

1. (10%) IP subnet partition. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 140.121.199/24. Also suppose that Subnet 1 is required to support up to 22 interfaces, Subnet 2 is to support up to 50 interfaces, and Subnet 3 is to support up to 10 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.
2. (10%) Packet routing. Is it possible for a destination address to match more than one entry in the forwarding table of a router? (2%) How to solve this problem? (4%) Use an example to explain your answer. (4%)
3. (10%) Multiple access control. How does carrier sense multiple access (CSMA) work? (4%) Will there be a collision in a network running CSMA? (2%) Why or why not? (4%)
4. (10%) Wireless communication. What is the hidden terminal problem? (5%) How the IEEE 802.11 MAC protocol avoids this problem? (5%)
5. (10%) Wireless communication. Describe the operation of ALOHA and slotted-ALOHA. (8%) Which one has better performance? (2%)
6. (10%) Packet forwarding mechanisms. What are the differences between “circuit switching” and “packet switching”?
7. (10%) TCP connection management. What is the TCP connection setup mechanism (that is, the three-way handshaking mechanism)? (5%) What is the TCP connection teardown (termination) mechanism? (5%)
8. (18%) Network protocols.
 - (a). In general, a network protocol consists of three parts: (i) syntax, (ii) semantics, and (iii) rules. Please give a short description to explain each of them about what each of them mean. (6%, 2 point each)
 - (b). Persistent v.s. non-persistent connection. What are the differences between non-persistent HTTP connection and persistent HTTP connection? (3%)
 - (c). Stateless v.s. stateful protocol. What is the benefits to keep “state” information for a network protocol (for example using cookies mechanism in

HTTP) and what is the major bad side for including “state” information in a network protocol? (3%)

(d). HTTP condition GET. What is the HTTP condition GET mechanism? What is the major benefit for condition GET? (3%)

(e). DNS record. A DNS resource record (RR) consists of name, value, type, and TTL(time-to-live). What does TTL means? Why we need TTL for a DNS RR record? (3%)

9. (12%) SDN technology. One of most striking networking technology innovations in recent years is SDN (software-defined networking). What are the unique features of SDN technologies compared with conventional approaches applied in non-SDN network devices? (6%) How to use a SDN switch to work as a NAT (network address translation) device? Please give a short description on the key steps. Suppose the internal network is 10.0.0.0/24, and the external gateway address is 140.121.100.5. (6%)