System & Networks II: Midterm Review

A. Overview of Computer Networks

Topics Covered:

- Network types and architectures.
- Network protocols and services - OSI reference model.
- Client - server and peer-to-peer networking.
- Topology of networks, network devices, network cables.
- Data transport in networks: packet-switched and circuit-switched networks.
- Multiplexing in network links.
- Loss and delay in packet-switched networks.
- Performance measures.

Selected Questions:

1. What are the four types of delays for packet-switched networks?
2. What data unit is encapsulated in a frame?
3. How many point-to-point WANs are needed to connect n LANs if each LAN should be able to directly communicate with any other LAN?
4. What is the role of a router in networks, what is the role of a switch?
5. What are active devices in networks, what are passive devices?
6. What cables are needed to connect a host to a switch, two switches, and two routers?

B. Network Programming

Topics Covered:

- UDP and TCP client server programming.
- Requirements for sending and receiving data at the server and client.
- Architectures of TCP and UDP servers.

C. Application Layer Services

Topics Covered:

- HTTP and SMTP.
- Transport service requirements for applications.
- Persistent connections in HTTP.
- DNS and services.

Selected Questions:

1. Which entity in a client-server (peer-to-peer) architecture requests services, which delivers services.
2. How is the URL in a browser translated into an HTTP request and a connection to the server? What services are involved in the network?

3. In an SMPT connection, how does the mail server know the end of a mail message?
4. Can a host use a Telnet client to get services provided by an HTTP or SMTP server?
5. What services does DNS provide?
6. What enables DNS to provide services to hosts in large-scale networks?

D. Transport Layer Services

Topics Covered:

- UDP and TCP.
- RDT with automata.
- Go-back-N and Selective Repeat.
- Time-space diagrams for RDT and TCP.
- Flow and congestion control.

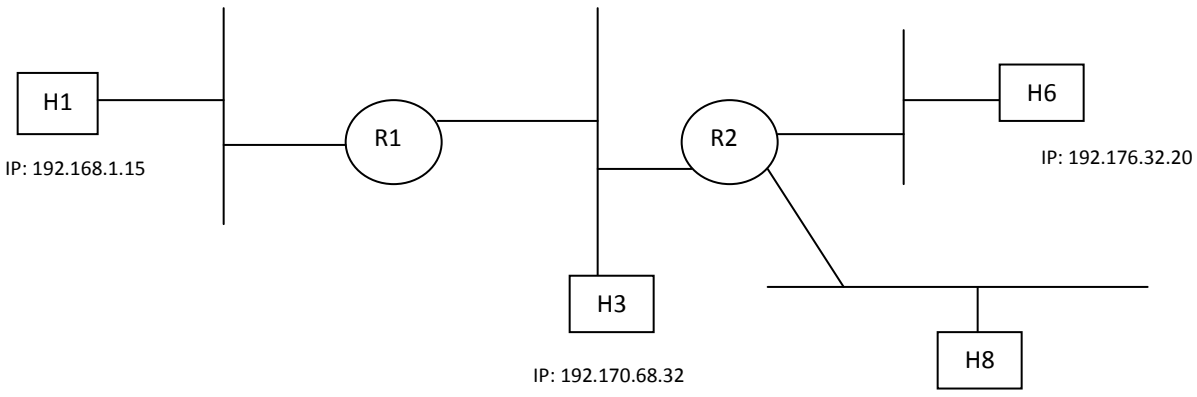
E. Network Layer Services

Topics Covered:

- Forward and routing.
- VC and packet-switched networks.
- Router architectures, switching fabrics, and queuing issues.
- IP Addressing.
- Fragmentation of IP datagrams.
- Subnetting and division of IP networks.

