Vidun Jayakody - Assignment 4

1. Consider a datagram networking using 8-bit host addresses. Suppose a router uses longest prefix matching.

   (a) (5 points) Consider a datagram networking using 8-bit host addresses. Suppose a router uses longest prefix matching.

Prefix Match	Interface	Number of Addresses	Address Range
00	0	$2^6 = 64$	0-63
010	1	$2^5 = 32$	64-95
011	2	$2^6 = 64$	96-127
10	2	$2^6 = 64$	128-191
11	3	$2^6 = 64$	192-255

   (b) (4 points) Repeat part (a) for the following forwarding table:

Prefix Match	Interface	Number of Addresses	Address Range
1	0	$2^7 = 128$	128-255
10	1	$2^6 = 64$	128-191
111	2	$2^5 = 32$	224-255
Otherwise	3	$2^7 + 2^5 = 160$	0-127, 192-223

2. Consider the network 108.17.154/23.

   (a) (2 points) What is the maximum number of interfaces that this network can support?

   There are 23 bits dedicated to the network portion, which means there are 32-23 = 9 host bits, or $2^9 = 512$ total interfaces (if these were hosts, there would only be 510 available as 2 of these addresses would go to the network address and broadcast address).

   (b) (6 points) Suppose we like to divide this network using a router that interconnects four subnets. Suppose that each of the four subnets is required to support the following number of interfaces:

Subnet number	Required to support
1	60 interfaces
2	60 interfaces
3	125 interfaces
4	250 interfaces
Total	495

   Can these constraints be satisfied? If yes, provide four subnet addresses (of the form a.b.c.d/x) that satisfy these constraints. If no, justify your answer.

   Note: For this question I'm going to assume interfaces $\neq$ hosts, meaning we *don't* have to account for network/broadcast addresses.

The first subnet needs to support 60 interfaces. The smallest power of 2 that supports this number is $2^6 = 64$, so our first subnet will have 64 addresses.

The second subnet also needs 60 interfaces, so that is another 64 addresses.

The third subnet needs 125, for which the smallest power of 2 is $2^7 = 128$ addresses.

The fourth and final subnet will have $2^8 = 256$ addresses.

The sum total of these addresses are $64+64+128+256 = 512$, which is within the maximum number of interfaces that the network can support, meaning the constraints *can* be satisfied. To find the subnet addresses of each of the subnets, we add the number of hosts to the end of the each subnet, starting at the network address like so:

Subnet 1	108.17.154.0/26
Subnet 2	108.17.154.64/26
Subnet 3	108.17.154.128/25
Subnet 4	108.17.155.0/24

(c) (6 points) Consider instead that we like to divide the network into two subnets, such that each support the following number of interfaces:

Subnet number	Required to support
1	5 interfaces
2	260 interfaces
Total	265

Can these constraints be satisfied? If yes, provide ~~four~~ two (typo?) subnet addresses (of the form a.b.c.d/x) that satisfy these constraints. If no, justify your answer.

For the first subnet, we need 5 interfaces, and the nearest power of 2 that accommodates for that is $2^3 = 8$, and a subnet mask of /29 (since 32 - 3 = 29).

The second subnet would need $2^8 = 256$ addresses, or a subnet mask of /24.

Subnet 1	108.17.154.0/29
Subnet 2	108.17.154.8/24