Computer Network 2008 Final Exam

1. (10%) 802.11
   (a) Explain the hidden terminal problem
   (b) What does RTS/CTS stand for? Explain how it works in 802.11

2. (10%) Please explain the pure ALOHA protocol and show that the maximum efficiency of Pure Aloha efficiency is 1/(2e)

3. (10%) Please explain
   (a) which approaches (excluding error detection) we usually use for providing reliable delivery service in **both** transport-layer and link-layer.
   (b) with reliability service providing by transport layer, why we still need link-level reliability

4. (10%) Please explain link-state and distance-vector routing algorithms and compare them

5. (5%) What is HOL blocking? Does it occur in input ports or output ports?

6. (10%) Please explain (a) what two multicast distribution scenarios are recognized in PIM (Protocol-Independent Multicast) routing protocol and (b) why.

7. (5%) What is the rate adaptation in 802.11?

8. (10%) Please explain what Direct Routing and Indirect Routing (to a Mobile Node) are and compare them.

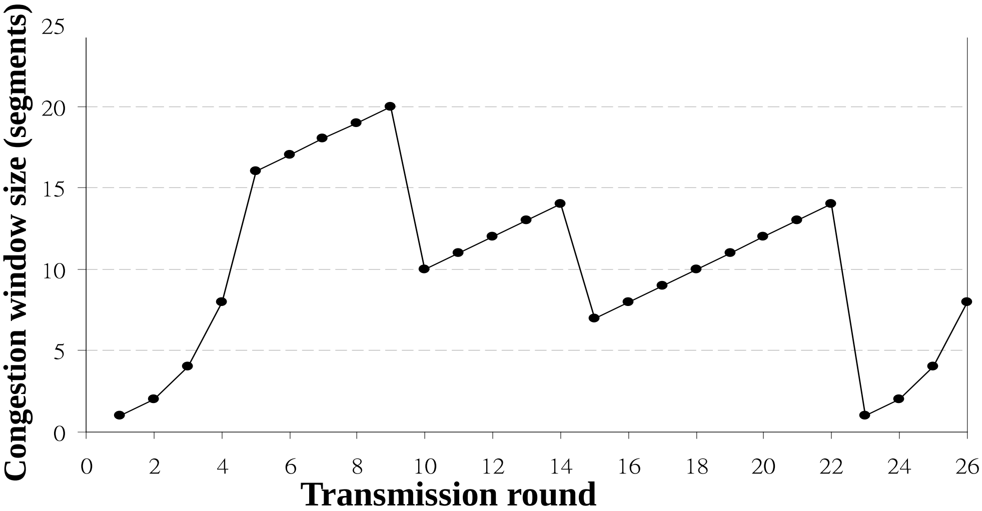
9. (10%) Recall the idealized model for the steady-state dynamics of TCP. In the period of time from when the connection's rate varies from $W/(2 \cdot RTT)$ to W/RTT, only one packets is lost (at the very end of the period).
   (a) Show that the loss rate (fraction of packets lost) is equal to

$$L = \text{loss rate} = \frac{1}{\frac{3}{8}W^2 + \frac{3}{4}W}$$

   (b) Use the result above to show that if a connections has loss rate L, then its average rate is approximately given by

$$\approx \frac{1.22 \bullet MSS}{RTT\sqrt{L}}$$

10. (10%) Consider the following plot of TCP window size as a function of time.



Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

(a) Identify the intervals of time when TCP slow start is operating.

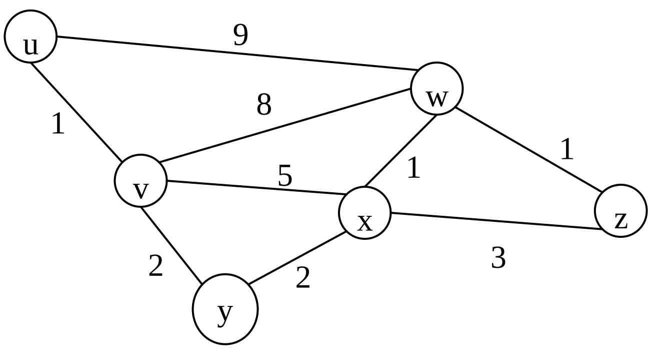
(b) Identify the intervals of time when TCP congestion avoidance is operating.

