Robert Ignatowicz CSE 310 - HW 3

1.

Core router: 18.28.32.1/25

Subnet 1 router: 18.28.32.2/27
- Host 1: 18.28.32.3
- Host 2: 18.28.32.4

Subnet 2 router: 18.28.32.33/27
- Host 3: 18.28.32.34
- Host 4: 18.28.32.35

Subnet 3 router: 18.28.32.65/27
- Host 5: 18.28.32.66
- Host 6: 18.28.32.67

2.

Addresses forwarded to Router B: 18.0.192.0 - 18.0.255.255
Addresses forwarded to Router C: 18.0.224.0 - 18.0.255.255
Addresses forwarded to Router D: 18.0.128.0 - 18.0.191.255

A packet with a destination address 18.0.225.0 would be forwarded to Router C for the next hop because it has more matching prefix bits than Router B. Router B matches the first 18 bits of 18.0.225.0, while Router C matches the first 19 bits, so it is chosen due to Longest Prefix Matching.

3.

Network Address Translation allows hosts from inside a local network to connect with the outside world, but outside connections are not able to connect to that host unless there is another means of connection such as port forwarding or VPN. The gateway router in the local network has both an external public IP address and internal private IP address. The inbound connections only see the router as a single device with the public IP address, and cannot see the devices on the local network. The devices inside the network all have addresses within the range of private IP addresses which can only be accessed from inside the network, and communicate to the gateway router on the internal private IP address.

To give an example of NAT, suppose there is a router with the public IP address 18.28.32.1. The private gateway address is 192.168.0.1. Suppose there is a host with the address 192.168.0.2. When that host wants to communicate outside of the local network, the router chooses an outbound port and generates an entry in the NAT translation table for that local IP address. Let's say the source port on the host was 3000 and the outbound port is 5000. The NAT table would have a mapping between 192.168.0.2:3000 and 18.28.32.1:5000. After the NAT table entry is generated, whenever traffic comes to the router with a destination of 18.28.32.1:5000, that traffic is forwarded to 192.168.0.2:3000.

4.

Longest prefix matching is a way to determine which hop is next if an incoming packet's destination address is overlapping between multiple address spaces in a routing table. The way longest prefix matching works is the address space that has the most matching prefix bits to the destination address is chosen. Ternary Content Addressable Memory (TCAM) is a hardware that allows for very efficient longest prefix matching regardless of the size of the routing table. TCAM is useful because if you have a routing table with many entries, manually comparing all the address spaces to see which one has the longest prefix could take a while, but with TCAM it can be done in a single clock cycle.