THE UNIVERSITY OF WINNIPEG

APPLIED COMPUTER SCIENCE

ACS-3911-050 Computer Networks
Winter 2020

Assignment 4
Due Date: 3rd Apr, 2020

The assignment only has one part, Questions and Answer. A total of 100 mark for this assignment. Please complete by due date. No assignment will be accepted after the due date and the date/time stamp on the email will be used to determine if the assignment was on time or late.

Email your assignment in PDF format to 3911-050@acs.uwinnipeg.ca by 11:59pm April 3rd, 2020. The name of your file should be named - <First name Last Name> - <Student ID> – Assignment <number>, e.g. John Doe – 12345 – Assignment 4. The subject line of your email must be: <your name><your student #>< course # with section #>Assignment 4.

Chapter 4

Review Questions

Section 4.1
R1. Let's review some of the terminology used in this textbook. Recall that the name of a transport-layer packet is segment and that the name of a link-layer packet is frame. What is the name of a network-layer packet? Recall that both routers and link-layer switches are called packet switches. What is the fundamental difference between a router and link-layer switch? (Marks 4)

R3. We made a distinction between the forwarding function and the routing function performed in the network layer. What are the key differences between routing and forwarding? (Marks 4)

Section 4.2

R8. What is meant by destination-based forwarding? How does this differ from generalized forwarding (assuming you've read Section 4.4, which of the two approaches are adopted by Software-Defined Networking)? (Marks 5)

R10. Three types of switching fabrics are discussed in Section 4.2. List and briefly describe each type. Which, if any, can send multiple packets across the fabric in parallel? (Marks 5)

Section 4.3

R21. Do routers have IP addresses? If so, how many? (Marks 2)

R22. What is the 32-bit binary equivalent of the IP address 223.1.3.27? (Mark 1)

Section 4.4

R32. How does generalized forwarding differ from destination-based forwarding? (Marks2)

Problems

P2. Suppose two packets arrive to two different input ports of a router at exactly the same time. Also suppose there are no other packets anywhere in the router. (Marks 6)

a) Suppose the two packets are to be forwarded to two different output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a shared bus?
b) Suppose the two packets are to be forwarded to two different output ports. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses switching via memory?
c) Suppose the two packets are to be forwarded to the same output port. Is it possible to forward the two packets through the switch fabric at the same time when the fabric uses a crossbar?

P8. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. (Marks 3)

P15. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer. (Marks 4)

Chapter 5

Review Questions

Section 5.1
R1. What is meant by a control plane that is based on per-router control? In such cases, when we say the network control and data planes are implemented “monolithically,” what do we mean? (Marks 5)

R2. What is meant by a control plane that is based on logically centralized control? In such cases, are the data plane and the control plane implemented within the same device or in separate devices? Explain. (Marks 5)

Section 5.2
R6. Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not? (Marks 2)

Sections 5.3–5.4
R7. Why are different inter-AS and intra-AS protocols used in the Internet? (Marks 4)

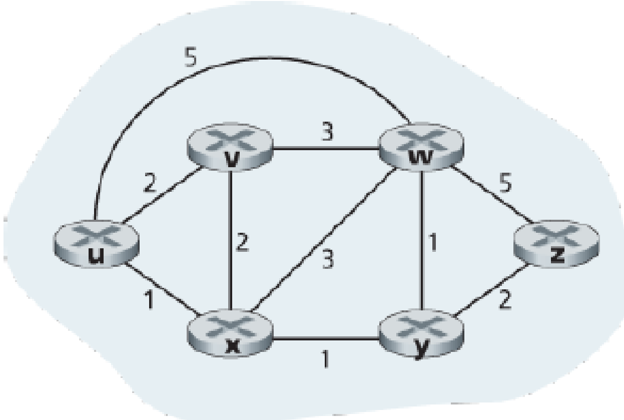
R10. Define and contrast the following terms: subnet, prefix, and BGP route. (Marks 3)

R13. True or false: When a BGP router receives an advertised path from its neighbor, it must add its own identity to the received path and then send that new path on to all of its neighbors. Explain. (Marks 5)

