ELEC3500/ELEC6500/SENG6400 - Telecommunications Networks

Assignment 2

This is an **individual assignment**.

Weight: **7.5%** of the course final mark.

Submission due date: **11.59pm Friday 22 October 2021 (Week 12)**.

Submit your assignment via the course Blackboard (using the Assessment tab). Any late submission will be penalised as per the Course Outline.

Total Mark: 75.

Instruction: Show a complete solution for each problem in your submission.

1. (15 marks) Consider the network setup in Figure. Router R connects the home network (on the right-hand side) to the ISP (on the left-hand side). Router R implements the network address translation (NAT) technique. Suppose that the ISP assigns the router R the address 25.35.115.244, and that the network address of the home network is 192.168.1.0/24.
   a. Assign addresses to all interfaces in the home network.
   b. Suppose each host has two ongoing TCP connections, all to port 80 at host 128.120.41.85. Provide the six corresponding entries in the NAT translation table.

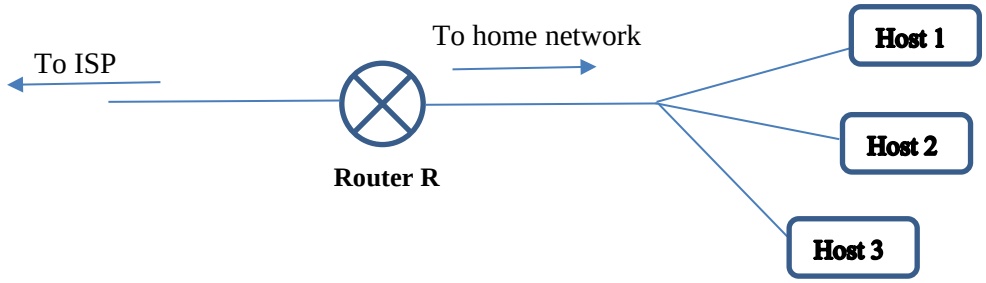

Figure 1. For Question 1

2. (15 marks) Consider the three-node topology shown in Figure 2. The link costs are c(N1, N2) = 4, c(N1, N3) = 5, c(N2, N3) = 2. Compute the distance tables after the initialisation step and after each iteration of a synchronous version of the distance-vector algorithm.

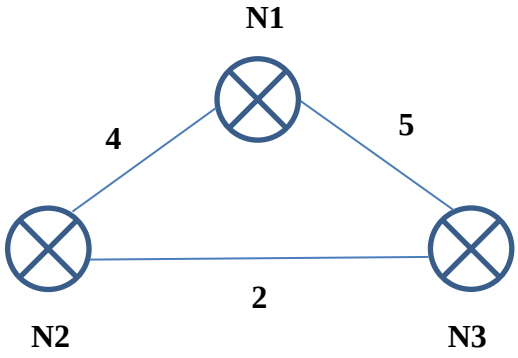

Figure 2. For Question 2

3. (15 marks) Consider the network in Fig. 3. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from node **w** to all other nodes. Show how the algorithm works by computing a table similar to that discussed in the lecture. Then, show all entries in the forwarding table at node **w**.

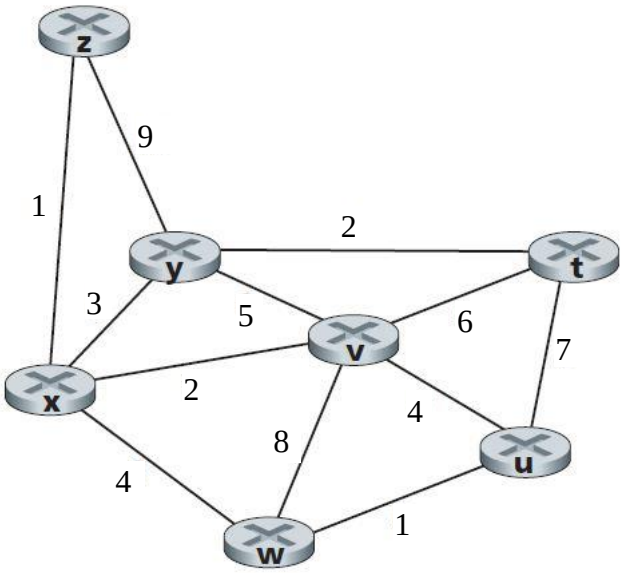

Figure 3. For Question 3

4. (15 marks) Consider three LANs interconnected by two routers, as shown in Figure 4.

