System Programming

Windows System Programming
Getting Started with Windows
Operating System Essentials
Windows Evolution
Windows Versions
The Windows Market Role
Windows, Standards, and Open Systems
Windows Principles
32-bit and 64-bit Source Code Portability
The Standard C Library: When to Use It for File Processing
What You Need to Use This Book
Example: A Simple Sequential File Copy
Summary and Exercises
Using the Windows File System and Character I/O The Windows File Systems
File Naming Opening, Reading, Writing, and Closing Files
Interlude: Unicode and Generic Characters
Unicode Strategies
Example: Error Processing
Standard Devices
Example: Copying Multiple Files to Standard Output
Example: Simple File Encryption
File and Directory Management
Console I/O
Example: Printing and Prompting
Example: Printing the Current Directory
Summary and Exercises
Advanced File and Directory Processing, and the Registry
The 64-bit File System
File Pointers
Getting the File Size
Example: Random Record Updates
File Attributes and Directory Processing Example: Listing File Attributes
Example: Setting File Attributes Example: Setting File Times
File Processing Strategies
File Locking
The Registry
Registry Management
Example: Listing Registry Keys and Contents
Summary and Exercises
Exception Handling
Exception and Their Handlers
Floating-Point Exceptions
Errors and Exceptions
Example: Treating Errors as Exceptions

Termination Handlers
Example: Using Termination Handlers to Improve Program Quality
Example: Using a Filter Function
Console Control Handlers
Example: A Console Control Handler
Vectored Exception Handling
Summary and Exercises
Memory Management, Memory-Mapped Files, and DLLs
Windows Memory Management Architecture
Heaps
Managing Heap Memory
Example: Sorting Files with a Binary Search Tree
Memory-Mapped Files
Example: Sequential File Processing with Mapped Files
Example: Sorting a Memory-Mapped File
Example: Using Based Pointers
Dynamic Link Libraries
Example: Explicitly Linking a File Conversion Function The DLL Entry Point
DLL Version Management
Summary and Exercises
Process Management Windows Processes and Threads
Process Creation
Process Identities Distribution Headles
Duplicating Handles
Exiting and Terminating a Process
Waiting and Terminating a Process
Waiting for a Process to Terminate
Environment Blocks and Strings
Example: Parallel Pattern Searching
Processes in a Multiprocessor Environment
Process Execution Times
Example: Process Execution Times
Generating Console Control Events
Example: Simple Job Management
Example: Using Job Objects
Summary and Exercises
Threads and Scheduling
Thread Overview
Thread Basics
Thread Management
Using the C Library in Threads
Example: Multithreaded Pattern Searching
Performance Impact
The Boss/Worker and Other Threading Models
Example: Merge-Sort – Exploiting Multiple Processors
Introduction to Program Parallelism
Thread Local Storage
Process and Thread Priority and Scheduling
Thread States

Ditfelle and Common Mistelles
Pitfalls and Common Mistakes
Timed Waits
Fibers
Summary and Exercises
Thread Synchronization
The Need for Thread Synchronization
Thread Synchronization Objects
CRITICAL_SECTION Objects
A CRITICAL_SECTION for Protecting Shared Variables
Example: A Simple Producer/Consumer System
Mutexes
Semaphores
Events
Examples: A Producer/Consumer System
More Mutex and CRITICAL_SECTION Guidelines
More Interlocked Functions
Memory Management Performance Considerations
Summary and Exercises
Locking, Performance, and NT6 Enhancements
Synchronization Performance Impact
A Model Program for Performance Experimentation
Tuning Multiprocessor Performance with CS Spain Counts
NT6 Slim Reader/Writer Locks
Thread Pools to Reduce Thread Contention
I/O Completion Ports
NT6 Thread Pools
Summary: Locking Performance
Parallelism Revisited
Processor Affinity
Performance Guidelines and Pitfalls
Summary and Exercises
Advanced Thread Synchronization
The Condition Variable Model and Safety Properties
Using SingnalObjectAndWait
Example: A Threshold Barrier Object
A Queue Object
Example: Using Queues in a Multistage Pipeline
Windows NT6 Condition Variables
Asynchronous Procedure Calls
Queuing Asynchronous Procedure Calls
Alterable Wait Stages
Safe Thread Cancellation
Pthreads for Application Portability
Thread Stacks and the Number of Threads
Hints for Designing, Debugging, and Testing
Beyond the Windows API
Summary and Exercises
Inter-process Communication
Anonymous Pipes
Example: I/O Redirection Using an Anonymous Pipe
Named Pipes
Numer i ipes

Named Pipe Transaction Functions
Example: A Client/Server Command Line Processor
Comments on the Client/Server
Command Line Processor
Mail-slots
Pipe and Mail-slot Creation, Connection, and Naming
Example: A Server That Clients Can Locate
Summary and Exercises
Network Programming with Windows Sockets
Windows Sockets
Socket Server Functions
Socket Client Functions
Comparing Named Pipes and Sockets
Example: A Socket Message Receive Function
Example: A Socket-Based Client
Example: A Socket-Based Server with New Features
In-Process Servers
Line-Oriented Messages, DLL Entry Points, and TLS
Example: A Thread-Safe DLL for Socket Messages
Example: An Alternative Thread-Safe DLL Strategy
Datagrams
Berkeley Sockets Versus Windows Sockets
Overlapped I/O with Windows Sockets
Windows Sockets Additional Features
Summary and Exercises
Windows Services
Writing Windows Services – Overview
The main() Function
SericeMain() Functions
The Service Control Handler
Event Logging
Example: A Service 'Wrapper'
Managing Windows Services
Summary: Service Operation and Management
Example: A Service Control Shell
Sharing Kernel Objects with a Service
Notes on Debugging a Service
Summary and Exercises
Asynchronous Input / Output and Completion Ports
Overview of Windows Asynchronous I/O
Overlapped I/O
Example: Synchronizing on a File Handle
Example: File Conversion with Overlapped I/O and Multiple Buffers
Extended I/O with Completion Routines
Example: File Conversion with Extended I/O
Asynchronous I/O with Threads
Waitable Timers
Example: Using a Waitable Timer
I/O Completion Ports
Example: A Server Using I/O Completion Ports
Summary and Exercises
Summary and Exercises

