

Contents

Preface (First Edition)	7
Preface	11
Acknowledgements	13
Part I — Introduction	
Compilers	17
How Does a Compiler Work?	19
Phases of Compilation	21
A Simplified Model	28
The Peculiarities of C	31
Rules of the Game	35
The Source Language	35
The Object Language	38
The Runtime Library	39
Part II — The Tour	
Definitions and Data Structures	43
Definitions	43
Global Data	50
Function Prototypes	56
Utility Functions	59
Error Handling	63
Lexical Analysis	67
A Brief Theory of Scanning	77
The Implementation of the Scanner	81
Symbol Table Management	91
Syntactic and Semantic Analysis	103
A Brief Theory of Parsing	104
<i>Mapping Grammars to Parsers</i>	<i>109</i>
Expression Parsing	114

Constant Expression Parsing	147
Statement Parsing	152
Declaration Parsing	169
Preprocessing	189
Code Generation	197
A Brief Theory of Code Generation	197
The Code Generator	200
Framework	204
Load Operations	206
Binary Operators	207
Unary Operators	214
Jumps and Function Calls	216
Data Definitions	219
Increment Operators	221
Switch Table Generation	226
Store Operations	227
Rvalue Computation	230
Target Description	233
The 386 Target	236
Framework	237
Load Operations	238
Stack Operations	241
Binary Operations	241
Unary Operations	245
Increment Operations	246
Jumps and Branches	252
Store Operations	253
Functions and Function Calls	255
Data Definitions	256
The Compiler Controller	259

Part III — The Runtime Environment

The Runtime Startup Module	273
The System Calls	278
Header Files	289
<i>The System Call Header</i>	289
<i>The Setjmp Header</i>	290
<i>The Signal Header</i>	290
The Runtime Library	293
Library Initialization	293
Standard I/O	294
<i>The stdio.h Header</i>	295
<i>Required Stdio Functions</i>	301
Utility Library	330
<i>The stdlib.h Header</i>	330
<i>Required Stdlib Functions</i>	331
String Library	340
<i>The string.h Header</i>	340
<i>Required String Functions</i>	341
Character Types	345
<i>The ctype.h Header</i>	345
<i>The Ctype Functions</i>	345
The errno.h Header	347
Part IV — Beyond SubC	
Code Synthesis	351
Instruction Queuing	352
<i>CISC versus RISC</i>	362
<i>Comparisons and Conditional Jumps</i>	363
Register Allocation	365
<i>Cyclic Register Allocation</i>	371
Optimization	375

Peephole Optimization	375
Expression Rewriting	379
<i>Constant Expression Folding</i>	385
<i>Strength Reduction</i>	388
Common Subexpression Elimination	393
Emitting Code from an AST	399
Part V — Conclusion	
Bootstrapping a Compiler	403
<i>Design</i>	403
<i>Implementation</i>	404
<i>Testing</i>	407
Having Some Fun	409
Appendix	
Where Do We Go from Here?	415
Piece of Cake	415
This May Hurt a Bit	416
Bring 'Em On!	418
(Sub)C Primer	421
Data Objects and Declarations	421
<i>Void Pointers</i>	424
Expressions	425
<i>Pointer Arithmetics</i>	428
Statements	429
Functions	432
Prototypes and External Declarations	433
Preprocessor	434
Library Functions	436
386 Assembly Primer	437
Registers	437
Assembler Syntax	439

Contents	5
Assembler Directives	439
Sample Program	440
Addressing Modes	442
<i>Register</i>	442
<i>Immediate</i>	442
<i>Memory</i>	442
<i>Indirect</i>	443
Instruction Summary	444
<i>Move Instructions</i>	444
<i>Arithmetic Instructions</i>	445
<i>Branch and Call Instructions</i>	447
List of Figures	449
Bibliography	451
Index	453