Ch. 8 Project on Canvas Addressing & Subnetting Practice

Answer the following questions and where applicable show your work / calculations.

1. What is the public IPv4 address range for public Class A networks? (Hint: Reference Ch.3)
   The IPv4 address range for public Class A networks is 1.0.0.0 to 126.255.255.255

2. What is the default subnet mask for a Class A network?
   The default subnet mask for a Class A network is 255.0.0.0

3. What is the public IPv4 address range for public Class B networks?
   The IPv4 address range for public Class B networks is 128.0.0.0 to 191.255.255.255

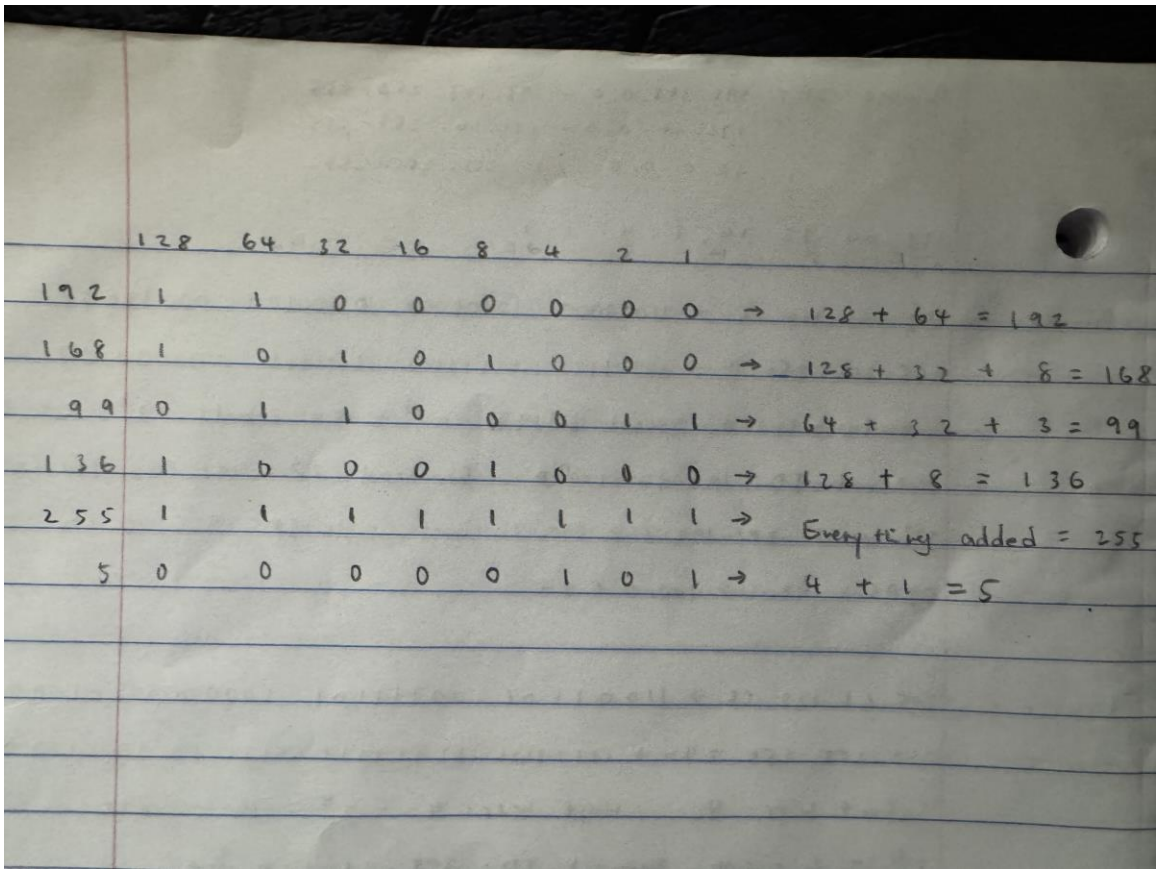
4. What is the default subnet mask for a Class B network?
   The default subnet mask for a Class B network is 255.255.0.0

5. What is the public IPv4 address range for public Class C networks?
   The IPv4 address range for public Class C networks is 192.0.0.0 to 223.255.255.0

6. What is the default subnet mask for a Class C network?
   The default subnet mask for a Class C network is 255.255.255.0