Securing Windows Objects
Security Attributes
Security Overview: The Security Descriptor
Security Descriptor Control Flags
Security Identifiers
Managing ACLs
Example: UNIX-Style Permission for NTFS Files
Example: Initializing Security Attributes
Reading and Changing Security Descriptors
Example: Reading File Permissions
Example: Changing File Permissions
Securing Kernel and Communication Objects
Example: Securing a Process ad Its Threads
Overview of Additional Security Features
Summary and Exercises
Appendix
Using the Sample Program
Source Code Portability: Windows, UNIX, and Linux
Performance Result

Graph Theory

	Graph Theory
	The Basics
01	Graphs
02	The Degree of a Vertex
03	Paths and Cycles
04	Connectivity
05	Trees and Forests
06	Bipartite Graphs
07	Contraction and Minors
08	Euler Tours
09	Some Linear Algebra
10	Other Notations of Graphs
	Exercises
	Matching
11	Matching in Bipartite Graphs
12	Matching in General Graphs
13	Path Covers
	Exercise
	Connectivity
14	2-Connected Graphs and Subgraphs
15	The Structure of 3-Connected Graphs
16	Menger's Theorem
17	Mader's Theorem
18	Edge-Disjoint Spanning Trees
19	Paths Between Given Pairs of Vertices
	Exercise
	Planar Graphs
20	Topological Prerequisites
21	Plan Graphs
22	Drawings
23	Planar Graphs: Kuratowski's Theorem
24	Algebraic Planarity Criteria
25	Plane Duality
	Exercise
	Colouring
26	Colouring Maps and Planar Graphs
27	Colouirng Vertices
28	Colouring Edges
29	List Colouring
30	Perfect Graphs
	Exercises
	Flows
31	Circulations
32	Flows in Networks
33	Group-Valued Flows
34	k-Flows for Small k
35	Flow-Colouring Duality
36	Tutte's Flow Conjectures
	,

Substructures in Dense Graphs 37 Subgraphs 38 Szemeredi's Regularity Lemma 39 Applying the Regularity Lemma Exercises Substructures in Sparse Graphs 40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		Exercises
37 Subgraphs 38 Szemeredi's Regularity Lemma 39 Applying the Regularity Lemma Exercises Substructures in Sparse Graphs 40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey Soriginal Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
38 Szemeredi's Regularity Lemma 39 Applying the Regularity Lemma Exercises Substructures in Sparse Graphs 40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees Tree-Decompositions	37	·
Applying the Regularity Lemma Exercises Substructures in Sparse Graphs 40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees Tree-Decompositions		
Exercises Substructures in Sparse Graphs 40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees Tree-Decompositions		
Substructures in Sparse Graphs Topological Minors Minors Hadwiger's Conjecture Exercises Ramsey Theory for Graphs Ramsey Theory for Graphs Ramsey Numbers Induced Ramsey Theorems Ramsey Properties and Connectivity Exercise Hamilton Cycles Simple Sufficient Conditions Hamilton Cycles and Degree Sequences Hamilton Cycles in the Square of a Graph Exercises Random Graphs The Notion of a Random Graph The Probabilistic Method Properties of Almost all Graphs Threshold Functions and Second Moments Exercises Minors, Trees, and WQO Well-Quasi-Ordering The-Decompositions	33	
40 Topological Minors 41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
41 Minors 42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	40	·
42 Hadwiger's Conjecture Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
Exercises Ramsey Theory for Graphs 43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
Ramsey Theory for Graphs Ramsey's Original Theorems Ramsey Numbers Induced Ramsey Theorems Ramsey Properties and Connectivity Exercise Hamilton Cycles Simple Sufficient Conditions Hamilton Cycles and Degree Sequences Hamilton Cycles in the Square of a Graph Exercises Random Graphs The Notion of a Random Graph The Probabilistic Method Properties of Almost all Graphs Threshold Functions and Second Moments Exercises Minors, Trees, and WQO Well-Quasi-Ordering The Graph Minor Theorem for Trees Tree-Decompositions	72	· ·
43 Ramsey's Original Theorems 44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
44 Ramsey Numbers 45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	43	
45 Induced Ramsey Theorems 46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	_	
46 Ramsey Properties and Connectivity Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		· · · · · · · · · · · · · · · · · · ·
Exercise Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	_	,
Hamilton Cycles 47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	40	
47 Simple Sufficient Conditions 48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
48 Hamilton Cycles and Degree Sequences 49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	47	
49 Hamilton Cycles in the Square of a Graph Exercises Random Graphs 50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
Exercises Random Graphs The Notion of a Random Graph The Probabilistic Method Properties of Almost all Graphs Threshold Functions and Second Moments Exercises Minors, Trees, and WQO Well-Quasi-Ordering The Graph Minor Theorem for Trees Tree-Decompositions		
Random Graphs The Notion of a Random Graph The Probabilistic Method Properties of Almost all Graphs Threshold Functions and Second Moments Exercises Minors, Trees, and WQO Well-Quasi-Ordering The Graph Minor Theorem for Trees Tree-Decompositions		, , , , , , , , , , , , , , , , , , , ,
50 The Notion of a Random Graph 51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
51 The Probabilistic Method 52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	50	•
52 Properties of Almost all Graphs 53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		·
53 Threshold Functions and Second Moments Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
Exercises Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		' '
Minors, Trees, and WQO 54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
54 Well-Quasi-Ordering 55 The Graph Minor Theorem for Trees 56 Tree-Decompositions		
55 The Graph Minor Theorem for Trees 56 Tree-Decompositions	54	
56 Tree-Decompositions	_	, and the second
1 3 7 1 1 CC WINCH WIN I OLDINACH WILLION	57	Tree-Width and Forbidden Minors
58 The Graph Minor Theorem		
Exercises		·

