- **Problem 2** (0 point)

  1. Assume that a client machine obtained a leased IP address by DHCP for a network connection. The client closed this connection to the network and stored the leased IP address in the disk. The client machine wants to re-connect to the nework by the stored IP address. Is this always possible? Explain your answer.

     Answer; No, it is not always possible. DHCP uses the dynamic IP address assignment to lease an IP address to a client for a time period and may lease this IP address to a different machine in the next time period.

  2. Explain by figures the TCP three way handshake for connection establishment and the modified three way handshake for connection termination.

     Answer: See Figures 11.14 and 11.15 in the text book.

  3. Assume that a source in a TCP connection has sent k segments and obtained the round trip time $RTT(i), = 1, 2, ..., k$. The TCP computes a smoothed round trip time for segment $k+1$: $SRTT(k+1) = \alpha \times SRTT(k) + (1-\alpha) \times RTT(k)$ and $SRTT(1) = RTT(1)$. Express $SRTT(k+1)$ in terms of $RTT(1), RTT(2), ..., RTT(k)$. $SRTT(k+1)$ is a weighted average of the previous k round trip times. For a constant $\alpha = 0.8$ and a large k (say $k > 10$), which round trip time has the largest weight in the average?

     Answer: $SRTT(k+1) = \alpha^{k-1}RTT(1) + \alpha^{k-2}(1-\alpha)RTT(2) + ... + \alpha(1-\alpha)RTT(k-1) + (1-\alpha)RTT(k)$. $RTT(K)$ has the largest weight for large k.

  4. What techniques are used in TCP to response the congestion? Explain these techniques.

     Answer: Slow start and multiplicative decrease.

  5. Below is the RIP routing table of a router:

Destination	next-hop-router	hops
N1	R2	4
N2	R3	2
N3	R3	1
N4	R4	5

     The router receives the following message from a neighbor router $R2$ and updates its routing table.

Destination	hops
N1	7
N2	3
N3	5
N4	3
N5	5

     Show the updated routing table.

     Answer:

Destination	next-hop-router	hops
N1	R2	8
N2	R3	2
N3	R3	1
N4	R2	4
N5	R2	6

6. RIP uses distance vector routing algorithm. Explain how the distance routing algorithm updates the routing table in the previous question.

   Answer: In the routing table, the next hop router for destination N_1 is R_2 and the advertisement from R_2 says the distance to N_1 changed, So the entry for N_1 is updated.

   The advertisement from R_2 does not give a better route for destinations $N2$ and N_3 whose next hop routers are R_3. So the entries for N_2 and N_3 are not changed.

   The advrtisement from R_2 gives a shorter route to N_4. So the entry for N_4 is updated.

   The advertisement from R_2 contains an entry for N_5 which is not in the routing table. So a new entry for N_5 is included in the routing table.

7. Give the weighted directed graph used by OSPF for representing the AS in Figure 1. Give the routing table of Router R_5 computed by OSPF, the metric in the routing table is the link-state (delay).

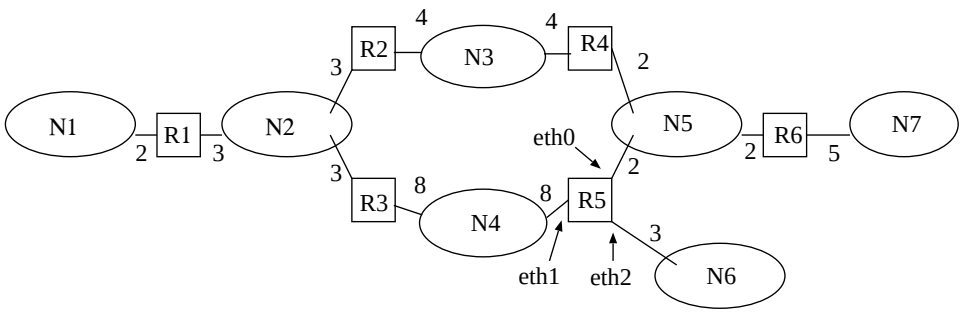

Figure 1: An autonomous system.

Answer:

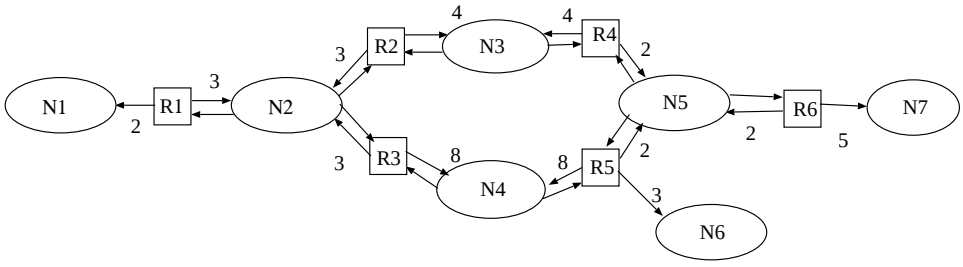

Figure 2: The digraph for the autonomous system.

Routing table at R_5:

Destination	Next Hop	Metric
N1	R4	11
N2	R4	9
N3	R4	6
N4	*	8
N5	*	2
N6	*	3
N7	R6	7

8. Study the example of an AS in RFC 1131 and explain why partition the AS into areas would reduce the traffics generated by OSPF.

   Answer: Because the flooding of link states is limited within each area.

9. Describe how loops in paths can be detected in BGP.

   Answer: In BGP, a routing path is described by a next hop router and a sequence of ASs. BGP checks the sequence of ASs, if an AS appears more than once in the sequence, then a routing loop is detected.

10. Assume that routers $R_0 \rightarrow R_1 \rightarrow R_2 \rightarrow R_3$ form an MPLS routing path from R_0 to R_3, the flow of datagrams from R_0 to R_3 is given label 1, and the flow of datagrams from R_1 to R_2 is given label 2. Show the labels and the S bit in the MPLS headers attached to a datagram in the flow from R_0 to R_3 in the routing path from R_0 to R_3.

    Answer: