

# Internet Technology

## Midterm 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 9 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.
- Make clear which questions you want graded

Question Type	Point Total	Scored Amount
0. Network Layers	24	
1. TCP Details	20	
2. Delay and Congestion	20	
3. Delay and Transfer Calc	30	
4. HTTP Protocol	30	
5. Extra	3	
Total:	124	

[illegible]

## 0. Network Layers

Select and answer 6 of the following 9 questions:

0. Enumerate the 7 layers of the ISO OSI stack in order:

1. What does the Session layer do?

2. Can you implement a Transport protocol at the Application layer? Why or why not?

3. If you have a Physical layer whose performance smoothly degrades relative to the number of users, is it using time-division or frequency-division multiplexing? Why?

4. How do a router and a switch differ?

5. Is it possible to do a DNS lookup without involving a top-level name server? How or why not?

6. What is the difference between message switching and circuit switching?

7. What are the differences between flow control and congestion control?

## **1. TCP Details**

Select and answer 5 of the following 7 questions:

0. What triggers the TCP Fast-Retransmit mechanism?

1. What does the TCP Fast-Retransmit mechanism avoid? How does it avoid it?

2. What two things does a TCP sequence number communicate?

3. How does the TCP slow start mechanism enforce fair link usage?

4. What services does TCP offer that UDP does not?

5. If TCP can determine the optimal MSS, why would it ever try to increase it and risk timeouts?

6. How can TCP's exponential MSS increase result in less bandwidth than switching to linear MSS increase at a threshold?

## **2. Delay and Congestion**

Select and answer 5 of the following 6 questions:

0. What types of traffic are circuit, message and packet switching optimal for?

1. What types of networks lend themselves well to circuit, message and packet switching?

2. Does 'Selective Repeat' always result in better performance than 'Go-Back N'? Why or why not?  
(give an example or counter-example)

3. At what point does decreasing packet size no longer increase bandwidth?

4. Why is it problematic to have a sliding window 1 smaller than the number of sequence numbers?  
(Detail a scenario where this causes a problem. Be sure to explain fully what the problem is)

5. Why is it problematic to continually update the expected RTT based on new data?

### 3. Delay and Transfer Calculations

Presume you have a network link with the following properties: (all data measurements are in powers of 2, not SI units)

You are node A and regularly send 3GB batches of data to node B

Node A is separated from node B by 3 intermediate nodes, each link is 500m long.

The media's data rate is 48Mbps

The packet header is 1KB and maximal packet data size is 3KB

Packet protocol delay accounts for ~32 microseconds per link ( $2^{15}$ )

Circuit setup time is half a second per link

The media allows you to transfer a bit over a kilometer in 5 microseconds

You are asked to analyze the network above to determine if circuit or packet switching is better:

Since the propagation distance is the same, please disregard propagation delay.

0. Is circuit or packet switching faster? How much faster?

1. Disregarding processing time, how much time does packet switching waste sending header rather than data?

## 4. HTTP Protocol

Given the following files in an HTTP 1.0 server's document root:

Path:	Permissions:
/doc_root/index.html	read, write, execute
/doc_root/scripts/script.js	read, execute
/doc_root/scripts/code.js	execute

0. Determine the status code that should be returned for the following requests:

(represent a file's content with <content>, you may ignore headers)

a. GET /doc\_root/index.html HTTP 1.2

b. GET /doc\_root/index.html HTTP 1.2

c. GET /doc\_root/index.html HTTP/1.2

d. GET /doc\_root/index.html HTTP/1.0

e. GET /doc\_root/scripts/code.js HTTP/1.0



1. Why are MIME types necessary to HTTP 1.0?

2. What is the difference between the Content-Coding and Content-Type headers?

## **5. Extra:**

One point each. No partial credit.

0. If your HTTP server is short and stout with a demonstrable handle and spout, what status code should it return?

1. ICANN, IEEE, W3C and the ISO all are responsible for many of the different standards that shape the Internet. What are the full names of each organization?

2. What are the canonical ports that the HTTP, FTP, SSH, SCP and DNS protocols use?