COMP9332 Network Routing and Switching
Solution of Self-assessed Tutorial for NAT

Q1. Which of the following addresses are globally unique?

(a) 192.167.5.6 (b) 192.168.5.6 (c) 172.17.10.2 (d) 172.19.11.3 (e) 172.15.2.3

A1. (a) and (e)

Q2. Does a basic NAT (NOT port mapped) need to modify any IP header fields other than the source or destination address fields? Why or why not?

A2. Header Checksum (16 bits) needs to be recalculated because of the changes made in the source/destination fields.

Q3. Does a basic NAT (NOT port mapped) need to modify any TCP header fields? Why or why not?

A3. No. The basic NAT does not use TCP port numbers.

Q4. What protocol fields, other than the IP address fields, a port mapped NAT may have to modify? Why?

A4. IP header checksum, TCP source/destination ports, TCP sequence number, TCP acknowledgment number, TCP checksum, FTP payload.

Q5. How many internal hosts can communicate with the same external host at the same time using a basic NAT configured with two global public IP addresses?

A5. 2

Q6. How many internal hosts can communicate with the same external host at the same time using a port mapped NAT configured with two global public IP addresses?

A6. A 16-bit port field could hold 2^{16} unique port numbers in the table. This allows 2^{16} internals hosts to communicate with a single external server at the same time for a single global IP address. With two global IP addresses, the answer is 2^{17}.

Q7. How many IP addresses are translated by a twice NAT when a packet leaves the network for the Internet?

A7. 2

Q8. How many IP addresses are translated by a twice NAT when a packet arrives at the network from the Internet?

A8. 2

Q9. A company has a registered domain name of www.maximum.com with 192.165.8.0/21 assigned as its address. The company runs a server called www.games.maximum.com with the address 192.165.8.5 assigned to it. Later, due to a provider switch, the company has been assigned a new address, 193.166.8.0/21. The old address block, 192.165.8.0/21, has been taken up by another company called www.minimum.com, which runs a server called www.games.minimum.com with the address 192.165.8.5 assigned to it.

(a) If someone on the Internet looks up the DNS for www.games.maximum.com, what address is likely to be returned to her?
(b) If someone on the Internet looks up the DNS for www.games.minimum.com, what address will be returned to her?
(c) If someone inside maximum.com looks up the DNS for www.games.minimum.com, what could be a possible address that will be returned to her?
(d) When a packet arrives from www.games.minimum.com to a client inside maximum.com, what could be the possible source and destination addresses be in the IP packet header?
(e) When a packet arrives from www.games.maximum.com to a client inside minimum.com, what could be the possible source and destination addresses be in the IP packet header?

A9.

(a) 193.166.8.5
(b) 192.165.8.5
(c) 192.168.8.5
(d) Source: 192.168.8.5, Destination: 192.165.8.1
(e) Source: 193.166.8.5, Destination: 192.165.8.1

Q10. R1 advertises the following networks to R2. If R2 wants to apply *address aggregation*, how many entries it will actually need in its routing table where R1 becomes the next hop? Show those entries.

Networks advertised by R1: 200.100.9.0/24, 200.100.12.0/24, 200.100.16.0/24, 200.100.8.0/24

A10. The first 23 bits in 200.100.8.0/24, 200.100.9.0/24 are the same. Hence these three addresses can be aggregated to the single entry 200.100.8.0/23. 200.100.12.0/24, 200.100.16.0/24 can be listed separately giving a total of 3 entries in the table where R1 is the next hop.