

U N I V E R S I T Y

CS 240: Programming in C

Networking Wrap-up Final Exam Review The End

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SI Review Session

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



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Course Evaluations

- Please complete them – they make a difference!



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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



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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



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`connect()`

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

- Connects sockfd to address addr



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server.c

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



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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



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Review

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



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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



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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



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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



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Review (cont'd)

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



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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`



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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



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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



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Review (cont'd)

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



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Review (cont'd)

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



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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



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Review (cont'd)

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



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Review (cont'd)

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



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Be prepared!

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



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Aleatha Jane Turkstra



May 16, 1931 to October 11, 2019



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The End



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