Theory of Computation

Introduction to Automata Theory, Languages, and Computation Automata: The Methods and the Madness Why Study Automata Theory? – Topics 3
I WNV STUDY AUTOMATA I NEORY? — LODICS 3
Introduction to Formal Proof – Topics 4
Additional Forms of Proof – Topics 4
Inductive Proofs – Topics 4
The Central Concepts of Automata Theory – Topics 4
Summary
Gradiance Problems
Finite Automata
An Informal Picture of Finite Automata – Topics 5
Deterministic Finite Automata – Topics 6
Nondeterministic Finite Automata – Topics 7
An Application: Text Search – Topics 4
Finite Automata With Epsilon-Transitions – Topics 6
Summary Cradianae Brahlane
Gradiance Problems
Regular Expressions and Languages
Regular Expressions – Topics 4
Finite Automata and Regular Expression – Topics 4
Applications of Regular Expressions – Topics 4
Algebraic Laws for Regular Expressions – Topics 8
Summary
Gradiance Problems
Properties of Regular Languages
Proving Languages Not to Be Regular – Topics 3
Closure Properties of Regular Languages – Topics 5
Decision Properties of Regular Languages – Topics 4
Equivalence and Minimization of Automata – Topics 5
Summary
Gradiance Problems
Context-Free Grammars and Languages
Context-Free Grammars – Topics 7
Parse Trees – Topics 7
Applications of Context-Free Grammars – Topics 5
Ambiguity in Grammars and Languages – Topics 5
Summary
Gradiance Problems
Pushdown Automata
Definition of the Pushdown Automaton – Topics 5
The Languages of a PDA – Topics 5
Equivalence of PDA's and CFG's – Topics 3
Deterministic Pushdown Automata – Topics 5
Summary
Gradiance Problems
Properties of Context-Free Languages
Normal Forms for Context-Free Grammars – Topics 6
The Pumping Lemma for Context-Free Languages – Topics 4

142	Closure Properties of Context-Free Languages – Topics 6
148	Decision Properties of CFL's – Topics 6
	Introduction to Turning Machines
152	Problems That Computers Cannot Solve – Topics 4
159	The Turning Machine – Topics 7
163	Programming Techniques for Turing Machines – Topics 4
168	Extensions to the Basic Turing Machine – Topics 5
173	Restricted Turing Machines – Topics 5
176	Turing Machines and Computers – Topics 3
	Summary
	Gradiance Problems
	Undecidability
181	A Language That Is Not Recursively Enumerable – Topics 5
186	An Undecidable Problem that Is RE – Topics 5
191	Undecidable Problems About Turing Machines – Topics 5
195	Post's Correspondence Problem – Topics 4
199	Other Undecidable Problems – Topics 4
	Summary
	Gradiance Problems
	Intractable Problems
206	The Classes P and NP – Topics 7
210	An NP-Complete Problem – Topics 4
215	A Restricted Satisfiability Problem – Topics 5
222	Additional NP-Complete Problems – Topics 7
	Summary
	Gradiance Problems
	Additional Classes of Problems
225	Complements of Languages in NP – Topics 3
228	Problems Solvable in Polynomial Space – Topics 3
233	A Problem That Is Complete for PS – Topics 5
241	Language Classes Based on Randomization – Topics 8
247	The Complexity of Primality Testing – Topics 6
	Summary
	Gradiance Problems

Operation System

Operating System: Reference-1

Operating System Concepts Overview Introduction What Operating Systems Do Computer-System Organization Computer-System Architecture Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security Distributed Systems	
Introduction What Operating Systems Do Computer-System Organization Computer-System Architecture Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
What Operating Systems Do Computer-System Organization Computer-System Architecture Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
Computer-System Organization Computer-System Architecture Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
Computer-System Architecture Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
Operating-System Structure Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
Operating-System Operations Process Management Memory Management Storage Management Protection and Security	
Process Management Memory Management Storage Management Protection and Security	
Memory Management Storage Management Protection and Security	
Storage Management Protection and Security	
Protection and Security	
Distributed Systems	
Special-Purpose Systems	
Computing Environments	
Open-Source Operating Systems	
Summary, Exercises	
System Structures	
Operating-System Services	
User Operating-System Interface	
System Calls	
Types of Systems Calls	
System Programs	
Operating-System Design and Implementation	
Virtual Machines	
Operating-System Debugging	
Operating-System Generation	
System Boot	
Summary, Exercises	
Process Management	
Process Concept	
Process Concept	
Process Scheduling	
Operations on Processes	
Interposes Communication	
Examples of IPC Systems	
Communication in Client-Server Systems	
Summary, Exercises	
Multithreaded Programming	
Overview	
Multithreading Models	
Thread Libraries	
Threading Issues	
Operating-System Examples	
Summary, Exercises	
Process Scheduling	
Basic Concepts	

Scheduling Criteria
Scheduling Algorithms
Thread Scheduling
Multiple-Processor Scheduling
Operating System Examples
Algorithm Evaluation
Summary, Exercises
Process Coordination
Synchronization
Background
The Critical-Section Problem
Peterson's Solution
Synchronization Hardware
Semaphores
Classic Problems of Synchronization
Monitors
Synchronization Examples
Atomic Transactions
Summary, Exercises Deadlocks
System Model Deadlock Characterization
Methods for Handling Deadlocks Deadlock Prevention
Deadlock Avoidance
Deadlock Detection
Recovery from Deadlock
Summary, Exercises
Memory Management Memory-Management Strategies
Background
Swapping Contiguous Memory Allocation
Paging Structure of the Page Table
Segmentation
Example: The Intel Pentium
Summary, Exercises Virtual Management
Virtual-Memory Management Background
Demand Paging
Copy-on-Write
Page Replacement
Allocation of Frames
Thrashing
Memory-Mapped Files
Allocating Kernel Memory
Other Considerations Operating System
Operating-System Example
Summary, Exercises Steamer Management
Storage Management

