Goals, and Metrics – Topics 2 |
| 233 | Formal Approaches to SQA |
| 235 | Statistical Software Quality Assurance – Topics 2 |
| 237 | Software Reliability – Topics 2 |
| 238 | The ISO 9000 Quality Standards |
| 239 | The SQA Plan |
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|  | **Software Testing Strategies** |
| 243 | A Strategic Approach to Software Testing – Topics 4 |
| 244 | Strategic Issues |
| 246 | Test Strategies for Conventional Software – Topics 2 |
| 248 | Test Strategies for Object-Oriented Software – Topics 2 |
| 249 | Test Strategies for WebApps |
| 252 | Validation Testing – Topics 3 |
| 257 | System Testing – Topics 5 |
| 261 | The Art of Debugging – Topics 4 |
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|  | **Testing Conventional Application** |
| 262 | Software Testing Fundamentals |
| 263 | Internal and External Views of Testing |
| 264 | White-Box Testing |
| 268 | Basis Path Testing – Topics 4 |
| 271 | Control Structure Testing – Topics 3 |
| 275 | Black-Box Testing – Topics 4 |
| 276 | Model-Based Testing |
| 289 | Testing for Specialized Environments, Architectures, and Applications – Topics 4 |
| 290 | Patterns for Software Testing |
|  | Summary |
|  | **Testing Object-Oriented Applications** |
| 291 | Broadening the View of Testing |
| 293 | Testing OOA and OOD Models – Topics 2 |
| 296 | Object-Oriented Testing Strategies – Topics 3 |
| 302 | Object-Oriented Testing Methods – Topics 6 |
| 304 | Testing Methods Applicable at the Class Level – Topics 2 |
| 306 | Interclass Test-Case Design – Topics 2 |
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|  | **Testing Web Applications** |
| 310 | Testing Concepts for WebApps – Topics 4 |
| 311 | The Testing Process – An Overview |
| 313 | Content Testing – Topics 2 |
| 318 | User Interface Testing – Topics 5 |
| 319 | Component-Level Testing |
| 321 | Navigation Testing – Topics 2 |
| 323 | Configuration Testing – Topics 2 |
| 324 | Security Testing |
| 327 | Performance Testing – Topics 3 |
|  | Summary |
|  | **Formal Modeling and Verification** |
| 328 | The Cleanroom Strategy |
| 331 | Functional Specification – Topics 3 |
| 333 | Cleanroom Design – Topics 2 |
| 335 | Cleanroom Testing – Topics 2 |
| 336 | Formal Methods Concepts |
| 337 | Applying Mathematical Notation for Formal Specification |
| 339 | Formal Specification Languages – Topics 2 |
|  | Summary |
|  | **Software Configuration Management** |
| 343 | Software Configuration Management – Topics 4 |
| 346 | The SCM Repository – Topics 3 |
| 351 | The SCM Process – Topics 5 |
| 357 | Configuration management for WebApps – Topics 6 |
|  | Summary |
|  | **Product Metrics** |
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| 364 | Metrics for the Requirements Model – Topics 2 |
| 374 | Metrics for the Design Model – Topics 8 |
| 375 | Design Metrics for WebApps |
| 376 | Metrics for Source Code |
| 378 | Metrics for Testing – Topics 2 |
| 379 | Metrics for Maintenance |
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|  | **Part-4: Managing Software Projects** |
|  | **Project Management Concepts** |
| 383 | The Management Spectrum – Topics 4 |
| 388 | People – Topics 5 |
| 390 | The Product – Topics 2 |
| 392 | The Process – Topics 2 |
| 393 | The Project |
| 394 | The W5HH Principle |
| 395 | Critical Practices |
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|  | **Process and Project Metrics** |
| 397 | Metrics in the Process and Project Domains – Topics 2 |
| 403 | Software Measurement – Topics 6 |
| 405 | Metrics for Software Quality – Topics 2 |
| 408 | Integrating Metrics within the Software Process – Topics 3 |
| 409 | Metrics for Small Organizations |
| 410 | Establishing a Software Metrics Program |
|  | Summary |
|  | **Estimation for Software Projects** |
