NAME:

Rules:

Open Notes :

Any notes, book material, lectures, programming assignments, research can be used in this assignment.
Turn-in a single PDF for the final.

Not allowed:

Sharing of notes, books or any materials is forbidden

Score:

Question	***Score***	***Total***
1		*10*
2		*20*
3		*10*
4		*60*
total		*100*

Final Exam

Due Date:

- Written exam
  - Due on June 7 by 11:59 pm
  - Submit one per PERSON
    - *PDF* document to individual perforce directories
- Submit your document to your individual directories in perforce
  - Please place your *.pdf document in PERFORCE
- Questions
  - Please ask questions to clarify any items you don't understand.
  - By NOT asking questions
    - I assume that you understand and are following the procedures correctly.
    - So please ask.

Questions:

Questions:

- *Please relate your experiences from this class to the questions.*
  (These are essays or opinion paper they are not formal papers therefore no citations are expected. The expected exam length is 5 to 7 pages. Don't try to stretch it, give full detailed answers.)

Question 1: Networking (10 pts) (1-2 sentences each)

a) (2 pts) How is it possible that one machine can simultaneously surf the internet with google, stream music, and download code from perforce ***with only one IP address***?
b) (2 pts) How does ***NAT*** allow us to have many different internet devices behind a single router?
c) (2 pts) How does the internet automagically return the ***IP address*** of www.zombiehunters.org?
d) *TCP*
   a. (1 pts)***Benefits*** of using this protocol
   b. (1 pts)***Cons*** of using this protocol
e) *UDP*
   a. (1 pts)***Benefits*** of using this protocol
   b. (1 pts)***Cons*** of using this protocol

Question 2: Socket Programming Scenarios (20 pts)

- This problem references the UDP socket programming assignment.
- Recall the client sends individual packets to the server where it is sorted and sent back to the client individually in sorted order

a) (8 pts) How would you ***modify*** that program to send across an ***arbitrary number*** of packets to sort? The number of packets is not known in advanced. You cannot queue up a complete list of

packets then send them to the server to sort. Describe any data, packets, headers, and protocols that you would you change

- *Think of the packets being generated by someone on a keyboard, not knowing when it will end.*

b) (4 pts) What ***modification**s* would you do if the data packet were received by the server was ***garbled and scrambled***? (high-level sketch 1-3 sentences or bullet points)

c) (4 pts) What ***modifications*** would you do if the data packets received by the client or the server were ***out of order***? (high-level sketch 1-3 sentences or bullet points)

d) (4 pts) What ***modifications*** would you do if the data packets may or may not reach the server, due to ***unreliable delivery***? (high-level sketch 1-3 sentences or bullet points)

Question 3: Applied problems (10 pts) short discussion 3-4 sentences

a) (3 pts) Server Load

- Suppose you just finished a network game called ***Zombies Go Home***. The number of users your new Zombie game is growing geometrically. Your current design cannot sustain that many players in the same world at once. Your servers cannot manage the number of connections. Describe how ***Shards*** might be a solution to your dilemma?

b) (3 pts) Consistency and Replication

- In a game, the critical information of the enemy zombies is initially being retrieved with a ***Pull Model***. As the game design evolves and the game can increase the number of simultaneous zombies from 4 to 40, the system architect changes the zombie information to a ***Push Model. Why?***

c) (4 pts) Performance

- Suppose you own an Elite software company in Chicago. You are playing a competitive network game against your rival company in Denver. The first game you played last month, you noticed a ***high level of latency***. To give your Chicago Company an advantage over those bastards in Denver, you secretly contacted your ISP and ***increased your bandwidth***. To your surprise, in the next match the latency didn't decrease at all. ***Why?***

Question 4: Omega Race (60 pts)

Answer completely (expecting several pages), worth the majority of grade

a) Diagram and discuss the networking communication for your game.

- Queue, types of messages, topology - Client Server or Peer to Peer

b) Describe the challenges you had converting this non-networked game to networked

- What was the hardest task, unexpected design problems, debugging etc.

c) Imagine you are assigned as the software architect on a new networked game underdevelopment.

- What lessons or design decisions related to networking would you have the team implement for this game based on your experience.
- Elaborate on the development (debugging) as well as the design.