File System
File Concept
Access Methods
Directory and Disk Structure
File-System Mounting
File Sharing
Protection
Summary, Exercises
Implementing File Systems
File-System Structure
File-System Implementation
Directory Implementation
Allocation Methods
Free-Space Management
Efficiency and Performance
Recovery
NFS
Example: The WAFL File System
Summary, Exercises
Secondary-Storage Structure
Overview of Mass-Storage Structure
Disk Structure
Disk Attachment
Disk Scheduling Disk Management
Disk Management RAID Structure
Stable-Storage Implementation
Tertiary-Storage Structure Summary, Exercises
·
I/O Systems Overview
Overview
I/O Hardware
Application I/O Interface
Kernel I/O Subsystem
Transforming I/O requests Hardware Operations
STREAMS Performance
Summary, Exercises Protection and Security
System Protection Goals of Protection
Principles of Protection
Domain of Protection
Access Matrix
Implementation of Access Matrix Access Control
Revocation of Access Rights Canability Resed Systems
Capability-Based Systems
Language-Based Protection
Summary, Exercises
System Security

The Security Problem
Program Threats
System and Network Threats
Cryptography as a Security Tool
User Authentication
Implementing Security Defenses
Firewalling to Protect Systems and Networks
Computer-Security Classifications
An Example: Windows XP
Summary, Exercises
Distributed Systems
Distributed Operating Systems
Motivation
Types of Network-based Operating Systems
Network Structure
Network Topology
Communication Structure
Communication Protocols
Robustness
Design Issues
An Example: Networking
Summary, Exercises
Distributed File Systems
Background
Naming and Transparency
Remote File Access
State-full Versus State-less Service
File Replication
An Example: AFS
Summary, Exercises
Distributed Synchronization
Event Ordering
Mutual Exclusion
Atomicity
Concurrency Control
Deadlock Handling
Election Algorithms
Reaching Agreement
Summary, Exercises
Special Purpose Systems
Real-Time Systems
Overview
System Characteristics
Features of Real-Time Kernels
Implementing Real-Time Operating Systems
Real-Time CPU Scheduling
An Example VxWorks 5.x
Summary, Exercises
Multimedia Systems
What is Multimedia?
Compression

Requirements of Multimedia Kernels
CPU Scheduling
Disk Scheduling Disk Scheduling
Network Management
An Example: CineBlitz
Summary, Exercises
Case Studies
The Linux System
Linux History
Design Principles
Kernel Modules
Process Management
Scheduling
Memory Management
File Systems
Input and Output
Inter-process Communication
Network Structure
Security
Summary, Exercises
Window XP
History
Design Principles
System Components
Environmental Subsystems
File System
Networking
Programmer Interface
Summary, Exercises
Influential Operating Systems
Feature Migration
Early Systems
Atlas
XDS-940
THE
RC 4000
CTSS CTSS
MULTICS
IBM OS/390
TOPS-20
CP/M and MS/DOS
Macintosh Operating System and Windows
Match Match
Other Systems
Summary, Exercises
BSD UNIX
UNIX History
Design Principles
Programmer Interface
User Interface
Process Management
1 Toccos Management

	Mamary Management
	Memory Management
	File System
	I/O System
	Inter-process Communication
	Summary, Exercises
	Appendix B: The Mach System
	History of the Mach System
	Design Principles
	System Components
	Process Management
	Inter-process Communication
	Memory Management
_	Programmer Interface
	Summary, Exercises

Operating System: Reference-2

	Modern Operating Systems
	Introduction
02	What is an Operating System? – Topics 2
07	History of Operating Systems – Topics 5
13	Computer Hardware Review – Topics 6
21	The Operating System Zoo – Topics 9
28	Operating System Concepts – Topics 7
33	System Calls – Topics 5
39	Operating System Structure – Topics 6
43	The World According To C – Topics 4
44	Research on Operating Systems
45	Outline of the Rest of This Book
46	Metrics Units
47	Summary
.,	Processes and Threads
54	Processes – Topics 7
63	Threads – Topics 9
73	Inter-process Communication – Topics 10
79	Scheduling – Topics 6
81	Classical IPC Problems – Topics 2
82	Research on Processes and Threads
83	Summary
	Memory Management
84	No Memory Abstraction
87	A Memory Abstraction: Address Spaces – Topics 3
91	Virtual Memory – Topics 4
101	Page Replacement Algorithms – Topics 10
110	Design Issues for Paging Systems – Topics 9
116	Implementation Issues – Topics 6
119	Segmentation – Topics 3
120	Research on Memory Management
121	Summary
	File Systems
128	Files – Topics 7
132	Directories – Topics 4
139	File-System Implementation – Topics 7
144	File-System Management and Optimization – Topics 5
147	Example File Systems – Topics 3
148	Research on File Systems
149	Summary
	Input / Output
154	Principles of I/O Hardware – Topics 5
158	Principles of I/O Software – Topics 4
162	I/O Software Layers – Topics 4
167	Disks – Topics 5
170	Clocks – Topics 3
172	User Interfaces: Keyboard, Mouse, Monitor – Topics 2
173	Thin Clients

