APPENDIX H

Practice for Chapter 20: Variable-Length Subnet Masks

Practice Problems

This appendix includes two varieties of VLSM practice problems related to Chapter 20, "Variable-Length Subnet Masks." The first type of problem lists pairs of IP addresses and masks from a network, and your job is to discover whether any of the subnets implied by those addresses/masks overlap. The second problem starts with a list of existing subnets, and your job is to find the numerically lowest new subnet ID that could be added to that internetwork for a given mask.

Note that you can find additional practice at the author's CCENT and CCNA blog, which is linked from the author's website, www.certskills.com.

Practice Finding VLSM Overlaps

Table H-1 lists three practice problems where you can look for VLSM overlaps. Start with the five IP addresses listed in a single column, and then follow the three-step process outlined in Chapter 20 to find any VLSM overlaps. The answers can be found later in this appendix, in the section "Answers to Practice Finding VLSM Overlap Problems."

Table H-1 VLSM Overlap Practice Problems

Problem 1	Problem 2	Problem 3
10.8.114.25/22	172.20.1.237/30	192.168.1.10/27
10.8.100.99/20	172.20.1.225/28	192.168.1.100/27
10.8.104.99/24	172.20.1.254/29	192.168.1.70/29
10.8.77.33/19	172.20.1.222/27	192.168.1.190/30
10.8.117.21/30	172.20.1.129/27	192.168.1.150/26

Practice Adding New VLSM Subnets

Your boss wants you to add a subnet to an existing design. The existing design already has these five subnets:

172.16.0.0/20

172.16.20.0/22

172.16.32.0/21

172.16.18.240/30

172.16.18.0/28

The boss cannot decide among five competing subnet masks. However, the boss wants you to practice VLSM and plan the subnet ID he would use for each of those five possible masks. He tells you that the new subnet ID must be part of Class B network 172.16.0.0, that the new subnet must not overlap with the original five subnets, and that the new subnet ID must be the numerically lowest possible subnet ID (without breaking the other rules). Pick the one subnet ID you would plan to use based on each of the following mask choices by the boss:

1. /30
2. /23
3. /21
4. /26
5. /20

The answers appear later in this appendix, in the section "Answers to Practice Adding New VLSM Subnets Problems."

Answers

Answers to Practice Finding VLSM Overlap Problems

This section lists the answers to the three practice problems in the section "Practice Finding VLSM Overlaps," listed earlier in Table H-1. Note that the tables that list details of the answer reordered the subnets as part of the process.

In Problem 1, the second and third subnet IDs listed in Table H-2 happen to overlap. The second subnet's range completely includes the range of addresses in the third subnet.

Table H-2 VLSM Overlap Problem 1 Answers (Overlaps Highlighted)

Reference	Original Address and Mask	Subnet ID	Broadcast Address
1	10.8.77.33/19	10.8.64.0	10.8.95.255
2	10.8.100.99/20	10.8.96.0	10.8.111.255
3	10.8.104.99/24	10.8.104.0	10.8.104.255
4	10.8.114.25/22	10.8.112.0	10.8.115.255
5	10.8.117.21/30	10.8.117.20	10.8.117.23

In Problem 2, the third and fourth subnets in Table H-3, listed in sequential order by subnet ID, overlap. The third subnet's range completely includes the range of addresses in the fourth subnet. Also, the two overlapping subnets have the same subnet broadcast address, making the overlap more obvious.

Table H-3 VLSM Overlap Problem 2 Answers (Overlaps Highlighted)

Reference	Original Address and Mask	Subnet ID	Broadcast Address
1	172.20.1.129/27	172.20.1.128	172.20.1.159
2	172.20.1.222/27	172.20.1.192	172.20.1.223
3	172.20.1.225/28	172.20.1.224	172.20.1.239
4	172.20.1.237/30	172.20.1.236	172.20.1.239
5	172.20.1.254/29	172.20.1.248	172.20.1.255

In Problem 3, the last two subnets in Table H-4, listed in sequential order by subnet ID, overlap.

