PURDUE
UNIVERSITY®

CS 240: Programming in C

Networking Wrap-up
Final Exam Review
The End

Prof. Jeff Turkstra

SI Review Session

- Tonight, 4/30 5:30 – 7:20pm
- PHYS 112

Course Evaluations

- Please complete them – they make a difference!

Server

- man 7 ip
- Steps for listening…
  - Create a socket()
  - bind() that socket to an address and port
  - listen() for a connection
  - accept() the connection
  - [communicate – read, write, recv, send]
  - close() the connection

Client

- Steps for connecting…
  - Create a socket()
  - Optionally bind()
    - For a specific source port
  - connect() to an address:port
  - [communicate – read, write, recv, send]
  - close() the connection

connect()

```
int connect(int sockfd, const struct sockaddr *addr, socklen_t addrlen);
```

- Connects sockfd to address addr

server.c

- Simple echo server
- Can connect using telnet
  - Consider writing your own client – it’s not that hard!

Final Exam Review

- What follows is a broad overview of topics
- Questions on the exam may cover anything covered during lecture, homeworks, quizzes, previous exams
- You are encouraged to:
  - Review lecture notes and videos
  - Hand write code
    - Quizzes
    - Lecture examples
    - Parts of homeworks
  - Practice writing quickly but clearly

Review

- Background
  - Creators, motivation
  - Why use C?
- Compiling and linking:
  - Stages of compilation
  - gcc options and usage
  - Object files and executables

Review (cont'd)

- File operations:
  - fopen() / fclose()
  - fprintf() / fscanf()
    - Format specifiers, character sets, field width
  - fseek() / ftell()
  - fread() / fwrite()
  - access() / feof()
  - ferror() / clearerr()
  - Error checking and error handling

Review (cont'd)

- Typedef
  - Syntax, usage
- Structures
  - Properties
  - Declaration
  - Definition (what's a definition?)
  - Initialization (what are the properties?)
  - Nested structure declarations
  - Arrays of
  - Passing to and returning from functions
  - Assignment

Review (cont'd)

- assert()
  - When should you use it?
- Basic string operations:
  - strncpy()
  - strncmp()
  - What do they rely on for correctness?
- Variables
  - Are they global or local? Why?
  - Memory layout
    - Alignment and padding

Review (cont'd)

- Variables
  - sizeof()
  - Arrays and their initialization
  - Endianness
- bitfields
- unions
- enums
- Bitwise operators

Review (cont'd)

- Pointers
  - Obtaining the address of variables (&)
  - Dereferencing (getting contents of) pointers (*)
  - Using pointers as arrays and vice versa
  - Pointers to array elements
  - Pointer arithmetic
  - Passing variables by pointer
- Debugging
  - Approaches, gdb

Review (cont'd)

- Dynamic memory allocation
  - malloc(), calloc()
  - free()
- Pointers to structures
  - Use of the -> operator
  - Linked lists (singly-linked lists) and operations
  - Doubly-linked lists and operations
  - Trees and operations

Review (cont'd)

- Pointers to pointers
  - Re-writing list operations to use pointers to pointers
- Pointers inside structures (internal pointers)
  - E.g.: structure fields that point to dynamically allocated strings
- Pointers to functions
  - Passing a function name as an argument
  - Calling a passed function within a function

Review (cont’d)

- Recursion
- Zero
- Multidimensional, dynamically allocated arrays
- Types
  - Qualifiers, storage classes
- C Preprocessor
  - Directives, macros
- Casts
- void

Review (cont'd)

- Callbacks
- Efficiency Issues
  - Compiler, coding, data access
- Libraries
  - Static vs dynamic
  - Building
  - Why?
- Large-scale development
  - Include guards
  - General structure

Review (cont'd)

- Random number generation
- Graphical programming
    - SDL and GTK basics
- Security
    - Considerations throughout semester
    - Buffer overflow attack
        - How?
        - Stack layout
    - Mitigations
        - ASLR, Non-executable stack, canaries

Review (cont'd)

- System calls
- Core files
- goto
- Makefiles
- Bubble sort
- Networking basics
  - TCP/IP
  - DNS
  - Client/server architecture
  - Sockets

Review (cont’d)

- Networking
  - Server steps (socket(), bind(), listen(), send()/recv(), close())
  - Client steps
- Hardware
  - Interfacing basics
  - High level understanding of code demo

Be prepared!

- Review lecture notes and videos
- Hand write code
  - Quizzes
  - Lecture examples
  - Parts of homeworks
- Practice writing quickly but clearly

Aleatha Jane Turkstra

May 16, 1931 to October 11, 2019

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The End