Contents

1	An	Introduction to Engineering Problem Solving	3
	Grand Challenge: Weather Prediction		
	1.1 1.2	Grand Challenges Computing Systems	4
		Computer Hardware	6 7
	1.3	Computer Software An Engineering Problem-Solving Methodology	7 15
	1.0	Summary, Key Terms	18
2	Sim	nple C Programs	20
	Grand Challenge: Vehicle Performance		
	2.1	Program Structure	22
	2.2	Constants and Variables	25
		Scientific Notation	. 26
		Numeric Data Types	27
		Symbolic Constants	29
	2.3	Assignment Statements	30
		Arithmetic Operators	32
		Priority of Operators	34
		Overflow and Underflow	36
		Increment and Decrement Operators	37
		Abbreviated Assignment Operators	38
	2.4	Standard Input and Output	40
		printf Function	40
		scanf Function	44
	2.5	Mathematical Functions	4 5
		Elementary Math Functions	46
		Trigonometric Functions	47

Style Notes, Debugging Notes, Problems Control Structures and Data Files	52 58
Control Structures and Data Files	36
Grand Challenge: Global Change	
3.1 Algorithm Development	60
Top-Down Design	60
Structured Programming	67
3.2 Conditional Expressions	64
Relational Operators	65
Logical Operators	66
Precedence and Associativity	66
3.3 Selection Statements	67
Simple if Statement	68
if/else Statement 3.4 Loop Structures	69
while Loop	72
do/while Loop	73
for Loop	. 74
break and continue Statements	75
3.5 Problem Solving Applied: Weather Balloons	78 79
3.6 Data Files	84
I/O Statements	84
Reading Data Files	86
Generating a Data File	92
Summary, Key Terms, C Statement Summary	
Style Notes, Debugging Notes, Problems	94
4 Modular Programming with Functions	100
Grand Challenge: Enhanced Oil and Gas Recovery	
4.1 Modularity	102
4.2 Programmer-Defined Functions	102
Function Definition	103
Function Prototype	109
Parameter List	110
Storage Class and Scope	112



	CONTENTS	ix
Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems		113
One-Dimensional Arrays		118
Grand Challenge: Speech Recognition		
5.1 Array Definitions and Computations		120
Definition and Initialization		120
Computations and I/O		122
5.2 Arrays as Function Arguments		125
Call-by-Address References		127
Statistical Measurements		127
Summary, Key Terms, C Statement Summary		
		129
Character Data		134
Grand Challenge: Mapping the Human Genome		
6.1 Character Information		136
6.2 Character Initialization and Computations		137
Character I/O		138
Arrays of Characters		142
		144
		145
		147
Appendix A ASCII Character Codes		151
Complete Solutions to Practice! Problems		155
Index		160
	One-Dimensional Arrays Grand Challenge: Speech Recognition 5.1 Array Definitions and Computations Definition and Initialization Computations and I/O 5.2 Arrays as Function Arguments Call-by-Address References Statistical Measurements Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems Character Data Grand Challenge: Mapping the Human Genome 6.1 Character Information 6.2 Character Initialization and Computations Character I/O Arrays of Characters Character Comparisons 6.3 Character Functions Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems Appendix A ASCII Character Codes Complete Solutions to Practice! Problems	Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems One-Dimensional Arrays Grand Challenge: Speech Recognition 5.1 Array Definitions and Computations Definition and Initialization Computations and I/O 5.2 Arrays as Function Arguments Call-by-Address References Statistical Measurements Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems Character Data Grand Challenge: Mapping the Human Genome 6.1 Character Information 6.2 Character Initialization and Computations Charays of Characters Character Comparisons 6.3 Character Functions Summary, Key Terms, C Statement Summary Style Notes, Debugging Notes, Problems Appendix A ASCII Character Codes Complete Solutions to Practice! Problems