CS 542 – Computer Networks I: Fundamentals
Fall 2023 HW1 (108 points)

Submission instructions

– Due date: Sunday, Oct. 29, 11:59 pm Central Time

– Late submissions and submissions violating these instructions will NOT be accepted.

– No handwritten submissions. No credit will be given for the handwritten submissions.

– Teamwork is allowed (max. 4 students/team). Individual submissions are also OK.

– Upload your HW (pdf format only) to Blackboard. Submissions in formats other than pdf will be disregarded. The Beacon students: upload your submissions to Lumina.

– One submission per team only. Write down names, A#, and section numbers of all the team members on the front page. Do not submit multiple copies of your HW (e.g. by each team member). It is very confusing and will be penalized. Clearly indicate how each team member contributed to your teamwork.

– Show your work and explain every step of your solution for full credit. Only partial credit will be given for a correct final answer with missing calculations, no supporting explanations or unclear justifications.

– My TAs Pranav Saji (psaji@hawk.iit.edu) and Aditya Sai Kolluru (akolluru@hawk.iit.edu) are responsible for grading this HW assignment. Feel free to ask questions is something is not clear
but don't send me or my TAs:
- Your partial solutions with inquiries "Is that what you expect?".
- Questions, the answers to, may give explicit hints on how to solve the HW problems.

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1. Please give and explain your answers to the questions below. **(5 points)**

a. What is the range of addresses of the 64th block of Class A? **(1 point)**

b. Consider fixed-length subnetting. What is the maximum number of created subnets if the desired number of subnets is: **(4 points)**

a. 2
b. 62
c. 122
d. 250

2. A network administrator uses the subnet mask 255.255.252.0 in the network 191.168.0.0. How many total subnets have been created, and what's the size of each subnet? Assume classful addressing. **(3 points)**

3. If you subnet the network 10.0.0.0 with a subnet mask of 255.255.240.0, what's the maximum number of subnets and hosts per subnet? Assume classful addressing. **(3 points)**

4. A network 10.5.6.0/24 is subnetted with a mask of 255.255.255.192. How many subnets are created and what is the third subnet's last usable IP address? **(4 points)**

5. An ISP has the block 192.100.0.0/16 and wants to allocate subblocks to organizations, each with 500 IP addresses. How many subblocks can be provided and what is their mask? **(4 points)**

6. Find the network address, the direct broadcast address, and the number of addresses in the network, if one of the addresses is 183.70.230.23/20. **(4 points)**

7. Divide the network 126.168.24.0/24 into 4 subnets. What is the subnet mask? Give the range of IP addresses for each subnet. Which of these addresses can not be assigned to hosts?**(5 points)**

8. Can the following IP addresses be assigned to a host? Explain your answers. **(6 points)**

a. 255.255.255.255 **(1 point)**
b. 127.32.45.0 **(1 point)**
c. 43.0.0.0 (assume classless addressing; note that the mask is not given) **(2 points)**
d. 1.64.126.32 (assume classless addressing; note that the mask is not given) **(2 points)**

9. The block 172.16.0.0/16 is given. Create 3 subnets with the number of hosts given below. Find the subnet addresses and the subnet masks for each subnet. **(6 points)**

a. 1st subnet: 2000 hosts
b. 2nd subnet: 500 hosts
c. 3rd subnet: 100 hosts

10. An ISP is allocated the block 128.45.32.0/24. This ISP needs to assign 16 addresses per customer. Find the mask for each of these subnets and give the first and last usable IP addresses for the first three subnets. **(4 points)**

11. A certain company wants to create two subnets to meet its network requirements. Find the suffix and prefix lengths for these subnets, one with 67 addresses and the other with 34 addresses. **(3 points)**

12. The block of addresses 146.157.224.0/19 is divided into 3 subblocks. The 1st subblock is allocated to a group of 12 customers, each of which needs 64 addresses. The 2nd subblock is allocated to a group of 9 customers, each of which needs 32 addresses. The 3rd subblock is allocated to a group of 5 customers, each of which needs 16 addresses. **(16 points)**

a. Design the three subblock. Find the mask for each of them (i.e. for each subblock not for each customer). **(6 points)**

b. What is the range of addresses (find the first and last of them) allocated to the 10th customer in the 1st subblock? **(2 points)**

c. What is the range of addresses (find the first and last of them) allocated to the 5th customer in the 2nd subblock? **(2 points)**

d. What is the range of addresses (find the first and last of them) allocated to the 3rd customer in the 3rd subblock? **(2 points)**

e. How many addresses are still available after this allocation in each of the three subblocks? **(3 points)**

f. How many addresses are still available after this allocation in the entire original block? **(1 point)**

13. Is the delivery direct or indirect? **(4 points)**

a. A host with the IP address 131.16.192.4/16 sends a packet to a host with the IP address 132.16.128.19/18. Explain your answer.

b. A host with the IP address 87.136.56.126/25 sends a packet to a host with the IP address 87.136.56.111/25. Explain your answer.