(c) After 9th, 14th, and 22nd transmission rounds, is segment loss detected by the triple duplicate ACK or by the timeout? **(Justify your answer.)**

(d) What is the value of **Threshold** at the 24th transmission round?

(e) Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size of **Threshold**?

11. (10%) Consider the network shown in the following figure. Using Dijkstra's algorithm, and showing your work using a table similar to the following table, compute the shortest path from *z* to all network nodes.



step	*N'*	*D(u),p(u)*	*D(v),p(v)*	*D(w),p(w)*	*D(x),p(x)*	*D(y),p(y)*
0	*z*	∞	∞	1,*z*	3,*z*	∞

12. (20%) Consider the topology and subnet address assignment shown in Figure 1.

(a) Assume that no datagram has router interfaces as ultimate destinations. The forwarding table of the routers:

Longest Prefix Match	**Outgoing Interface**
Router 1	
11010110 01100001 11111111	Subnet A
11010110 01100001 11111110 0	Subnet D
11010110 01100001 11111110 1	Subnet F
Router 2	
11010110 01100001 11111111	Subnet E
11010110 01100001 11111110 0	Subnet F
11010110 01100001 11111110 1	Subnet C
Router 3	
11010110 01100001 11111111	Subnet E
11010110 01100001 11111110 0	Subnet B
11010110 01100001 11111110 1	Subnet D

What is the problem resulted from such forwarding tables? How could you solve the problem by modifying the forwarding table of **ONE** router? (The shortest path is unnecessary)

(b) Take an example (or application) that the datagram has router interfaces as ultimate destinations.

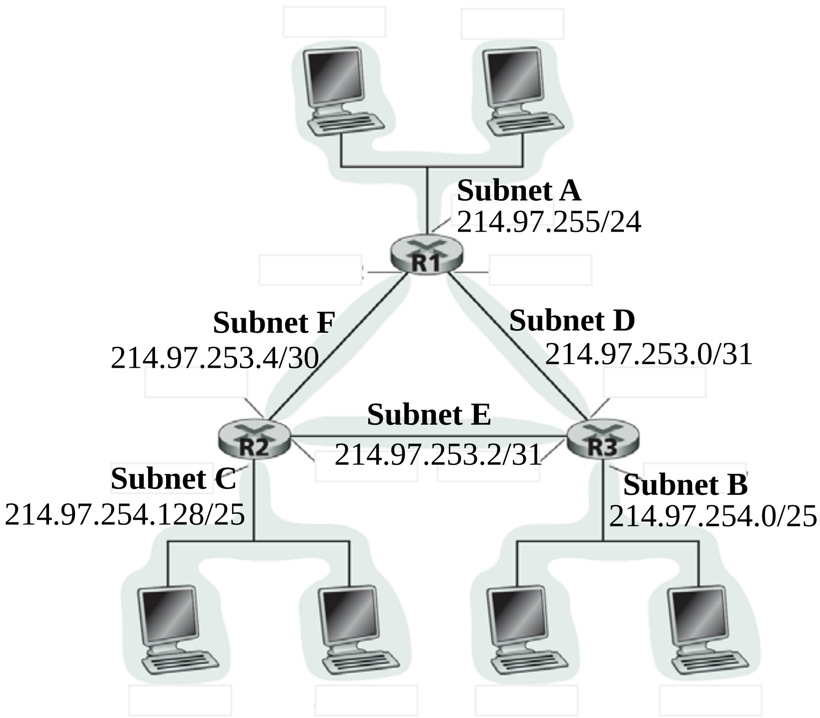


Figure 1