

# Internet Technology

## Final Exam

### Summer 2015

Name \_\_\_\_\_

- **Do not open this exam** until everyone has an exam and the instructor tells you to begin.
- Write your name in the space provided above.
- There are 11 pages in this exam, including this one. Make sure you have them all.
- This exam is closed book – closed notes.
- You must leave all electronic devices not explicitly exempted at the front of the room.
- You **may** use a calculator with only arithmetic functions
- Write clearly – if we can't read or can't find your answer, your answer is wrong.
- Make clear what is your answer versus intermediate work.

Question Type	Point Total	Scored Amount
0. Overview	20	
1. Public/Private Key	20	
2. Security	20	
3. Wireless	20	
4. Collision	20	
5. Web Technologies	20	
6. Hamming Coding	40	
7. Routing	50	
8. Internetworking	32	
9. Extra		
Total:		

[illegible]

## 0. Overview

Answer 4 of the following:

0. Is it possible to send packet data over a circuit switched network? Why or why not?
1. What advantages does a digital fountain have over standard packet delivery?
2. Does a digital fountain need to send every data packet? Why or why not?
3. Other than reliable, in-order delivery, what other services and capabilities does TCP have that UDP does not?
4. How does Chord use Distributed Hash Tables to construct fully decentralized P2P networks?
5. If you are given programs in Java, C, C++ and Python are told they need to be called via CGI, how many computers and web servers are absolutely necessary to deploy them all? Why?
6. Why is it bad if your RTT estimate is too short? What happens when it is too long?

## 1. Public/Private Key

Answer 4 of the following:

0. One of the main problems PPK is meant to solve is key distribution. Does PPK also have a key distribution issue? Why or why not?
1. What is the PPK two-step challenge? What problem does it solve?
2. Why doesn't PPK provide data integrity on its own?
3. Why doesn't PPK provide authentication on its own?
4. Which security dimensions can PPK provide on its own, without modification of the message being sent, or addition of external entities?
5. What is a digital certificate?
6. In order to make full use of PPK, what information is included in Operating System distributions and installation disks? Why must it be?

## 2. Security

Answer 4 of the following:

0. Why is it a bad idea to encrypt timestamps and sequence numbers?
1. Is it illegal to use the BitTorrent protocol to download any file? Why or why not?
2. Why would it be necessary to have firewalls and traffic inspectors inside an organization's network?
3. What is a 'rainbow table'?
4. Why is it necessary to log off from a site even if you close the tab/window?
5. How can a DoS attack be used to set up a Man-in-the-Middle attack?
6. Can Man-in-the-Middle attacks be detected or defeated by the PPK two-step challenge? Why or why not?

### 3. Wireless

Answer 4 of the following:

0. How does 802.11 enforce priority of management messages?
1. How does 802.11 deal with the Hidden Node problem?
2. Does 802.11 use TDMA or FDMA to separate users' traffic? Why is this a good design decision?
3. Are channels 1, 6 and 11 the only three 802.11 channels that do not collide?
4. Is it possible to improve 802.11 signal strength indoors by blocking your line of sight to the AP? Why or why not?
5. How does 802.11 ad-hoc mode route traffic without a router?
6. Bandwidth is expensive. Why did the FCC remove all license restrictions to the 802.11 2.4GHz frequencies?

## 4. Collision

Answer 4 of the following:

0. Why is Slotted ALOHA less efficient than Pure ALOHA?

1. Why is 1-Persistent CSMA less efficient than 0.75-Persistent CSMA?

2. Why is 1-Persistent CSMA more efficient than .01-Persistent CSMA?

3. Token-Ring LAN completely solves the problem of collision, but has not been deployed commercially since the late 1980s. Why?

4. Why can full-duplex Ethernet react more effectively to collision than a half-duplex channel?

5. What are the differences between congestion control, flow control and collision avoidance?

6. How does TCP's Slow-Start mechanism help minimize network collisions?

## 5. Web Technologies

Answer 4 of the following:

0. Are HTTP messages stateful or stateless? Why?

1. How can Cookies be used to track someone and see what sites they've been visiting?

2. Most implementations of CGI hand the entire URL-coded argument string directly to the script, why does this break object-oriented principles?

3. What authentication does a server need to set or read a client's Cookie?

4. What request attribute *must* be set in a multipart/form-data request that does not appear in an application/x-www-form-urlencoded?

5. What about POST-type CGI requests makes them more secure than GET-type CGI requests?

6. What does Content-Length refer to in a multipart/form-data request, the payload's raw bytes or the payload interpreted as data?



## 6. Hamming Coding

Compute the following using odd parity, and presume odd parity for all encoded messages.

0. Find the Hamming code for the data bits 10101:

1. Given the Hamming-coded bits 101101010. Determine if any bits were flipped. If so, which one(s)?

## 7. Routing

Answer all of the below:

0. What are the differences between a router, switch and hub?

1. If Dijkstra's Algorithm can compute a globally optimal path to a destination and Distance Vector can not, why is Distance Vector routing ever used?

2. Presume a network uses Dijkstra's Algorithm to implement Link State Routing based on normalized bandwidth.

Each host floods the bandwidths of all its links to its neighbors as they update.

The cost of a link is computed as  $2520/\text{bandwidth}$  (in Mbps).

e.g.:

252 Mbps  $\rightarrow 2520/252$  Mbps  $\rightarrow$  link cost of 10

84 Mbps  $\rightarrow 2520/84$  Mbps  $\rightarrow$  link cost of 30

Given the table of link bandwidths below:

Node A		Node B		Node C		Node D		Node E		Node F	
B	252	A	252	A	504	A	84	B	315	C	360
C	504	C	168	B	168	E	630	D	630	D	252
D	84	E	316	F	360	F	252	F	140	E	140

a. Draw the graph of this network, mark the names of hosts on the nodes, and the link costs on the edges.

b Host A wants to send a message to Host E, what path has the lowest cost?

## 8. Internetworking

0. If a host is assigned the IP address 173.194.123.82/20:

a. What is its CIDR or network mask?

b. What's the host's network address?

c. How many hosts can this network support, at most?

d. What are the minimal and maximal IP addresses in this network?

1. What two IP addresses have special meanings and are not valid IP addresses to assign to a host?

2. If everyone's wireless AP assigns them the address 192.168.0.1, how can computers actually tell each other apart and communicate?

## 9. Extra

One point each. No partial credit.

0. How many bits are required to represent any IP address?

1. How can you make all the information on a computer entirely secure?

2. What is quantum entanglement, and how could it give us unbounded data transmission speed?