176	Power Management – Topics 3
177	Research on Input/Output
178	Summary
1,0	Deadlocks
180	Resources – Topics 2
182	Introduction to Deadlocks – Topics 2
183	The Ostrich Algorithm
186	Deadlock Detection and Recovery – Topics 3
190	Deadlock Avoidance – Topics 4
194	Deadlock Prevention – Topics 4
198	Other Issues – Topics 4
199	Research on Deadlocks
200	Summary
200	Virtualization and The Cloud
201	History
201	Requirements for Virtualization
203	Type 1 and Type 2 Hypervisors Techniques for Efficient Visualization Tonics 2
	Techniques for Efficient Visualization – Topics 2
206	Are Hypervisors Microkernels Done Right?
207	Memory Virtualization I/O Virtualization
208	,
209	Virtual Appliances
210	Virtual Machines on Multicore CPUS
211	Licensing Issues
214	Clouds – Topics 3
220	Case Study: VMWare – Topics 6
221	Research on Virtualization and The Cloud
225	Multiple Processor Systems
225	Multiprocessors – Topics 4
232	Multi-computers – Topics 7
238	Distributed Systems – Topics 6
239	Research on Multiple Processor Systems
240	Summary
242	Security
242	The Security Environment – Topics 2
244	Operating Systems Security – Topics 2
247	Controlling Access to Resources – Topics 3
249	Formal Models of Secure Systems – Topics 2
254	Basics of Cryptography – Topics 5
256	Authentication – Topics 2
263	Exploiting Software – Topics 7
266	Insider Attacks – Topics 3
271	Malware – Topics 5
278	Defenses – Topics 7
279	Research on Security
280	Summary
20-	Case Study 1: UNIX, LINUX, and ANDROID
287	History of UNIX and LINUX – Topics 7
292	Overview of LINUX – Topics 5
297	Processes in LINUX – Topics 5
301	Memory Management in LINUX – Topics 4

306	Input / Output in LINUX – Topics 5
310	The LINUX File System – Topics 4
313	Security in LINUX – Topics 3
325	ANDROID – Topics 12
326	Summary
	Case Study 2: Windows 8
331	History of Windows Through Windows 8.1 – Topics 5
334	Programming Windows – Topics 3
338	System Structure – Topics 4
341	Processes and Threads in Windows – Topics 3
344	Memory Management – Topics 3
345	Caching in Windows
348	Input / Output in Windows – Topics 3
350	The Windows NT File System – Topics 2
351	Windows Power Management
355	Security in Windows 8 – Topics 4
356	Summary
	Operating System Design
358	The Nature of The Design Problem – Topics 2
361	Interface Design – Topics 3
370	Implementation – Topics 9
377	Performance – Topics 7
381	Project Management – Topics 4
387	Trends in Operating System Design – Topics 6
388	Summary

Data Communications and Networking

	Data Campanniastian and Naturallina
	Data Communication and Networking
	Part-01: Overview
	Introduction
03	Data Communications – Topics 3
09	Networks – Topics 6
11	The Internet – Topics 2
15	Protocols and Standards – Topics 4
18	Recommended Reading – Topics 3
	Key Terms
	Summary
	Practice Set – Topic 3
	Network Models
20	Layered Tasks – Topics 2
23	The OSI Model – Topics 3
41	Layers in The OSI Model – Topics 8
45	TCP/IP Protocol Suite – Topics 4
49	Addressing – Topics 4
52	Recommended Reading – Topics 3
	Key Terms
	Summary
	Practice Set – Topics 3
	Part-02: Physical Layer and Media
	Data and Signals
55	Analog and Digital – Topics 3
61	Periodic Analog Signals – Topics 6
65	Digital Signals – Topics 4
68	Transmission Impairment – Topics 3
71	Data Rate Limits – Topics 3
76	Performance – Topics 5
77	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Digital Transmission
81	Digital-to-Digital Conversion – Topics 4
83	Analog-to-Digital Conversion – Topics 2
85	Transmission Models – Topics 2
86	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Analog Transmission
90	Digital-to-Analog Conversion – Topics 4
93	Analog-to-Analog Conversion – Topics 3
94	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2

Bandwidth Utilization: Multiplexing and Spreading 98	
100 Spread Spectrum – Topics 2 101 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2 Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
101 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2 Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
Key Terms Summary Practice Set – Topics 2 Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
Summary Practice Set – Topics 2 Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
Practice Set – Topics 2 Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
Transmission Media 103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
103 Guided Media – Topics 2 106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
106 Unguided Media: Wireless – Topics 3 107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
107 Recommended Reading – Books Key Terms Summary Practice Set – Topics 2	
Key Terms Summary Practice Set – Topics 2	
Summary Practice Set – Topics 2	
Practice Set – Topics 2	
111 Circuit-Switched Networks – Topics 4	
115 Datagram Networks – Topics 4	
120 Virtual-Circuit Networks – Topics 5	
122 Structure of a Switch – Topics 2	
123 Recommended Reading – Books	
Key Terms	
Summary	
Practice Set – Topics 2	
Using Telephone and Cable Networks for Data Transmission	
127 Telephone Network – Topics 4	
128 Dialup Modems – Topics 1	
134 Digital Subscriber Line – Topics 6	
136 Cable TV Networks – Topics 2	
140 Cable TV For Data Transfer – Topics 4	
141 Recommended Reading – Books	
Key Terms	
Summary	
Practice Set – Topics 2	
Part-03: Data Link Layer	
Error Detection and Correction	
147 Introduction – Topics 6	
151 Block Coding – Topics 4	
153 Linear Block Codes – Topics 2	
159 Cyclic Codes – Topics 6	
160 Recommended Reading – Books and RFCs	
Key Terms	
Summary	
Practice Set – Topics 2	
Data Link Control	
162 Framing – Topics 2	
164 Flow and Error Control – Topics 2	
165 Protocols	
167 Noiseless Channels – Topics 2	
171 Noisy Channels – Topics 4	
174 HDLC – Topics 3	
178 Point-to-Point Protocol – Topics 4	