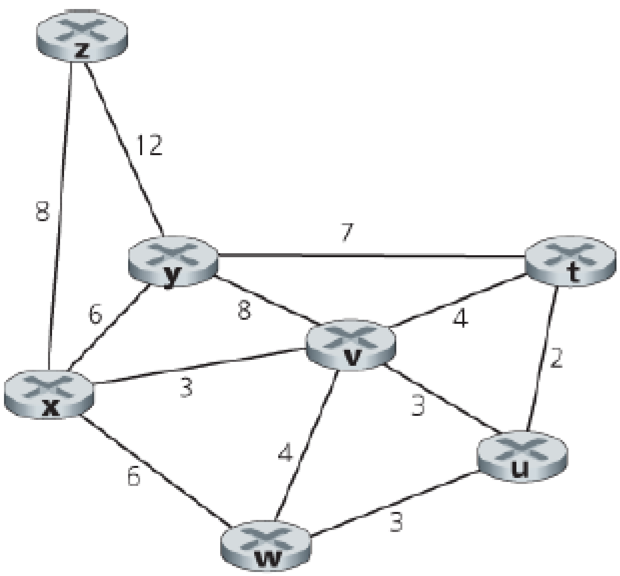
Section 5.6–5.7
R19. Names four different types of ICMP messages (Marks 4)

Problems

P1. Looking at network diagram, enumerate the paths from y to u that do not contain any loops. (Marks 14)



P3. Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes.

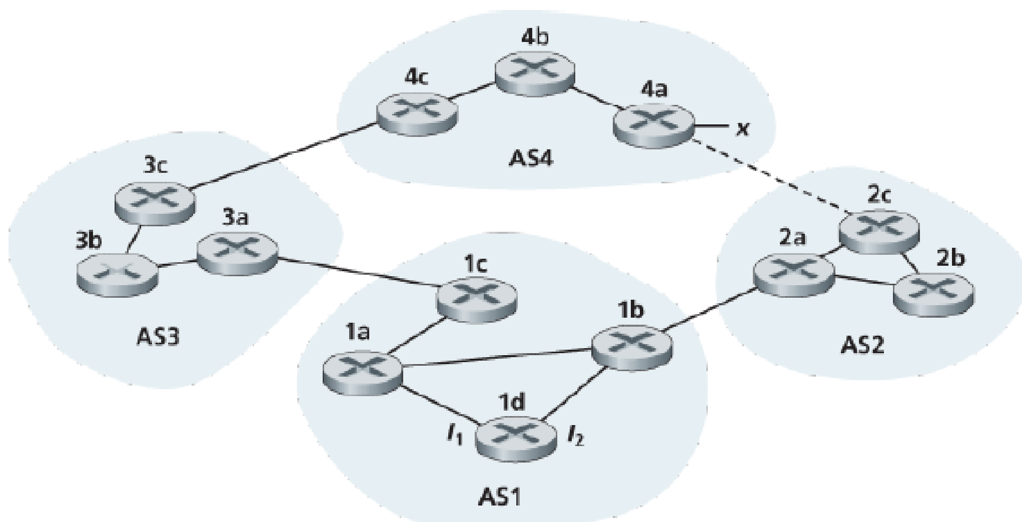


Show how the algorithm works by completing the following table. (Marks 11)

Step	*N'*	*D(t),p(t)*	*D(u),p(u)*	*D(v),p(v)*	*D(w),p(w)*	*D(y),p(y)*	*D(z),p(z)*
0	x						
1	xv						
2	xvu						
3	xvuw						
4	xvuwy						
5	xvuwyt						
6	xvuwytz						

P14. Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4. (Marks 4)

a) Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?
b) Router 3a learns about x from which routing protocol?
c) Router 1c learns about x from which routing protocol?
d) Router 1d learns about x from which routing protocol?



P21. Consider the two ways in which communication occurs between a managing entity and a managed device: request-response mode and trapping. What are the pros and cons of these two approaches, in terms of (1) overhead, (2) notification time when exceptional events occur, and (3) robustness with respect to lost messages between the managing entity and the device? (Marks 5)

P22. In Section 5.7 we saw that it was preferable to transport SNMP messages in unreliable UDP datagrams. Why do you think the designers of SNMP chose UDP rather than TCP as the transport protocol of choice for SNMP? (Marks 2)