1. Consider the scenario below in which three hosts, with private IP addresses 10.0.1.10, 10.0.1.15, 10.0.1.23 are in a local network behind a NATted IoT gateway/router that sits between these three hosts and the larger Internet. IP datagrams being sent from, or destined to, these three hosts must pass through this NAT router. The router's interface on the LAN side has IP address 10.0.1.28, while the router's address on the Internet side has IP address 135.122.193.211.

[10+10+10+10 =40 Marks]
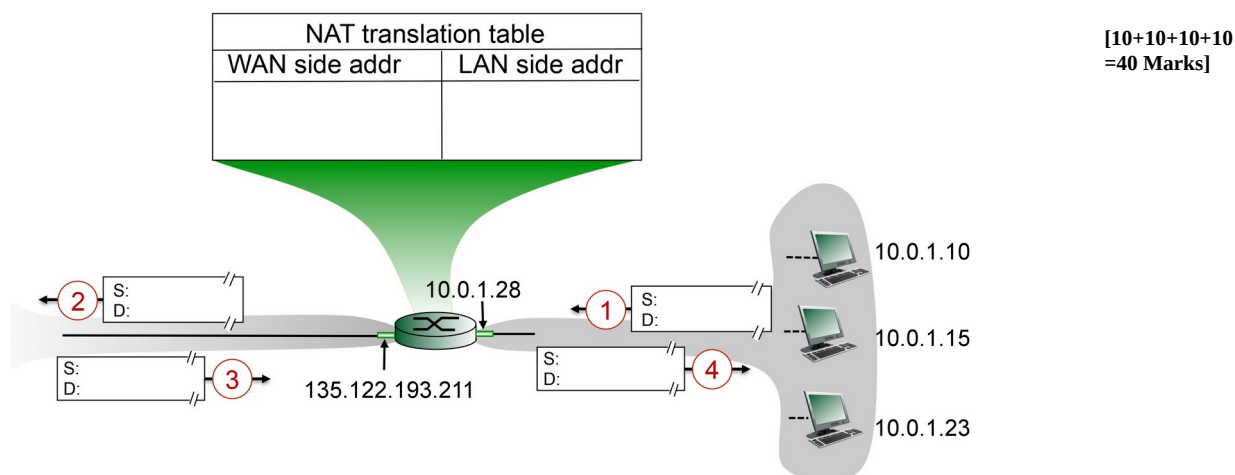
Suppose that the host with IP address 10.0.1.10 sends an IP datagram destined to host 128.119.172.186. The source port is 3465, and the destination port is 80.

1.1 Consider the datagram at step 1, after it has been sent by the host but before it has reached the NATted router. What are the source and destination IP addresses for this datagram? What are the source and destination port numbers in this IP packet?

source address of the IP datagram: 10.0.1.10
destination address of the IP datagram: 128.119.172.186
source port number for the TCP segment of the IP datagram: 3465
destination port number for the TCP segment of the IP datagram: 80

Host 10.0.0.10 has assigned an arbitrary source port number 3465 and sends the datagram to LAN. The datagram is received at the NAT router's right port.

1.2 Now consider the datagram at step 2, after it has been transmitted by the NATted router. What are the source and destination IP addresses? What are the source and destination port numbers?

source address of the IP datagram: 135.122.193.211
destination address of the IP datagram: 128.119.172.186
source port number for the TCP segment of the IP datagram: 5066
destination port number for the TCP segment of the IP datagram:80

After receiving the datagram from host 10.0.0.10, the NAT router generates a new source port number 5066 (not already in use within the NAT table) for the datagram and replaces the original source port number 3465 with the new source port number 5066. The traffic leaving the home router for the larger internet has the source IP of the NAT router which is 135.122.193.211, and thus the datagram's source IP address now changes to 135.122.193.211. The destination address and the port number remain the same.

1.3 Now consider the datagram at step 3, just before it is received by the NATted router. What are the source and destination IP addresses? What are the source and destination port numbers in this IP datagram?

source address of the IP datagram: 128.119.172.186
destination address of the IP datagram: 135.122.193.211
source port number for the TCP segment in the IP datagram: 80
destination port number for the TCP segment in the IP datagram: 5066
This arriving datagram was sent by remote host 128.119.172.186 in response to the datagram
sent by this NAT router in Step 2 above.

1.4 Last, consider the datagram at step 4, after it has been transmitted by the NATted router but before it has been received by the host. What are the source and destination IP address for this datagram? What are the source and destination port numbers being used in this IP datagram?

source address of the IP datagram: 128.119.172.186
destination address of the IP datagram: 10.0.1.10
source port number for the TCP segment of the IP datagram: 80
destination port number for the TCP segment of the IP datagram: 3465

When this datagram arrived at NAT router's left port from the Internet, the router indexed the NAT translation table using the destination IP address and destination port number to obtain the appropriate IP address(10.0.1.10) and destination port (3465) for the destination host in the home network. The router then rewrites the datagram's destination address and destination port number, and forwards the datagram into the home network.

2. Subnetting questions:

2.1. Enter the broadcast address for the network 10.88.0.0 with a subnet mask of 255.255.0.0:

10.88.255.255

2.2 What is the shorthand (/ notation) corresponding to a subnet mask of 255.255.240.0?

/20

2.3 What is the last valid host on the network 172.17.240.0/20

172.17.255.254