179	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Multiple Access
182	Random-access Aloha – Topics 3
185	Controlled Access – Topics 3
188	Channelization – Topics 3
189	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Wired LANs: Ethernet
191	IEEE Standards – Topics 2
193	Standard Ethernet – Topics 2
196	Changes in the Standard – Topics 3
198	Fast Ethernet – Topics 2
201	GIGABIT Ethernet – Topics 3
202	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Wireless LANs
206	IEEE 802.11 – Topics 4
212	Bluetooth – Topics 6
223	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Connecting LANs, Backbone Networks, and Virtual LANs
231	Connecting Devices – Topics 8
234	Backbone Networks – Topics 3
239	Virtual LANs – Topics 5
240	Recommended Reading – Books and Site
	Key Terms
	Summary
	Practice Set – Topics 2
	Wireless WANs: Cellular Telephone and Satellite Networks
247	Cellular Telephony – Topics 7
253	Satellite Networks – Topics 6
254	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
255	Sonetisdh
257	Architecture – Topics 3
262	Sonet Layers – Topics 5
266	Sonet Frames – Topics 4
269	STS Multiplexing – Topics 3
272	Sonet Networks – Topics 3
273	Virtual Tributaries – Topics 1

274	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Virtual-Circuit Networks: Frame Relay and ATM
281	Frame Relay – Topics 7
287	ATM – Topics 6
291	ATM LANs – Topics 4
292	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Part-04: Network Layer
	Netvl/ark Layer: Logical Addressing
297	IPv4 Addresses – Topics 5
299	IPv6 Addresses – Topics 2
300	Recommended Reading – Books, Sites, RFCs
300	Key Terms
	Summary
	Practice Set – Topics 3
	Network Layer: Internet Protocol
303	Internetworking – Topics 3
307	IPv4 – Topics 4
310	IPv6 – Topics 3
313	Transition Form IPv4 to IPv6 – Topics 3
314	Recommended Reading – Books, Sites, RFCs
311	Key Terms
	Summary
	Practice Set – Topics 3
	Network Layer: Address Mapping, Error Reporting, and Multicasting
316	Address Mapping – Topics 2
321	ICMP – Topics 5
327	IGMP – Topics 6
329	ICMPv6 – Topics 2
330	Recommended Reading – Books, Sites, RFCs
	Key Terms
	Summary
	Practice Set – Topics 3
	Network Layer: Delivery, Forwarding, and Routing
331	Delivery – Topics 1
334	Forwarding – Topics 3
339	Unicast Routing Protocols – Topics 5
343	Multicast Routing Protocols – Topics 4
344	Recommended Reading – Books, Sites, RFCs
	Key Terms
	Summary
	Practice Set – Topics 3
	Part-05: Transport Layer
	Process-fa-Process Delivery: UDp, TCp, and SeTP
349	Process-to-Process Delivery – Topics 5
354	User Datagram Protocol (UDP) – Topics 5
	, , ,

361	TCP – Topics 7
368	SCTP – Topics 7
369	Recommended Reading – Books, Sites, RFCs
	Key Terms
	Summary
	Practice Set – Topics 3
	Congestion Control and Quality of Service
371	Data Traffic – Topics 2
372	Congestion – Topics 1
374	Congestion Control – Topics 2
376	Two Examples – Topics 2
378	Quality of service – Topics 2
382	Techniques to Improve QoS – Topics 4
388	Integrated Services – Topics 6
389	Differentiated Services – Topics 1
391	QoS In Switched Networks – Topics 2
392	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2
	Part-06: Application Layer
	Domain Name System
394	Name Space – Topics 2
397	Domain Name Space – Topics 3
401	Distribution of Name Space – Topics 4
404	DNS in The Internet – Topics 3
410	Resolution – Topics 6
411	DNS Messages – Topics 1
413	Types of Records – Topics 2
414	Registrars
415	Dynamic Domain Name System (DDNS)
416	Encapsulation
417	Recommended Reading – Books, Sites, RFCs
	Key Terms
	Summary Direction Set Topics 2
	Practice Set – Topics 2
418	Remote Logging, Electronic Mail, and File Transfer
	Remote Logging – Topics 1
423 425	Electronic Mail – Topics 5 File Transfer – Topics 2
425	·
420	Recommended Reading – Books, Sites, RFCs Key Terms
	Summary
	Practice Set – Topics 3
	WWW and HTTP
430	Architecture – Topics 4
433	Web Documents – Topics 3
436	HTTP – Topics 3
430	Recommended Reading – Books, Sites, RFCs
437	Key Terms
	Summary
	Junitary

	Practice Set Tonics 2
	Practice Set – Topics 2 Network Management: SNMP
442	·
	Network Management System – Topics 5
451	Simple Network Management Protocol (SNMP) – Topics 9
452	Recommended Reading – Books, Sites, RFCs
	Key Terms
	Summary Describes Sets Toxics 2
	Practice Set – Topics 3
45.4	Multimedia Division Andreas de Calendaria Constantina
454	Digitizing Audio and Video – Topics 2
456	Audio and Video Compression – Topics 2
460	Streaming Stored Audio / Video – Topics 4
461	Streaming Live Audio / Video
462	Real-Time Interactive Audio / Video – Topics 1
464	RTP – Topics 2
470	RTCP – Topics 6
472	Voice Over IP – Topics 2
473	Recommended Reading – Books, Sites
	Key Terms
	Summary
	Practice Set – Topics 3
	Part-07: Security
	Cryptography
475	Introduction – Topics 2
479	Symmetric-Key Cryptography – Topics 4
481	Asymmetric-Key Cryptography – Topics 2
482	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 3
	Network Security
487	Security Services – Topics 5
489	Message Confidentiality – Topics 2
494	Message Integrity – Topics 6
495	Message Authentication – Topics 1
500	Digital Signature – Topics 5
502	Entity Authentication – Topics 2
504	Key Management – Topics 2
505	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 3
	Security in the Internet: IPSec, SSUFLS, PNP, VPN, and Firewalls
510	IPSecurity (IPSec) – Topics 5
515	SSLffLs – Topics 5
521	PGP – Topics 6
523	Firewalls – Topics 2
524	Recommended Reading – Books
	Key Terms
	Summary
	Practice Set – Topics 2

