Name _____KEY_____

CS3516 A15
Computer Networks
Mid Term Exam
September 21, 2015

Question	Points	Score
0	1	
1	4	
2	3	
3	4	
4	4	
5	6	
6	4	
7	5	
8	6	
9	7	
10	5	
11	5	
12	9	
13	18	
Total	80	

Trivia Question (1 extra credit point)

0. (a) What is the capital of **New Zealand**?

Wellington

-OR-

(b) Who performed at the half-time of **Super Bowl XLIX**?

Katy Perry

(4 pts.) 1. What is the difference between a **computer network** and a **distributed system**?

"**Namely, the distinction between a computer network and a distribution system lies in the transparency in assigning tasks to computers."**
"In a computer network, the user has to deal with specific computers in terms of an address and may assign tasks to the computers."

"In a distributed system:: the collection of independent computers appears to its users as a single coherent system. Thus, the user has no knowledge of which computer is performing a particular task."

(3 pts.) 2. Explain the differences between the **OSI Reference Model** and the **TCP/IP Internet stack**.

OSI has seven layers and TCP/IP has five layers. The two missing layers are the session layer and the presentation layer. This means functionality of these two layers (e.g., compression, encryption) needs to be provided somewhere else for TCP/IP.

(4 pts.) 3. Explain the interaction between the **connect** system call on a **TCP client** and the **accept** system call on a **TCP server** using **TCP sockets** on a UNIX/Linux system.

The TCP Server issues a listen and then an accept. At accept, the server stops and waits for a client wishing to connect. When the connect is sent by the client, the request will come through the listen queue and then accept will create an active connection for the client issuing the connect.

Once the underlying three-way handshake is completed both sides can then proceed to execute the next set of code on their side of the conversation.

(4 pts.) 4. Explain the advantages and disadvantages between **store-and-forward** and **cut-through packet-switched routers** inside a sub-network.

S&F checks for transmission errors upon receiving packet and does not forward bad packets.
But it receives the whole packet in before beginning forwarding. This implies a full re-transmission.

Cut-through starts sending the arriving packet once it has read the destination address. This is quicker but means bad packets will be forwarded on to the next hop (this wastes link capacity).

(4 pts) 5a. Explain the differences between using a **repeater** for a **digital transmission** versus using an **amplifier** for an **analog transmission**.

Amplifiers amplify both the signal and the noise which cascades the noise when multiple amplifiers are used. Repeaters regenerate a 'new' single without any noise.

(2pts.) 5b. Define **attenuation.**

In computer networking, *attenuation* is a loss of *signal* strength measured in decibels (dB). This occurs as the signal travels through the medium. Thus the signal strength will go down with distance traveled.

(4 pts.) 6. Explain the difference and the relationship between **bandwidth** (in the EE sense) and **capacity** (in the CS sense).

Bandwidth is about cycles per sec or the rate at which the signal modulates.

Capacity is the rate at which data is transmitted in bits per second.

The difference lies in the encoding method. The higher the number of different encoding levels or possibilities to encode a symbol, the higher the capacity will be while the bandwidth does not change.

(5 pts.) 7. Draw a diagram and explain how a **T1** line works.

(6 pts.) 8. Draw a diagram and briefly explain the components of the **HFC architecture** and how **HFC** sends traffic **downstream** and **upstream** to residences.

(2 pts.) 9a. Explain the role of a **wireless access point (AP)** in a **WLAN**.

The AP receives Internet traffic and then broadcasts the traffic to the wireless nodes. The wireless nodes send traffic upstream through the AP.

(5 pts.) 9b. Define the difference between **throughput** at the **AP** versus **goodput** at a **wireless node** when using **TCP** to stream a Youtube video from a Web server down to the Web client located at the wireless node.

Throughput is the rate in Mbps at which the AP sends frames downstream to the wireless nodes.

Goodput at a wireless node is the rate at which in receives good frames. Goodput does not include duplicate frames received or any frames lost in transit. Thus, throughput will be higher than the goodput because the AP will retry sending frames.

(5 pts.) 10. The **IETF** has recently ratified **HTTP/2.** Who is the **IETF** and discuss at least two reasons why **HTTP/2** should provide improved Web performance over **HTTP/1.1**.

IETF = Internet Engineering Task Force They coordinate and research changes in Internet protocols.

HTTP/2 does compression, multiplexing and prioritizing to reduce head-of-line issues. Converts format from ASCII into binary frames separating headers from date. Minifies number of requests to render a page. Allows for server to "push" data ahead of client request. Also has encryption.

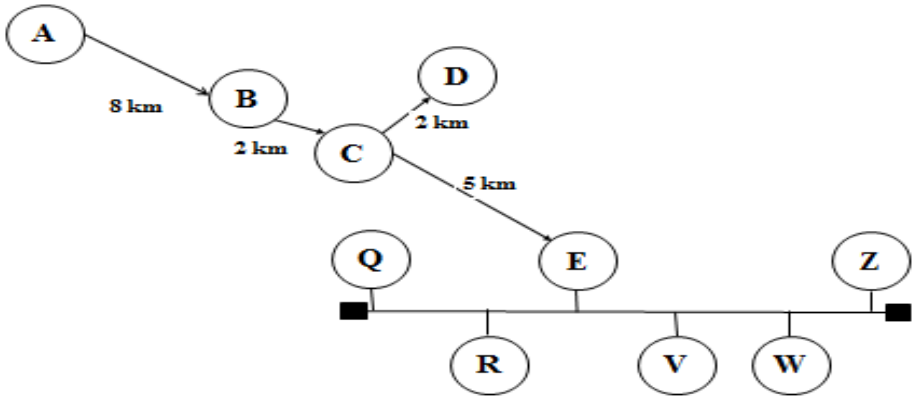
(5 pts.) 11. Explain the statement: **"HTTP is stateless**". How do **cookies** change **HTTP**?

"HTTP is "stateless" means server maintains no information about past client requests. Client also maintains no information about server state.

Cookies as part of HTTP allow server to record info about client and client's state and send back to client a cookie id number such that on future requests in different sessions from client, server can customize its response based on cookie ID.

(9 pts.) 12. Draw a diagram and show clearly the steps that **DNS** uses to **iteratively** go through the **DNS server hierarchy** to do **name resolution** for a **DNS query**.

(18 pts) 13.



Given the internet pictured above with a propagation speed of **200 m/microsecond** on the **100BASE5 LAN** and a propagation speed of **150 m/microsecond** on the store-forward packet-switched **WAN** where nodes **Q, R, E, V, W** and **Z** are equally spaced on the **Ethernet** with nodes **Q** and **Z** at opposite extreme ends.

Nodes **A to E** are spaced on the WAN as shown with **2 Gbps** links between nodes. Assume it takes each WAN node **500 microseconds** to look up a packet's route in its routing table and there is a **1 microsecond** delay for an Ethernet frame to pass through a node on the ether.

Assume an IP packet has **1300 bytes** and the frame header is **100 bytes** and the frame trailer is **100 bytes** on both the Ethernet LAN and the point-to-point WAN.

How long does it take to send a frame from node **A** to node **W** in the situation that when the frame arrives at node **C** there are five frames waiting to go to node **E** and six frames waiting to go to node **D**? Assume all frames are the same size and that there is no other traffic on the internet when the frame is sent.

{Clearly indicate ALL assumptions you make to determine your answer.}
{To receive full or partial credit, you MUST show all your work.}