(1) What is “IP address” (what does each IP address represent)?

Each IP address is a (logical) unique identification of a network interface (NIC) installed to a host computer.

(2) If a domain has 25,000 host computers (i.e., needs 25,000 IP addresses) and if the domain is supposed to have 12 subnets, what is its subnet mask (answer in the standard “x.x.x.x” format, where ‘x’ is a decimal number between 0 and 255)? Assume that the 25,000 host computers are evenly distributed to 12 subnets.

Show all work (not much credit without showing your work).

- Each subnet should have: \( \text{ceiling}(25,000/12) = 2084 \) host computers.
- For the host addresses, they need: \( \text{ceiling}(\log_2(2084)) = 12 \) bits
- For the subnet address, they need: \( \text{ceiling}(\log_2(12)) = 4 \) bits
- For the domain address, they have 32 – (4 + 12) = 16 bits

Thus, the subnet-mask needs to cover the first 16 bits as:

“1111 1111.1111 1111.1111 0000.0000 0000” = “255.255.240.0”
(3) How many host computers can exist (no subnet) for a network domain that has “/18” CIDR block-prefix?

Show all your work (not much credit without showing your work)

\[ = 2^{(32-18)} = 2^{14} (= 16384) \text{ host computers} \]

(4) What is “subnet” for?

Subnet is making management (or assignments) of IP addresses easier for (human) network administrators.

(5) Why does each IP address consist of two addresses of “domain address” and “host address” (what is the motivation behind the design)?

“Domain address” makes each internet core-router on the way (those in the public internet) easier (faster for looking up the direction in a routing table) to find its path (or route) to its destination domain, while “host address” makes the internal routers or switches within a destination domain easier (faster for looking up the direction in either a routing table or a switching table) to find its way to a destination host computer in a domain.