7. (3 points) What is the IPv4 address ranges reserved for private network (not used on the internet)? Hint: Reference Ch. 3 or RFC-1918
   The IPv4 address ranges reserved for private network are:
   10.0.0.0 through 10.255.255.255
   172.16.0.0 through 172.31.255.255
   192.168.0.0 through 192.168.255.255

8. (6 points) Convert the following from decimal to binary:
   a. 192 – 1 1 0 0 0 0 0 0
   b. 168 – 1 0 1 0 1 0 0 0
   c. 099 – 0 1 1 0 0 0 1 1
   d. 136 – 1 0 0 0 1 0 0 0
   e. 255 – 1 1 1 1 1 1 1 1
   f. 005 – 0 0 0 0 0 1 0 1



9. (18 points) A computer has the following Class C IP address and subnet:
   192.168.100.137 (11000000 10101000 01100100 10001001)
   255.255.255.192 (11111111 11111111 11111111 11000000)

   a. Is this a public or private IP?
      This is a private IP address, because it belongs to the 192.168.0.0 through 192.168.255.255 range

   b. Write the IP and subnet mask in CIDR notation.
      This IP in CIDR notation is 192.168.100.137/26, because there are 26 counted 1s in this subnet mask.

   c. How many subnet bits?
      There are 2 subnet bits, because 2 bits are borrowed from the host portion if the subnet masks.

   d. How many subnets can be created?
      In total, 2^2 = 4 subnets can be created.

   e. How many host bits?
      There are 6 host bits, because there's only 8–2 = 6 bits left in this subnet mask.

   f. How many usable hosts per subnet?
      There are 2^6 - 2 = 62 usable hosts per subnet.

g. What is the network ID?
The network ID is 192.168.100.128, because I converted both the IP, and the subnet mask addresses into binary and uses the AND operation:
11000000 10101000 01100100 10001001
11111111 11111111 11111111 11000000 AND
11000000 10101000 01100100 10000000

h. What is the broadcast IP?
The broadcast IP is 192.168.100.128 + 63 (Magic#) = 192.168.100.191

i. What is the first usable IP?
The first usable IP is 192.168.100.129, because 192.168.100.128 is the network address for this subnet.

j. What is the magic number?
The magic number is 2^6 – 1 = 63.

k. What is the network ID for subnet 1? Network ID: 192.168.100.128 (+63)

l. What is the broadcast IP for subnet 1? Broadcast ID: 192.168.100.191 (+1)

m. What is the network ID for subnet 2? Network ID: 192.168.100.192 (+63)

n. What is the broadcast IP for subnet 2? Broadcast ID: 192.168.100.255 (+1)

o. What is the network ID for subnet 3? Network ID: 192.168.100.0 (+63)

p. What is the broadcast IP for subnet 3? Broadcast ID: 192.168.100.63 (+1)

q. What is the network ID for subnet 4? Network ID: 192.168.100.64 (+63)

r. What is the broadcast IP for subnet 4? Broadcast ID: 192.168.100.127 (+1)

10. (8 points) The organization known as Skynet has grown rapidly over the last year. Originally a Class C network of 192.168.1.0/24 was large enough for the entire organization. Now Skynet requires approximately 1000 IP addresses. Using the existing 192.168.1.0/24 network and a new 10.0.0.0/8 network perform network segmentation using VLANs for the following departments. Remember to conserve IPs, but also leave some room for growth for each department. The following list shows the amount of host IPs required by department:

    Executive department requires 10 host IPs
    Accounting department requires 36 host IPs
    Sales department requires 64 host IPs
    HR department requires 8 host IPs
    R&D drones department requires 384 host IPs
    R&D AI department requires 200 host IPs
    R&D exoskeleton department requires 100 host IPs
    WAN connection requires 2 host IPs

Which VLAN ID & network subnet (written in CIDR notation) will be used for each of the following?

Network 192.168.1.0/24 has a Class C subnet of 255.255.255.0, and Network 10.0.0.0/8 has a subnet of 255.0.0.0, which is a Class A network.

