H1 MAC: 12… IP: _____	H2 MAC: 88… IP: _____

**Assume Subnet masks of
255.255.255.248
(248=11111000 in binary)**

MAC: 74… IP: 128.2.6.1	Router R1
MAC: 35… IP: 205.2.22.1	

H3 MAC: 93… IP: _____	H4 MAC: 22… IP: _____

A) What are valid IP addresses for H1-H4?

Use the subnet mask and the IP address of the router on each network to decide.

You can copy and experiment with the *IPv4 Addresses* Google Sheet at http://ipv4.heinz-ds.is/

The host address of all 0's is reserved as a network address and is not used for any hosts.
The host address of all 1's is reserved as a broadcast IP address on the network.
Assign IP addresses to each of H1-H4

B) How is an HTTP request passed via TCP/IP from H1 to H4?

Simplified TCP Segment:

Ethernet Frame Header		Ethernet Frame Payload					
		IP Datagram Header			Datagram Payload		
					TCP Segment Header		TCP Payload
MAC Source	MAC Destination	IP Source	IP Destination	Protocol	Source Port	Destination Port	Application Data
				TCP			

Step 1: Begin at the Application layer (HTTP) and fill in the Application Data.

Note that last week we covered the HTTP protocol, including its header and payload sections.

Step 2: What are the transport protocol source and destination Ports?

Refer to transport protocol slides.

Step 3: The next layer down is the Internet Protocol Layer. What are the source and destination IP addresses?

Refer to the IP Layer slide

Step 4: Is the IP address of H4 is on the same network as H1 or not? How do you know?

Because the IP Destination address is on a different network than the IP Source address, the Ethernet Frame cannot be directly addressed to H4. Therefore, the Ethernet Frame must be addressed to a router that will pass the message on to the destination network.

Step 5: What is the address of the *Default Gateway* for this network? How was it obtained?

Step 6: What is the MAC Destination of the *Default Gateway?*

Refer to MAC addressing slides.

We have the IP Address of the *Default Gateway*, but we might not yet have cached the MAC address corresponding to that IP Address.

Therefore, H1 broadcasts an ARP request on the network asking, "Who is < IP address>"? The packet structure for the data in this request can be found at: http://en.wikipedia.org/wiki/Address_Resolution_Protocol .

Step 6a: Our purposes, you can simply use the string "Who is _____".   Fill in the MAC source and destination addresses.

Simplified Ethernet Frame:

Frame Header		Ethernet Frame Payload
MAC Source	MAC Destination	Data

Step 6b: R1 receives the ARP request and replies. "I am <IP address>"

Simplified Ethernet Frame:

Frame Header		Ethernet Frame Payload
MAC Source	MAC Destination	Data

Step 7: H1 can now complete addressing of the Ethernet Frame, and put the message on the network

Step 8: R1 receives the Ethernet Frame and passes its payload up to the IP layer. The IP layer decides where to route the message. It then sends the Datagram to the Data Link layer of the network interface on the destination network.

You can assume that R1 has cached the IP address to MAC address mapping of H4 in its ARP table.

Simplified TCP Segment:

Ethernet Frame Header		Ethernet Frame Payload					
		IP Datagram Header			Datagram Payload		
					TCP Segment Header		TCP Payload
MAC Source	MAC Destination	IP Source	IP Destination	Protocol	Source Port	Destination Port	Application Data
				TCP			

Step 9: H4 receives the Ethernet Frame, and the request is sent up the network stack.

What is the application that handles the request?

Step 10: H4 replies to H1

Simplified TCP Segment:

Ethernet Frame Header		Ethernet Frame Payload					
		IP Datagram Header			Datagram Payload		
					TCP Segment Header		TCP Payload
MAC Source	MAC Destination	IP Source	IP Destination	Protocol	Source Port	Destination Port	Application Data
				TCP			

Step 11: R1 routes the message to the appropriate network

Simplified TCP Segment:

Ethernet Frame Header		Ethernet Frame Payload					
		IP Datagram Header			Datagram Payload		
					TCP Segment Header		TCP Payload
MAC Source	MAC Destination	IP Source	IP Destination	Protocol	Source Port	Destination Port	Application Data
				TCP			