14. Why do we need both the IP addresses and the physical addresses in networking? **(3 points)**

15. For the routing tables given below, draw the network configuration including <u>all</u> the 4 routers (i.e. not each router separately). Indicate the next-hop addresses in the figure. **(12 points)**

R1:

Mask	Network Address	Next-Hop Address	Interface Number
/24	223.153.9.0	----------	M0
/24	200.156.72.0	----------	M1
/16	191.194.0.0	12.0.213.12	M2
/16	135.65.0.0	223.153.9.126	M0
/16	128.98.0.0	12.0.213.12	M2
/8	12.0.0.0	----------	M2
/8	126.0.0.0	223.153.9.126	M0
Default	Default	unspecified	M3

R2:

Mask	Network Address	Next-Hop Address	Interface Number
/16	191.194.0.0	----------	M0
/16	128.98.0.0	----------	M1
/8	12.0.0.0	----------	M2
Default	Default	12.163.31.4	M2

R3:

Mask	Network Address	Next-Hop Address	Interface Number
/16	135.65.0.0	----------	M0
/8	126.0.0.0	----------	M1
Default	Default	135.65.13.6	M0

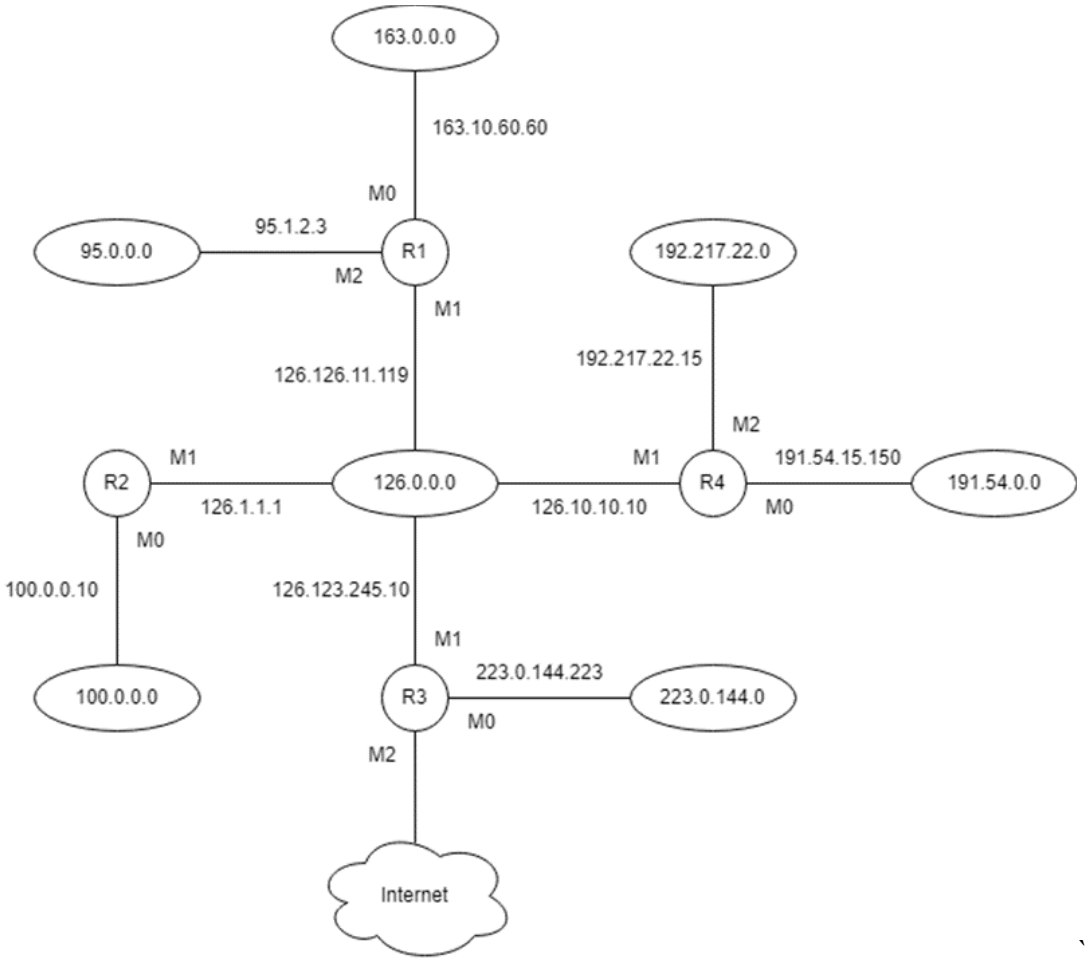
R4:

Mask	Network Address	Next-Hop Address	Interface Number
/24	223.153.9.0	----------	M0
/16	135.65.0.0	----------	M1
/8	126.0.0.0	135.65.172.11	M1
Default	Default	223.153.9.1	M0

16. Consider the network configuration given below. Assume classful addressing. **(14 points)**

a. Are there any errors in this figure? If so, correct them. **(2 points)**

b. Create a routing table for each router given in this figure. Indicate class, network address, next-hop address and interface number in each routing table. **(12 points)**



17. Consider the network configuration given above in Question 16. Assume classful addressing. Explain how the following packets are routed in this network (consider the entire network, not a single router). **(6 points)**

a. Host 100.235.37.18 sends a packet to destination 191.54.17.05
b. Host 192.217.22.173 sends a packet to destination 223.0.144.2
c. Host 95.12.234.7 sends a packet to destination 127.201.165.11

18. Convert the hexadecimal IP address 0xC0A801A2 to the dotted decimal and binary notations. Determine the class of this address in each of these notations. **(4 points)**

19. Convert the decimal number 218892292 to the base 256 numbering system. **(2 points)**