	Appendix A: Unicode
525	Unicode – Topics 6
526	ASCII – Topic 1
	Appendix B: Numbering System
527	BASE 10: Decimal – Topics 1
529	BASE 2: Binary – Topics 2
532	BASE 16: Hexadecimal – Topics 3
534	BASE 256: IP Addresses – Topics 2
536	Other Conversions – Topics 2
	Appendix C: Mathematical Review
540	Trigonometric Functions – Topics 4
542	Fourier Analysis – Topics 2
544	Exponent and Logarithm – Topics 2
545	Appendix D: 8B/6T Code
546	Appendix E: Telephone History – Topics 3
547	Appendix F: Contact Address
548	Appendix G: RFCs
549	Appendix H: UDP and TCP Ports

Distributed System

	Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services
	Introduction
01	A Brief History of Systems Development
04	A Brief History of Patterns in Software Development – Topics 3
07	The Value of Patterns, Practices, and Components – Topics 3
08	Summary
00	Part-01: Single-Node Patterns
09	Motivations and Summary
- 03	The Sidecar Pattern
10	An Example Sidecar: Adding HTTPS to a Legacy Services
11	Dynamic Configuration with Sidecars
12	Modular Application Containers – Topics 1
13	Building a Simple PaaS with Sidecars
16	Designing Sidecars for Modularity and Reusability – Topics 3
17	Summary
1/	Ambassadors
18	Using an Ambassador to Shard a Service – Topics 1
19	Using an Ambassador to Shard a Service – Topics 1 Using an Ambassador for Service Brokering
20	Using an Ambassador to Do Experimentation or Request Splitting – Topics 1
20	Adapters
21	Monitoring – Topics 1
22	Logging – Topics 1
23	Adding a Health Monitor – Topics 1
23	Part-02: Serving Patterns
24	Introduction to Micro-services
24	Replicated Load-Balanced Services
26	Stateless Services – Topics 2
27	Session Tracked Services Session Tracked Services
28	Application-Layer Replicated Services
30	Introducing a Caching Layer – Topics 2
33	Expanding the Caching Layer – Topics 3
34	Summary
34	Sharded Services
38	Sharded Caching – Topics 4
41	An Examination of Sharding Functions – Topics 3
42	Sharded, Replicated Serving
43	Hot Sharding Systems
7.5	Scatter/Gather
44	Scatter/Gather Scatter/Gather with Root Distribution – Topics 1
46	Scatter/Gather with Leaf Sharding – Topics 2
47	Scaling Sctter/Gather for Reliability and Scale
т,	Functions and Event-Driven Processing
52	Determining When FaaS Makes Sense – Topics 5
58	Patterns for FaaS – Topics 6
30	Ownership Election
59	Determining If Your Even Need Master Election
64	The Basics of Master Election – Topics 5
65	Handling Concurrent Data Manipulation
0.5	Harraning Concurrent Data Manipulation

	Part-03: Batch Computational Patterns
	Work Queue Systems
68	A Generic Work Queue System – Topics 3
69	Hands On: Implementing a Video Thumbnail
70	Dynamic Scaling of the Workers
71	The Multi-Worker Pattern
	Event-Driven Batch Processing
76	Patterns of Event-Driven Processing – Topics 5
77	Hands On: Building an Event-Driven Flow for New User Sign-Up
78	Publisher/Subscriber Infrastructure
79	Hands On: Deploying Kafka
	Coordinated Batch Processing
80	Join (or Barrier Synchronization)
83	Reduce – Topics 3
84	Hands On: An Image Tagging and Processing Pipeline
	Conclusion: A New Beginning?

Parallel Computing

	Algorithms and Parallel Computing
	Introduction
01	
01	Introduction Toward Automating Parallel Programming
	Toward Automating Parallel Programming
03	Algorithms Resultation Resident Considerations
04	Parallel Computing Design Considerations
05	Parallel Algorithms and Parallel Architectures
06	Relating Parallel Algorithm and Parallel Architecture
07	Implementation of Algorithms: A Two-Sided Problem
08	Measuring Benefits of Parallel Computing
09	Amdahl's Law for Multiprocessor Systems
10	Gustafson-Barsis's Law
11	Applications of Parallel Computing
40	Enhancing Uniprocessor Performance
12	Introduction
13	Increasing Processor Clock Frequency
14	Parallelizing ALU Structure
15	Using Memory Hierarchy
16	Pipelining
17	Very Long Instruction Word (VLIW) Processor
18	Instruction-Level Parallelism (ILP) and Superscalar Processors
19	Multithreaded Processor
	Parallel Computers
20	Introduction
21	Parallel Computing
22	Shared-Memory Multi-processors (Uniform Memory Access [UMA])
23	Distributed-Memory Multiprocessor (Non-uniform Memory Access [NUMA])
24	SIMD Processor
25	Systolic Processor
26	Cluster Computing
27	Grid (Cloud) Computing
28	Multicore Systems
29	SM
30	Communication Between Parallel Processors
31	Summary of Parallel Architectures
	Shared-Memory Multiprocessors
32	Introduction
33	Cache Coherence and Memory Consistency
34	Synchronization and Mutual Exclusion
	Interconnection Networks
35	Introduction
36	Classification of Interconnection Networks by Logical Topologies
37	Interconnection network Switch Architecture
	Concurrency Platforms
38	Introduction
39	Concurrency Platforms
40	Cilk++
41	OpenMP
	·

