5th Sem. B. Tech
CN, IT 3001
[CSE & IT]

Repeat Mid-Semester Examination – 2015

COMPUTER NETWORKS

[IT 3001]

Full Marks: 25 Time : 2 Hours

Answer All the questions.

1. Answer all the questions [1*5]

   i. Suppose N packets arrive simultaneously at a router every T seconds. Suppose the packets are of size S bits and the transmission rate of the router is R bps. What should the minimum value of T be such that the queuing delay does not grow without bound?
   Ans : NS/R

   ii. When a router discards a packet, it sends the ICMP message to whom?
   Ans : to the originator or source host of the packet.

   iii. What is the maximum number of application data in bytes can be accommodated as UDP payload?
   Ans: 65507. While the UPD length field indicates it can accommodate (2^16)-8 (8 is header length). This is not quite true since IP packet itself can accommodate only (2^16)-20 bytes of UDP segment. Out of this, again 8 bytes goes towards the UDP header leaving 65535-8-20 bytes to UDP payload.

   iv. What is the source IP address of a DHCP discover message generated by a host?
   Ans: 0.0.0.0

   v. Under what conditions does one go directly from FIN_WAIT_1 to TIME_WAIT?

   Ans: Suppose A sent a FIN to B and entered FIN_WAIT_1. At host B, if the application closed its end of connection when A's FIN was received, then B could piggy back the ACK of A's FIN with its own FIN in the same packet leading to FIN+ACK being received by A. In response to it A will send the ACK for B's FIN and enter TIME_WAIT.

2. a) Suppose two hosts A and B are connected by a 1 Mbps link of length 10 km. Suppose the speed of light over the link is 2 * 10^8 m/s. If a 5 MB file were to be transferred between the hosts as back-to-back packets, how many bits will be in the link at any given time?

   Ans: 50
   Two ways to solve:
   1) Bit duration is 1 us. In 1us, the bit will occupy 200m. Number of bits is 10km/200m = 50 bits
   2) Propagation delay is distance/speed = 10000/2*10^8 = 50 us. If the rate of the link is 1Mbps, it can hold (capacity) 1Mbps * 50us bits = 50 bits
   Note that the file size has no role to play here since its more than the link capacity.

   b) Describe the various layers of OSI Model. Explain the functionality of for each layer? [2]

3. a) Consider the topology as shown. Link costs are all '1'. [3]

   A --- B --- C
   Suppose link B--C were to fail. Explain, in what scenario a routing loop be formed in the above topology and list all sequence of message exchanges during the same. Assume no preventive approaches like split horizon etc are used.

   b) Explain, when employing slow start (cwnd=1 at time t=0), at what time (in ms) is cwnd > 20KB? Assume a RTT of 20ms and maximum segment size of 1500 Bytes. [2]

   Ans: Cwnd doubles every RTT. Note that the MSS is 1500B.
   So, after 1RTT: cwnd is 3kB
   a little time after 2RTT : cwnd=6KB;
   a little time after 3RTT: cwnd=12KB;
   a little time after 4RTT: cwnd=24KB
   The little time arises to account for the ack separation.
   So at 4RTT, it is still under 20KB. It reaches 20KB sometime between 4RTT and 5RTT.
   So, only at 5RTT the condition will be true.
   So the answer is 5RTT i.e. 5*20ms = 100ms

4. a) Explain in detail how SMTP send your email to your friend's mailbox. [3]

   b) Describe TCP 3-way handshake procedure through the timing diagram. Explain various state changes during the 3-way handshaking through the state transition diagram.[2]

5. a) Suppose the maximum time an IP datagram can stay in the network before being delivered to the receiver is 60 sec (MSL: Maximum segment lifetime is 60 sec). What is the maximum rate a host should send out datagrams so as to avoid confusion during reassembly of fragments at the receiver? Assume the datagram size of 1000 Bytes. Express the answer in Mbps. [3]

   Ans : We need to ensure that the identification field does not wrap around within 60

sec. Since identification field is 16 bits, that means a host can send 2^16 datagrams in 60 sec before wrap around occurs. So, data rate of sending should be kept under 2^16 * 1000 * 8 bits / 60 sec to prevent wrap around. As long as its under, given the fact that no datagram stays past 60 sec in the network, wrap around does not happen.

So rate is < 8.7Mbps

b) An organization with 4000 hosts, that is assigned 16 class C addresses has an efficiency of how much? Express in percentage. [2]

Ans: Total no. Of hosts can be configured with 16 class C address = 256 * 16 = 4096

Efficiency = (100/4096) * 4000 = 97.7 %