Turn everything into binary:

192.168.1.0:	11000000	10101000	00000001	00000000
255.255.255.0:	11111111	11111111	11111111	00000000
10.0.0.0:	00001010	00000000	00000000	00000000
255.0.0.0:	11111111	00000000	00000000	00000000

a. Executive department (Requires 10)
   Network Subnet: 192.168.1.0/28
   Subnet Mask: 255.255.255.240
   VLAN ID: 10

   This Class C network and subnet, 192.168.1.0/24 is more than what this department needs. Therefore, we can borrow 4 bits from the host portion (/28 subnet), leaving with 2^4 = 16 hosts. The range is from 192.168.1.1 to 192.168.1.15 (14 usable IPs).

b. Accounting department (Requires 36)
   Network Subnet: 192.168.1.16/26
   Subnet Mask: 255.255.255.192
   VLAN ID: 20

   This Class C network and subnet, 192.168.1.0/24 is more than what this department needs. Therefore, we can borrow 2 bits from the host portion (/26 subnet), leaving with 2^6 = 64 hosts. The range is from 192.168.1.17 to 192.168.1.79 (62 usable IP).

c. Sales department (Requires 64)
   Network Subnet: 192.168.1.80/25
   Subnet Mask: 255.255.255.128
   VLAN ID: 30

   This Class C network and subnet, 192.168.1.0/24 is way more than what this department needs. Therefore, we can borrow 1 bit from the host portion (/25 subnet), leaving with 2^7 = 128 hosts. The range is from 192.168.1.81 to 192.168.1.143 (126 usable IP).

d. HR department (Requires 8)
   Network Subnet: 192.168.1.144/28
   Subnet Mask: 255.255.255.240
   VLAN ID: 40

   This Class C network and subnet, 192.168.1.0/24 is more than what this department needs, therefore, we can borrow 4 bits from the host portion (/28

subnet), leaving with 2^4 = 16 hosts. The range is from 192.168.1.145 to 192.168.1.159 (14 usable IP).

e. R&D drones department (Requires 384)
Network Subnet: 10.0.0.0/23
Subnet Mask: 255.255.254.0

VLAN ID: 50

We can use the Class A network and subnet in this department because it requires 384 hosts. However, 10.0.0.0/8 is way more than what it needs, therefore, we can borrow 15 bits from the host portion (/23 subnet), leaving with 2^9 = 512 hosts. The range is from 10.0.0.1 to 10.0.1.255 (510 usable IP).

f. R&D AI department (Requires 200)
Network Subnet: 10.0.2.0/24
Subnet Mask: 255.255.255.0
VLAN ID: 60

We can use the Class A network and subnet in this department because it's a larger department. However, 10.0.0.0/8 is way more than what it needs, therefore, we can borrow 16 bits from the host portion (/24 subnet), leaving with 2^8 = 256 hosts. The range is from 10.0.2.1 to 10.0.2.255 (254 usable IP).

g. R&D exoskeleton department (Requires 100)
Network Subnet: 10.0.3.0/25
Subnet Mask: 255.255.255.128
VLAN ID: 70

We can use the Class A network and subnet in this department because why not. However, 10.0.0.0/8 is way more than what it needs, therefore, we can borrow 17 bits from the host portion (/25 subnet), leaving with 2^7 = 128 hosts. The range is from 10.0.3.1 to 10.0.2.127 (126 usable IP).

h. WAN connection (Requires 2)
Network Subnet: 10.0.3.128/30
Subnet Mask: 255.255.255.252
VLAN ID: 80

We can use the Class A network and subnet in this department because Class C is typically meant for small area/usage, WAN is a large network, so Class A. However, 10.0.0.0/8 is way more than what it needs, therefore, we can borrow 22 bits from the host portion (/30 subnet), leaving with 2^2 = 4 hosts. The range is from 10.0.3.129 to 10.0.3.131 (2 usable IP).

11. (24 points) Draw a network diagram to depict the following with VLAN ID and subnets used: (Hint: Reference Diagrams Pg. 455, 463 & 468)
    a. 4 floor building (5 counting basement)

b. 1 router with 1 WAN interface (internet connection) and 1 LAN interface (basement)
c. Basement needs networking for WAN connection and R&D exoskeleton department
d. Floor 1 needs networking for sales and accounting departments
e. Floor 2 needs networking for HR and R&D AI departments
f. Floor 3 needs networking for R&D drones departments
g. Floor 4 needs networking for R&D drones department and executives
h. Identify which switch and router ports must be configured as 802.1Q trunk ports and access ports

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