Fall 2024, CS 3953: Computer Networks

Homework 4 Solution

Problem 1 (15 points)

1.

Destination Prefix	Link Interface
10010000 0	0
10010000 10	1
10010000 11	2
10010001	3
otherwise	3

2.

Destination Prefix	a.b.c.d/x notation	Link Interface
10010000 0	144.0/9	0
10010000 10	144.128/10	1
10010000 11	144.192/10	2
10010001	145/8	3
otherwise		3

3.

Destination Prefix	Link Interface
10010000 01010101 00001111 10101010	0 (matching 1st entry)
10010000 10010001 11100011 00010010	1 (matching 2nd entry)
10010100 00000000 11111111 00000000	3 (matching 5nd entry)

Problem 2 (20 points)

1. Subnet A: 192.168.17.0/24 (256 addresses)

Subnet B: 192.168.16.0/25 - 192.168.16.0/29 (128-8 = 120 addresses)

Subnet C: 192.168.16.128/25 - 192.168.16.128/29 (128-8 = 120 addresses)

Subnet D: 192.168.16.0/31 (2 addresses)

Subnet E: 192.168.16.2/31 (2 addresses)

Subnet F: 192.168.16.4/31 (2 addresses)

2.

Router1

Longest Prefix Match	Outgoing Interface
11000000 10101000 00010001	Subnet A
11000000 10101000 00010000 0000000	Subnet D
11000000 10101000 00010000 0000010	Subnet F

Router2

Longest Prefix Match	Outgoing Interface
11000000 10101000 00010000 0000010	Subnet F
11000000 10101000 00010000 0000001	Subnet E
11000000 10101000 00010000 1	Subnet C

Router3

Longest Prefix Match	Outgoing Interface
11000000 10101000 00010000 0000000	Subnet D
11000000 10101000 00010000 0	Subnet B
11000000 10101000 00010000 0000001	Subnet E

Problem 3 (15 points)

Cost to						
From		u	v	x	y	z
	v	∞	∞	∞	∞	∞
	x	∞	∞	∞	∞	∞
	z	∞	3	1	∞	0

Cost to						
From		u	v	x	y	z
	v	1	0	3	∞	3
	x	∞	3	0	3	1
	z	4	3	1	4	0

Cost to						
From		u	v	x	y	z
	v	1	0	3	3	3
	x	4	3	0	3	1
	z	4	3	1	4	0

Problem 4 (10 points)

Intra-AS and Inter-AS routing differ in the following 2 facets: policy:

• Inter-AS: admin wants control over how its traffic routed, and who routes through its net. (untrusted)

• Intra-AS: single admin, so no policy decisions needed (trusted)

performance:

• Intra-AS: can focus on performance

• Inter-AS: policy may dominate over performance

Problem 5 (10 points)

Methods to reduce the size of routing table include but not limited to:

• Using network prefix instead of the whole destination IP address.

• Using CIDR technology to converge multiple continuous IP prefix into one.

• Using hierarchical routing to reduce destination prefix.

Problem 6 (10 points)

The reasons for replacing IPv4 with IPv6 include but not limited to:

- To provide more IP addresses, IPv6 have larger IP address space.
- To simplify the IP header and speed up the routing processing.
- To support more features, including QoS, IP security etc.

Problem 7 (20 points)

network	network prefix	Network mask	network	network prefix	network prefix
LAN0	206.0.64.0	255.255.255.255	LAN7	206.0.66.128	255.255.255.192
LAN1	206.0.64.0	255.255.255.128	LAN8	206.0.66.192	255.255.255.192
LAN2	206.0.64.128	255.255.255.128	LAN9	206.0.67.0	255.255.255.192
LAN3	206.0.65.0	255.255.255.128	LAN10	206.0.67.64	255.255.255.192
LAN4	206.0.65.128	255.255.255.128	LAN11	206.0.67.128	255.255.255.192
LAN5	206.0.66.0	255.255.255.192	LAN12	206.0.67.192	255.255.255.192
LAN6	206.0.66.64	255.255.255.192			

RA		
Prefix	**Mask**	**Interface**
206.0.64.0	255.255.255.255	0
206.0.64.0	255.255.254.0	1
206.0.66.0	255.255.255.0	2
206.0.67.0	255.255.255.128	3
206.0.67.128	255.255.255.128	4

R1		
Prefix	**Mask**	**Interface**
206.0.64.0	255.255.255.128	1
206.0.64.128	255.255.255.128	2
206.0.65.0	255.255.255.128	3
206.0.65.128	255.255.255.128	4

R3		
Prefix	**Mask**	**Interface**
206.0.67.0	255.255.255.192	1
206.0.67.64	255.255.255.192	2

The above table isn't the only one solution. Other options could start from 68, 72,76...124 instead of 64 for the third 8-bit in the four 8-bit IPv4 address.