COMP2322 Computer Networking

Homework 4

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BsC in Computer Science
Academic year: 2024/2025 Sem 2

Questions

Question 1

Q: (4 points) Consider a network using 8-bit host addresses. Suppose a router uses the longest prefix matching and has the following forwarding table:

Prefix Match	Interface
00	0
01	1
011	2
10	2
11	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

Solution 1

Interface	Range (Binary)	Range (Decimal)	# of Addresses
0	00000000 – 00111111	0 – 63	64
1	01000000 – 01011111	64 – 95	32
2	01100000 – 10111111	96 – 191	96
3	11000000 – 11111111	192 – 255	64

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Question 2

Q: (1 point) Suppose datagrams are limited to 1,500 bytes (including header) between source Host-A and destination Host-B due to the link has an MTU of 1500 bytes. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 file that consists of 4M bytes when using TCP? Explain how you computed your answer. (Hint: $1M = 10^6$)

Solution 2

Let's assume that each TCP header takes up 20 Bytes.
Then, the amount of TCP data that can be carried by each packet is:

$$\begin{aligned}\text{Payload Size} &= \text{MTU} - \text{IP Header} - \text{TCP Header} \\ &= 1500 - 20 - 20 \\ &= 1460 \text{ Bytes}\end{aligned}$$

Then, the total number of datagrams needed to transmit this MP3 file is computed as:

$$\begin{aligned}\text{Number of Datagrams} &= \frac{\text{File Size}}{\text{Payload Size}} \\ &= \left\lceil \frac{4 \times 10^6}{1460} \right\rceil \\ &= 2740\end{aligned}$$

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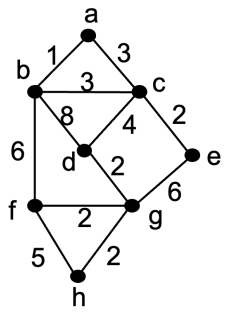
Question 3

Q: Consider the network below. Use Dijkstra's shortest-path algorithm to compute the shortest path from node b to all nodes in the network. Give detailed steps.



Solution 3

	a	b	c	d	e	f	g	h	visiting
Initial	∞	0	∞	∞	∞	∞	∞	∞	-
Step 1	1	0	3	8	∞	6	∞	∞	b
Step 2	1	0	3	8	∞	6	∞	∞	a
Step 3	1	0	3	7	5	6	∞	∞	c
Step 4	1	0	3	7	5	6	11	∞	e
Step 5	1	0	3	7	5	6	8	11	f
Step 6	1	0	3	7	5	6	8	11	d
Step 7	1	0	3	7	5	6	8	10	g
Step 8	1	0	3	7	5	6	8	10	h

Table 1: Execution procedure of Dijkstra's algorithm

	Dist	Shortest Path
a	1	$b \to a$
b	0	b
c	3	$b \to c$
d	7	$b \to c \to d$
e	5	$b \to c \to e$
f	6	$b \to f$
g	8	$b \to f \to g$
h	10	$b \to f \to g \to h$

Table 2: Shortest path from node b to all nodes in the network