

Princeton University
COS 217: Introduction to Programming Systems
Spring 2003 Final Exam Preparation

You are responsible for all material covered in lectures, precepts, assignments, and assigned readings.

The exam will be cumulative, but will emphasize the recent material heavily.

The exam will be closed book, but you may use a self-generated one-page summary sheet.

Topics

*New topics are in **boldface**.*

Programming style

- Modularity, interfaces, implementations
- Abstract data types
- Abstract objects
- Testing strategies
- Profiling and instrumentation
- Robust programming, error handling strategies

Advanced C programming

- Memory layout
- Dynamic memory management
- Void pointers
- Function pointers
- Variable declarations and definitions
- Variable scope, linkage, and duration
- Const variable declarations and definitions
- Function declarations and definitions
- Opaque pointers
- Macros and their dangers
- The assert macro
- Unions, enumerations, tagged unions
- Bitwise operators (\sim & $|$ $^$ \ll \gg)**
- Structure bit-fields**

The UNIX/GNU programming environment

- Emacs, gcc, gdb, make, gprof, **bash**, **gdb for SPARC assembly language**

Digital Circuits

Combinational Circuits

Building blocks: NOT, AND, and OR gates

Common combinational circuits: decoder, multiplexer, demultiplexer, adder, ALU

Designing combinational circuits using NOT, AND, and OR gates

Truth tables

Boolean expressions in sum of products form

Sequential Circuits

Building blocks: RS flip flops, clocked RS flip flops, clocked D flip flops,

Clocked master slave D flip flops

Common sequential circuits: register, register bank, memory

Designing sequential circuits using clocked master slave D flip flops

State machines

Truth tables

Boolean expressions in sum of products form

SPARC Architecture and Assembly Language

Registers vs. cache vs. memory vs. disk

Register windows

Instruction pipelining and delay slots

Assembly language

Directives

Mnemonics

Using the stack

Subroutines and leaf subroutines

Optimization: minimize memory access; postpone use of loaded data; fill delay slots with useful instructions; the annul bit

Machine language

The binary, octal, and hexadecimal number systems

Representation of signed numbers

Signed magnitude

One's complement

Two's complement

Representation of floating point numbers

Mnemonic formats

Assemblers

Pass1: Create symbol table

Pass2: Create data section, text section, relocation records

Linkers

Symbol resolution

Symbol relocation

Operating Systems

Operating system history

UNIX shells

UNIX shell built-in commands vs. executable binary commands

Processes

Scheduling, context switching

UNIX system calls: getpid, execvp (and other exec functions), fork, wait, kill, chdir, setenv, unsetenv

Standard C functions: exit, getenv

I/O

UNIX file descriptors

UNIX file redirection

UNIX system calls: creat, open, close, dup, dup2, read, write

Standard C functions: fopen, fclose, fflush, perror, fgetc, fputc, fgets, fputs, fscanf, fprintf, scanf, printf, getc, putc, putchar, getchar, gets, puts, etc.

Inter-Process Communication

Network communication: the Socket API

UNIX pipelines

UNIX system call: pipe

Signals

UNIX kill command

Standard C function: signal

Virtual memory

Segmentation, paging

Applications

String manipulation

Hash tables, symbol tables

Digital circuit simulation

Assemblers

UNIX Shells

Readings

*New readings are in **boldface**.*

Extracted from the course web pages:

Loukides: **2**, 3, 4, 6, 7, 9

King: 10, 15, 16.4-5, 17, 18, 19, **20**

Paul: 2, 3, 4, 5, 7, 8, 9

Kernighan (UNIX Programming Environment): 7

Exams from Previous Semesters

*Questions on new material are in **boldface**.*

These old exam questions are particularly pertinent:

Fall 2002 Exam 1: 3, 4, 5

Spring 2002 Exam 1: 1, 2, 3, 4, 5, 6, 8, 9 (generally, although the Set ADT is not pertinent)

Fall 2001 Exam 1: 3, 4, 5, 6, 10

Fall 2002 Exam 2: **1**, 2, **3**, 4a, 5, **6**

Spring 2002 Exam 2: **1, 2, 3, 4, 5, 6, 7, 8, 9**

Fall 2001 Exam 2: **1, 2, 3**, 4, **5, 6, 7, 8**

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