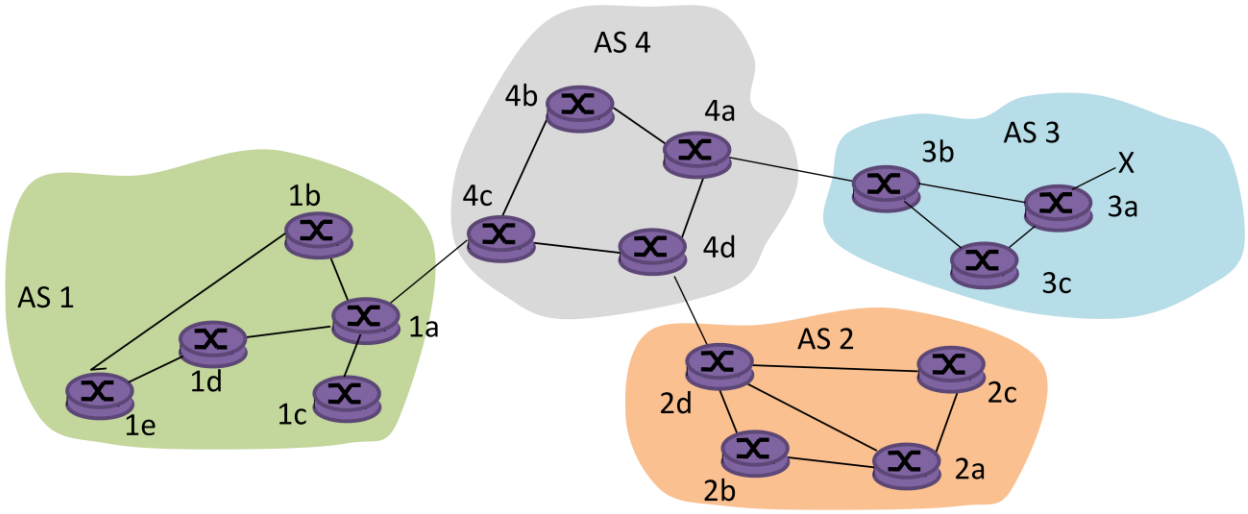
Selected Questions:

1. In classless addressing, we know the first and the last address in a block of IP addresses. Can we find the prefix length? Explain.
2. In classless addressing, can two different blocks of addresses have the same prefix length? Explain.
3. Assume the shortest path in a graph from node A to node H is A->B->H and the shortest path from H to N is H->G->N. What is the shortest path from node A to node N?
4. Suppose a packet originates at host A, travels through routers (labeled x, y, and z) and is delivered to host B. The distance from A to x is 4 meters, the distance from x to y is 120 meters, the distance from y to z is 30 meters and the distance from z to B is 5 meters. The propagation speed is 2×10^8 meters per second. The packet is 500 bytes long. The transmission rates at the host machines and the routers are the same, 100 Mbps. Assume the queues are empty at each hop and that there is no processing delays at each router. How long will it take for the data to be transmitted to host B?
5. Given the following network:

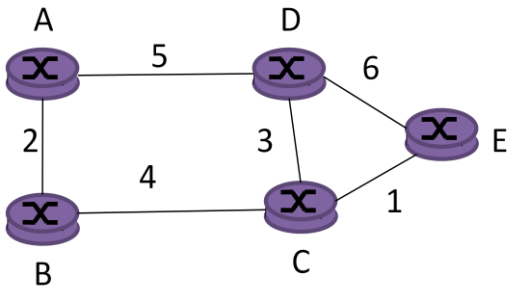


a. How many IP addresses does the router R2 have respectively?
b. How many subnets are depicted?
c. Assume the subnet mask of H1 is 255.255.224.0. What is a possible IP address of R1? What is the range of addresses available to all hosts on the same network?

6. Consider the diagram of a network below. Assume that AS1 and AS2 are running OSPF and AS3 and AS4 are running RIP for intra-AS routing. Further assume that eBGP and iBGP are used for inter-AS routing in the network.
    a. From which routing protocol does router 2d learn about prefix x?
    b. From which routing protocol does router 2b learn about prefix x?
    c. What is the prefix path that router 4c advertises to 1a for prefix x?
    d. Suppose a link is established between 2c and 3c. What routing protocols are being involved in computing a route for 2b for prefix x? Explain.



7. Consider the network diagram below and the distance-vector algorithm.
    a. What is the initial distance table computed by A?
    b. What is the distance vector that B sends to A after it generates its distance table and before it receives distance vector from adjoining nodes?
    c. What is the lowest number of distance vectors that must be exchanged between routers for A to compute a distance table with shortest distance to all routers? List the sequence of distance vectors along with the routers that exchange them.



8. Compute the distance table at router A for the network above using the link-state algorithm.

    a) Use the notation discussed in class.

Step	Confirmed	Tentative
1	(A,0,-)	

    b) Use a new notation:

    D(.) : the cost of a least-cost path from source to destination as of a given iteration

p(.): the previous node along the least-cost path from source

N: a list of nodes in the spanning tree that have been visited for a given iteration

Step	**N**	**D(B),p(B)**	**D(D),p(D)**	**D(C),p(C)**	**D(E),p(E)**
0	A	2,A	5,A	inf	inf
1					
2					
3					
4					
5					