42	Compute Unified Device Architecture (CUDA)
. –	Ad Hoc Techniques for Parallel Algorithms
43	Introduction
44	Defining Algorithm Variables
45	Independent Loop Scheduling
46	Dependent Loops
47	Loop Spreading for Simple Dependent Loops
48	Loop Unrolling Problem Partitioning
49	Divide-and-Conquer (Recursive Partitioning) Strategies
50	Pipelining
	Non-serial-Parallel Algorithms
51	Introduction
52	Comparing DAG and DCG Algorithms
53	Parallelizing NSPA Algorithms Represented by a DAG
54	Formal Technique for Analyzing NSPAs
55	Detecting Cycles in the Algorithm
56	Extracting Serial and Parallel Algorithm Performance Parameters
57	Useful Theorems
58	Performance of Serial and Parallel Algorithms on Parallel Computers
	z-Transform Analysis
59	Introduction
60	Definition of z-Transform
61	The 1-D FIR Digital Filter Algorithm
62	Software and Hardware Implementations of the z-Transform
63	Design 1: Using Horner's Rule for Broadcast Input and Pipelined Output
64	Design 2: Pipelined Input and Broadcast Output
65	Design 3: Pipelined Input and Output
	Dependence Graph Analysis
66	Introduction
67	The 1-D FIR Digital Filter Algorithm
68	The Dependence Graph of an Algorithm
69	Deriving the Dependence Graph for an Algorithm
70	The Scheduling Function for the 1-D FIR Filter
71	Node Projection Operation
72	Nonlinear Projection Operation
73	Software and Hardware Implementations of the DAG Technique
7.4	Computational Geometry Analysis
74	Introduction
75 76	Matrix Multiplication Algorithm The 3.D. Department of Computation De
76	The 3-D Dependence Graph and Computation Domain D
77	The Facets and Vertices of D
78	The Dependence Matrices of the Algorithm Variables
79	Null-space of Dependence Matrix: The Broadcast Subdomain B
80	Design Space Exploration: Choice of Broadcasting Versus Pipelining Variable s
81	Data Scheduling Projection Operation Using the Linear Projection operator
82	Projection Operation Using the Linear Projection operator Effect of Projection Operation on Data
83	Effect of Projection Operation on Data The Resulting Multithreaded (Multiprocessor Architecture)
84 85	The Resulting Multithreaded/Multiprocessor Architecture
65	Summary of Work Done in this Chapter Case Study: One-Dimensional IIR Digital Filters
86	Introduction
00	Introduction

87	The 1-D IIR Digital Filter Algorithm
88	The IIR Filter Dependence Graph
89	z-Domain Analysis of 1-D IIR Digital Filter Algorithm
	Case Study: Two and Three Dimensional Digital Filters
90	Introduction
91	Line and Frame Wraparound Problems
92	2-D Recursive Filters
93	3-D Digital Filters
	Case Study: Multi-rate Decimators and Interpolators
94	Introduction
95	Decimator Structures
96	Decimator Dependence Graph
97	Decimator Scheduling
98	Decimator DAG for s1 = [1 0]
99	Decimator DAG for s2 = [1-1]
100	Decimator DAG for s3 = [1 1]
101	Poly-phase Decimator Implementations
102	Interpolator Structures
103	Interpolator Dependence Graph
104	Interpolator Scheduling
105	Interpolator DAG for s1 = [1 0]
106	Interpolator DAG for s2 = [1 -1]
107	Interpolator DAG for s3 = [1 1]
108	Poly-phase Interpolator Implementations
	Case Study: Pattern Matching
109	Introduction
110	Expressing the Algorithm as a Regular Iterative Algorithm (RIA)
111	Obtaining the Algorithm Dependence Graph
112	Data Scheduling
113	DAG Node Projection
114	DESIGN 1: Design Space Exploration When s = [1 1]
115	DESIGN 2: Design Space Exploration When s = [1 -1]
116	DESIGN 3: Design Space Exploration When s = [1 0]
	Case Study: Motion Estimation for Video Compression
117	Introduction
118	FBMAs
119	Data Buffering Requirements
120	Formulation of the FBMA
121	Hierarchical Formulation of Motion Estimation
122	Hardware Design of the Hierarchy Blocks
	Case Study: Multiplication Over GF(2m)
123	Introduction
124	The Multiplication Algorithm in GF(2m)
125	Expressing Field Multiplication as an RIA
126	Field Multiplication Dependence Graph
127	Data Scheduling
128	DAG Node Projection
129	Design 1: Using d1 = [1 0]
130	Design 2: Using d2 = [1 1]
131	Design 3: Using d3 = [1 -1]
132	Applications of Finite Field Multipliers

	Case Study: Polynomial Division Over GF(2)
133	Introduction
134	The Polynomial Division Algorithm
135	The LFSR Dependence Graph
136	Data Scheduling
137	DAG Node Projection
138	Design 1: Design Space Exploration When s1 = [1 -1]
139	Design 2: Design Space Exploration When s2 = [1 0]
140	Design 3: Design Space Exploration When s3 = [1 -o.5]
141	Comparing the Three Designs
	The Fast Fourier Transform
142	Introduction
143	Decimation-in-Time FFT
144	Pipeline Radix-2 Decimation-in-Time FFT Processor
145	Decimation-in-Frequency FFT
146	Pipeline Radix-2 Decimation-in-Frequency FFT Processor
	Solving Systems of Linear Equations
147	Introduction
148	Special Matrix Structures
149	Forward Substitution (direct Technique)
150	Back Substitution
151	Matrix Triangularization Algorithm
152	Successive Over Relaxation (SOR) (Iterative Technique)
153	Problems
	Solving Partial Differential Equations Using Finite Difference Method
254	Introduction
255	FDM for 1-D Systems