| 411 | Observations on Estimation |
| 412 | The Project Planning Process |
| 413 | Software Scope and Feasibility |
| 416 | Resources – Topics 3 |
| 417 | Software Project Estimation |
| 426 | Decomposition Techniques – Topics 9 |
| 429 | Empirical Estimation Models – Topics 3 |
| 430 | Estimation for Object-Oriented Projects |
| 432 | Specialized Estimation Techniques – Topics 2 |
| 434 | The Make/Buy Decision – Topics 2 |
|  | Summary |
|  | **Project Scheduling** |
| 435 | Basic Concepts |
| 438 | Project Scheduling – Topics 3 |
| 440 | Defining a Task Set for the Software Project – Topics 2 |
| 441 | Defining a Task Network |
| 445 | Scheduling – Topics 4 |
| 446 | Earned Value Analysis |
|  | Summary |
|  | **Risk Management** |
| 447 | Reactive versus Proactive Risk Strategies |
| 448 | Software Risks |
| 450 | Risk Identification – Topics 2 |
| 452 | Risk Projection – Topics 2 |
| 453 | Risk Refinement |
| 454 | Risk Mitigation, Monitoring, and Management |
| 455 | The RMMM Plan |
|  | Summary |
|  | **Maintenance and Reengineering** |
| 456 | Software Maintenance |
| 457 | Software Supportability |
| 458 | Reengineering |
| 460 | Business Process Reengineering – Topics 2 |
| 462 | Software Reengineering – Topics 2 |
| 465 | Reverse Engineering – Topics 3 |
| 467 | Restructuring – Topics 2 |
| 469 | Forward Engineering – Topics 2 |
| 470 | The Economics of Reengineering |
|  | Summary |
|  | **Part-5: Advanced Topics** |
|  | **Software Process Improvement** |
| 473 | What is SPI – Topics 3 |
| 480 | The SPI Process – Topics 7 |
| 481 | The CMMI |
| 482 | The People CMM |
| 483 | Other SPI Frameworks |
| 484 | SPI Return on Investment |
| 485 | SPI Trends |
|  | Summary |
|  | **Emerging Trends in Software Engineering** |
| 486 | Technology Evolution |
| 487 | Observing Software Engineering Trends |
| 494 | Identifying ‘Soft Trends’ – Topics 7 |
| 501 | Technology Directions – Topics 7 |
| 503 | Tools-Related Trends – Topics 2 |
|  | Summary |
|  | **Concluding Comments** |
| 503 | The Importance of Software – Revisited |
| 504 | People and The Way They Build Systems |
| 505 | New Modes for Representing Information |
| 506 | The Long View |
| 507 | The Software Engineer’s Responsibility |
| 508 | A Final Comment |
|  | **Part-6: Appendix** |
| 509 | An Introduction to UML |
| 510 | Object Oriented Concepts |

# **Pure Mathematics – 1, 2, and 3**

|  |  |
| --- | --- |
|  | **Pure Mathematics (A-Level)** |
|  | **P1: Algebra** |
| 01 | Background Algebra |
| 02 | Linear Equations |
| 03 | Changing the Subject of a Formula |
| 04 | Quadratic Equations |
| 05 | Solving Quadratic Equations |
| 06 | Equations that cannot be Factorized |
| 07 | The Graphs of Quadratic Function |
| 08 | The Quadratic Formula |
| 09 | Inequalities |
|  | **P2: Algebra** |
| 10 | Operations with Polynomials |
| 11 | Solution of Polynomial Equations |
| 12 | The Modulus Function |
|  | **P3: Further Algebra** |
| 13 | The General Binomial Expansion |
| 14 | Review of Algebraic Functions |
| 15 | Partial Functions |
| 16 | Using Partial Functions with The Binomial Expansion |
|  | **P1: Co-Ordinate Geometry** |
| 17 | Co-Ordinates |
| 18 | Plotting, Sketching and Drawing |
| 19 | The Gradient of a Line |
| 20 | The Distance Between Two Points |
| 21 | The Mid-Point of a Line Joining Two Points |
| 22 | The Equation of a Straight Line |
| 23 | Finding the Equation of a Line |
| 24 | The Intersection of Two Line |
| 25 | Drawing Curves |
| 26 | The Intersection of A Line and A Curve |
|  | **P1: Sequences and Series** |
| 27 | Definitions and Notation |
| 28 | Arithmetic Progressions |
| 29 | Geometric Progressions |
| 30 | Binomial Expansions |
|  | **P1: Functions** |
| 31 | The Language of Functions |
| 32 | Composite Functions |
| 33 | Inverse Functions |
