1 Short Questions (33pts total, 3pts each, be brief)

1. What is DNS used for?

2. What is the most useful piece of information retained by a zombie process?

3. Name one of the layers of the Internet protocol stack.

4. Which bitwise operator is most useful for each of the following tasks:
   (a) Setting individual bits to 0?
   (b) Setting individual bits to 1?
   (c) Toggling individual bits between 0 and 1?

5. In version control systems, what does it mean for two branches to have a merge conflict?

6. Write an egrep-style regular expression that matches any line which contains exactly one lowercase word, with no spaces on either side.

7. Which type requires more bytes to store: a union with three fields in it, or a struct with the same three fields?

8. What is the term for the order and meaning of network messages?
9. What is the name of the tool that was recommended in class which automatically checks a program for errors such as memory leaks and heap corruption?

10. Write an egrep-style regular expression that matches undergraduate course identifiers from the CSE department: either CMPSC or CMPEN, followed by three digits, followed by an optional letter.

11. Aside from indicating success or failure, why is the return value from the fork function important to check?

2 Medium Questions (37pts total)

12. (5pts) Explain the difference between a port and a socket.
13. (5pts) Trick question alert: be sure to give a complete answer! What is the value of `htons(0xf00d)`? (You may answer in hexadecimal.)

14. (5pts) Why does the `connect` function take a pointer to `struct sockaddr` instead of a pointer to `struct sockaddr_in`?

15. (5pts) Explain why creating a new thread is faster than creating a new process.
16. *(5pts)* What are the main differences in behavior between a stream socket and a datagram socket? Identify at least two.

17. *(6pts)* Write a shell script that terminates a process intelligently using signals. This script should take the process ID as an argument on the command line. First it should ask the process to shut down gracefully, and wait five seconds. After this, it should terminate the process forcefully.

18. *(6pts)* Identify the standard C function which performs each of these socket operations.

   (a) Creating a socket:

   (b) Setting the local address for a socket to listen on:

   (c) Connecting to a remote host:

   (d) Getting the file descriptor for an incoming connection:

   (e) Receiving data:

   (f) Disconnecting a socket:
3 Long Questions (30pts total, 10pts each)

19. Write a short function which uses the low-level (file descriptor) I/O API to read a 32-bit unsigned integer from the beginning of the file "foo.dat" and return this value. (Note: you may assume the integer is already stored in host byte order, and you may omit error-checking code.)

20. Identify the three major stages in the C build workflow that starts with source code and ends with a running process. For each stage, identify what type of files and/or libraries are used as input for the stage, and what type of file or abstraction is created as a result.
21. The following is a list of several common operations used in distributed version control systems such as Git. All of these operations copy some information between local or remote repositories or working copies. For each operation, identify (1) what information it copies, (2) from where, and (3) to where.

(a) Check out

(b) Push

(c) Pull

(d) Clone