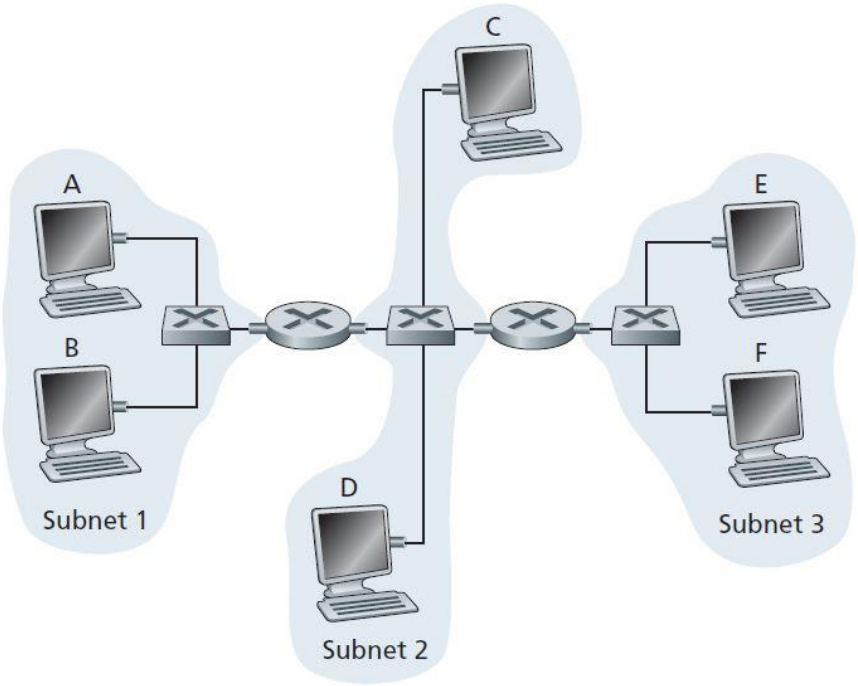

Figure 4. For Question 4

a. Assign IP addresses to all of the interfaces. For Subnet 1, use addresses of the form 101.101.101.xxx; for Subnet 2, use addresses of the form 102.102.102.xxx; and for Subnet 3 use addresses of the form 103.103.103.xxx.

b. Assign MAC addresses to all of the adapters (Choose the addresses such that they are easy to differentiate).
c. Suppose host B sends an IP datagram to host F. Suppose all of the ARP tables are up to date. Give the source and destination MAC addresses in the frame encapsulating this IP datagram as the frame is transmitted **(i)** from B to the left router, **(ii)** from the left router to the right router, **(iii)** from the right router to F. Also give the source and destination IP addresses in the IP datagram encapsulated within the frame at each of these points in time.
d. Suppose now that the leftmost router in Figure 4 is replaced by a switch. Hosts A, B, C, and D and the right router are all star-connected into this switch. Suppose host B sends an IP datagram to host F. Suppose all of the ARP tables are up to date. Repeat Question 4c for this case.

5. (15 marks) In this question, you will put together much of what you have learned about Internet protocols. Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are all the protocol steps that take place, starting from powering on your PC to getting the Web page? Assume there is nothing in our DNS or browser caches when you power on your PC. (Hint: the steps include the use of Ethernet, DHCP, ARP, DNS, TCP, and HTTP protocols.) Explicitly indicate in your steps how you obtain the IP and MAC addresses of a gateway router.