|  | **P1: Differentiation** |
| 34 | The gradient of a Curve |
| 35 | Finding the Gradient of a Curve |
| 36 | Finding the Gradient from First Principles |
| 37 | Differentiating by Using Standard Results |
| 38 | Using Differentiation |
| 39 | Tangents and Normals |
| 40 | Maximum and Minimum Points |
| 41 | Increasing and Decreasing Functions |
| 42 | Points of Inflection |
| 43 | The Second Derivative |
| 44 | Applications |
| 45 | The Chain Rule |
|  | **P2: Differentiation** |
| 46 | The Product Rule |
| 47 | The Quotient Rule |
| 48 | Differentiating Natural Logarithms and Exponentials |
| 49 | Differentiating Trigonometrical Functions |
| 50 | Differentiating Functions Defined Implicitly |
| 51 | Parametric Equations |
| 52 | Parametric Differentiation |
|  | **P3: Differential Equations** |
| 53 | Forming Differential Equations from Rates of Change |
| 54 | Solving Differential Equations |
|  | **P1: Integration** |
| 55 | Reversing Differentiation |
| 56 | Finding the Area Under A Curve |
| 57 | Area as The Limit of A Sum |
| 58 | Areas Below the X Axis |
| 59 | The Area Between Tow Curves |
| 60 | The Area Between A Curve and the Y Axis |
| 61 | The Reverse Chain Rule |
| 62 | Improper Integrals |
| 63 | Finding Volumes by Integration |
|  | **P2: Integration** |
| 64 | Integrals Involving The Exponential Function |
| 65 | Integrals Involving The Natural Logarithm Function |
| 66 | Integrals Involving Trigonometrical Functions |
| 67 | Numerical Integration |
|  | **P3: Further Integration** |
| 68 | Integration by Substitution |
| 69 | Integrals Involving Exponentials and Natural Logarithms |
| 70 | Integrals Involving Trigonometrical Function |
| 71 | The Use of Partial Fractions in Integration |
| 72 | Integration by Parts |
| 73 | General Integration |
|  | **P1: Trigonometry** |
| 74 | Trigonometry Background |
| 75 | Trigonometrical Functions |
| 76 | Trigonometrical Functions for Angles of any Size |
| 77 | The sine and cosine Graphs |
| 78 | The tangent graph |
| 79 | Solving Equations using Graphs of Trigonometrical Functions |
| 80 | Circular Measure |
| 81 | The Length of An ARC of A Circle |
| 82 | The Area of A Sector of A Circle |
| 83 | Other Trigonometrical Functions |
|  | **P2: Trigonometry** |
| 84 | Reciprocal Trigonometrical Functions |
| 85 | Compound-Angle Formulae |
| 86 | Double-Angle Formulae |
| 87 | The Forms rcos, rsin |
| 88 | The General Solutions of Trigonometrical Equations |
|  | **P1: Vectors** |
| 89 | Vectors in Two Dimensions |
| 90 | Vectors in Three Dimensions |
| 91 | Vectors Calculations |
| 92 | The Angle Between Two Vectors |
|  | **P3: Vectors** |
| 93 | The Vector Equation of a Line |
| 94 | The Intersection of Two Lines |
| 95 | The Angle Between Two Lines |
| 96 | The Perpendicular Distance from A Point to a Line |
| 97 | The Vector Equation of a Plane |
| 98 | The Intersection of A Line and A Plane |
| 99 | The Distance of A Point from A Plane |
| 100 | The Angle Between A Line and A Plane |
| 101 | The Intersection of Two Planes |
|  | **P2: Logarithms and Exponentials** |
| 102 | Logarithms |
| 103 | Exponential Functions |
| 104 | Modelling Curves |
| 105 | The Natural Logarithm Functions |
| 106 | The Exponential Function |
|  | **P2: Numerical Solution of Equations** |
| 107 | Interval Estimation – Change-of-Sign Methods |
| 108 | Fixed-Point Iteration |
|  | **P3: Complex Numbers** |
| 109 | The Growth of the Number System |
| 110 | Working with Complex Numbers |
| 111 | Representing Complex Numbers Geometrically |
| 112 | Sets of Points in An Argand Diagram |
| 113 | The Modulus-Argument form of Complex Numbers |
| 114 | Sets of Points Using The Polar Form |
| 115 | Working with Complex Numbers in Polar Form |
| 116 | Complex Exponents |
| 117 | Complex Numbers and Equations |