Table H-4 VLSM Overlap Problem 3 Answers (Overlaps Highlighted)

Reference	Original Address and Mask	Subnet ID	Broadcast Address
1	192.168.1.10/27	192.168.1.0	192.168.1.31
2	192.168.1.70/29	192.168.1.64	192.168.1.71
3	192.168.1.100/27	192.168.1.96	192.168.1.127
4	192.168.1.150/26	192.168.1.128	192.168.1.191
5	192.168.1.190/30	192.168.1.188	192.168.1.191

Answers to Practice Adding New VLSM Subnets Problems

This section lists the answers to the five practice problems in the earlier section "Practice Adding New VLSM Subnets."

All five problems for this section used the same set of five preexisting subnets. Table H-5 lists those subnet IDs and subnet broadcast addresses, in sequential order based on subnet ID. The list defines the lower and higher end of the range of numbers in each subnet.

Table H-5 Preexisting Subnets for the Add a VLSM Subnet Problems in This Appendix

Subnet	Subnet Number/Mask	Broadcast Address
1	172.16.0.0/20	172.16.15.255
2	172.16.18.0/28	172.16.18.15
3	172.16.18.240/30	172.16.18.243
4	172.16.20.0/22	172.16.23.255
5	172.16.32.0/21	172.16.39.255

The rest of the explanations follow the five-step process outlined in Chapter 20 in the section, "Adding a New Subnet to an Existing VLSM Design," except that the explanations ignore Step 3, because Step 3's results in each case are already listed in Table H-5.

Problem 1

Step 1. The problem statement tells us to use /30.

Step 2. The subnets would be 172.16.0.0, 172.16.0.4, 172.16.0.8, and so on, counting by 4 in the fourth octet and counting by 1 in the third octet.

Step 4. Many possible /30 subnets overlap: all 64 that begin 172.16.0, all 64 that begin 172.16.1, and so on, through all the subnets that begin 172.16.15 because the first existing somewhat-large subnet has a range from 172.16.0.0 to 172.16.15.255.

Step 5. 172.16.16.0/30 is the numerically lowest new subnet number that does not overlap with the existing subnets.

Problem 2

Step 1. The problem statement tells us to use /23.

Step 2. The subnets would be 172.16.0.0, 172.16.2.0, 172.16.4.0, 172.16.6.0, and so on, counting by 2 in the third octet.

Step 4. The first eight such subnets (through subnet 172.16.14.0/23) overlap with the first existing subnet. The first subnet ID that might not overlap would be 172.16.16.0, then 172.16.18.0, and so on.

Step 5. 172.16.16.0/23 is the numerically lowest new subnet number that does not overlap with the existing subnets.

Problem 3

Step 1. The problem statement tells us to use /21.

Step 2. The subnets would be 172.16.0.0, 172.16.8.0, 172.16.16.0, 172.16.24.0, and so on, counting by 8 in the third octet.

Step 4. The first two new possible subnets (172.16.0.0/21, 172.16.8.0/21) overlap with the first existing subnet. 172.16.16.0/21 overlaps with three other existing subnets, and 172.16.32.0/21 overlaps with the last subnet listed in Table H-5.

Step 5. 172.16.24.0/21 is the numerically lowest new subnet number that does not overlap with the existing subnets.

Problem 4

Step 1. The problem statement tells us to use /26.

Step 2. The subnets would be 172.16.0.0, 172.16.0.64, 172.16.0.128, 172.16.0.192, 172.16.1.0, 172.16.1.64, and so on, counting by 64 in the fourth octet and by 1 in the third octet.

Step 4. All the beginning /26 subnets overlap with the large first existing subnet (172.16.0.0/20). Although you could write down all the /26 subnets, you would need to write down 64 of these subnet numbers before getting to 172.16.16.0, which is the first number past the range for the first existing subnet.

Step 5. 172.16.16.0/26 is the numerically lowest new subnet number that does not overlap with the existing subnets.

Problem 5

Step 1. The problem statement tells us to use /20.

Step 2. The subnets would be 172.16.0.0, 172.16.16.0, 172.16.32.0, 172.16.48.0, 172.16.64.0, and so on, counting by 16 in the third octet.

Step 4. The first three subnets overlap with existing subnets per the details in Table H-5.

Step 5. 172.16.48.0/20 is the numerically lowest new subnet number that does not overlap with the existing subnets.