Indian Institute of Technology Kharagpur

Department of Computer Science and Engineering

Class Test-4, Spring 2020-21

Computer Networks (CS31006)

Students: 155 **Date**: 27-March-2021

Full marks: 30 **Time**: 60 minutes

Credit: 20%

INSTRUCTIONS: This is an OPEN-BOOK, OPEN-NOTES test. Please write your answers in a text file/.doc file, convert it to PDF, and submit this PDF file containing ONLY YOUR ANSWERS on Moodle. PLEASE DO NOT SUBMIT SCANNED HAND-WRITTEN ANSWERS, SUCH ANSWER-SCRIPTS WILL NOT BE GRADED. DO NOT FORGET TO WRITE YOUR NAME AND ROLL NUMBER AT THE TOP OF YOUR ANSWER SHEET. ANY DETECTED CASE OF PLAGIARISM WILL BE DEALT WITH STRICTLY, WITH ALL THE IMPLICATED STUDENTS RECEIVING ZERO IN THIS TEST. You may use calculators if required. This question paper contains two pages. ANSWER ALL QUESTIONS.

1. Assume that you have been appointed as the network administrator of Leo University, which have been established very recently. The university administrators have come up with a new campus. The campus currently houses 6 different blocks – (i) Administration, (ii) Hostel-1, (iii) Hostel-2, (iv) Residential, (v) Academic-1, (vi) Academic-2. The Computer Center of the university is within the Administration Block. Based on the current network planning of the institute, you found that each of the above six blocks need following numbers of IP addresses –

   - Administration – N
   - Hostel-1 – 2N
   - Hostel-2 – 3N
   - Residential – N
   - Academic-1 – 5N
   - Academic-2 – 6N

   Here, N is the number generated from your roll number as follows. If you roll number is 18CS30021, then take N=3002; i.e. take the 4 digits after "CS". Similarly, if your roll number is 18CS10001, then N=1000.

   Additionally, you have the following constraints for designing the network of the University.

   - Each of the above six blocks should be in separate CIDR subnets. Therefore, there will be a separate gateway router for each of the six blocks. The gateway router of Leo University directly connects to the gateway routers of these individual blocks.
   - If needed, you can create additional subnets within the blocks. However, the university has limited funds, so you should minimize the cost by considering the following policies.
     - Do not waste more than 100 IPs within a subnet. For example, if a subnet needs 700 IP addresses, then instead of taking 10 bit host addresses (that supports 1024 IP addresses), create 2 subnets – one with 500 number of hosts (needs a 9 bit host address), and another with 200 number of hosts (needs 8 bit host addresses).
     - Do not create the subnets unnecessarily, as it will need additional routers. Only create the subnets when the number of IP addresses wasted are more than 100.

   Design the network for the Leo University. Answer the following questions.

   (a) How many different subnets will you create under each of the above six blocks? What will be the maximum number of hosts (maximum number of IP addresses) needed in each of those subnets under the six blocks?

(b) What will be the subnet masks for the gateway routers of the six different blocks?

(c) What will be the subnet mask for the gateway router of Leo University?

(d) Assume that you get the Internet connection from NKN. NKN has available blocks of IP addresses under the following subnet – 13.0.0.0/8. NKN allocates a block to Leo University from this subnet. Write down a feasible network IP that can be allocated to the Leo University based on your requirement.

(e) With the above network IP, what will be the subnet IPs for the subnets of the six different blocks?

(f) Based on the above IP allocation, write down the CIDR Routing Table for the gateway router of Leo University. Assume that the gateway router directly connects to the NKN gateway interface GW_NKN. In the routing table, only show the network IP, Subnet Mask, and the Next Hop field. The Next Hop can be written as GW_ADMIN, GW_H1, GW_H2, GW_RES, GW_AC1, GW_AC2, which are the IP address alias for the incoming interface of the gateway routers of the Administration, Hostel-1, Hostel-2, Residential, Academic-1, and Academic-2 blocks, respectively, which interconnects those gateway routers with the university gateway router.

Write down the answers of the above questions clearly with the corresponding justifications. Note that you should justify your answer to claim for the corresponding marks.

[6 + 6 + 2 + 2 + 3 + 6 = 25]

2. Assume that you have a network graph where S is a sink node. You can use the centralized Bellman-Ford Algorithm to find out the shortest paths from all other nodes to S, but with Distance Vector routing, you can only compute the shortest path from S to all other nodes – why? Although the RIP uses Distance Vector routing, it limits the maximum number of hops in a network to 16 – why?

[3+2 = 5]