INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Department of Computer Science and Engineering

Subject Code: CS31204
Subject Name: Computer Networks
Date: 09th April 2025

Class Test 2
Full Marks: 25
Time: 1 Hour

Instructions:

- Answer all the questions. The answers should be precise and to the point.
- Write your answer at the designated spaces only. Marks won't be awarded for answers written elsewhere.
- Write your assumptions clearly, if any. No queries will be entertained during the exam hour.

1. A router is running a classful routing protocol (e.g., RIPv1 or IGRP), which does not support subnet masks in updates. It receives the following route updates:

Network Advertised	Next Hop Interface	Next Hop IP
192.168.1.0	eth0	10.0.0.2
192.168.2.0	eth1	172.16.0.2

Now, the router receives a packet destined for IP address 192.168.3.5. Assume no other routes exist in the routing table. What will the router do with the packet? Justify your answer. **[3 Marks]**

192.168.x.x belongs to Class C IP address. Default subnet mask of 255.255.255.0 (/24).

With this subnet mask, 192.168.3.5 belongs to the network IP 192.168.3.0. This route entry is not there in the table. So, the router will drop the packet

2. An ISP has been allocated the address block 200.10.0.0/22. It needs to assign IP ranges to 4 customers as follows: Customer A (100 hosts), Customer B (50 hosts), Customer C (25 hosts), Customer D (10 hosts). How should the ISP allocate subnets to the customers using CIDR so that:
   - No IPs are wasted unnecessarily
   - The addresses remain contiguous **[8 Marks]**

Customer	Needed Host	Required Block Size	CIDR Subnet Mask
A	100	128	/25
B	50	64	/26
C	25	32	/27
D	10	16	/28

Customer A: 200.10.0.0/25
Customer B: 200.10.0.128/26
Customer C: 200.10.0.192/27
Customer D: 200.10.0.224/28

NB: There can be other solutions. Check the solution while marking. All-zero and All-one subnets can be used. But the addresses need to remain contiguous.

3. (a) With an example, explain what are the issues of All-Zero and All-One subnets if variable-length subnet mask (VLSM) is not used in the routing table formation. (b) With the modern routing algorithms like RIPv2, OSPF, etc. supporting CIDR (Classless Inter-domain Routing), RFC 1878 (Variable Length Subnet Table For IPv4) recommends that All-Zero and All-One subnets should be usable. Explain how CIDR-enabled routing eliminates the issues of All-Zero and All-One subnets. **[3+2 = 5 Marks]**

(a) Check the slides – we discussed in the class (Broadcast address and Network address of the parent network and the subnet become the same)

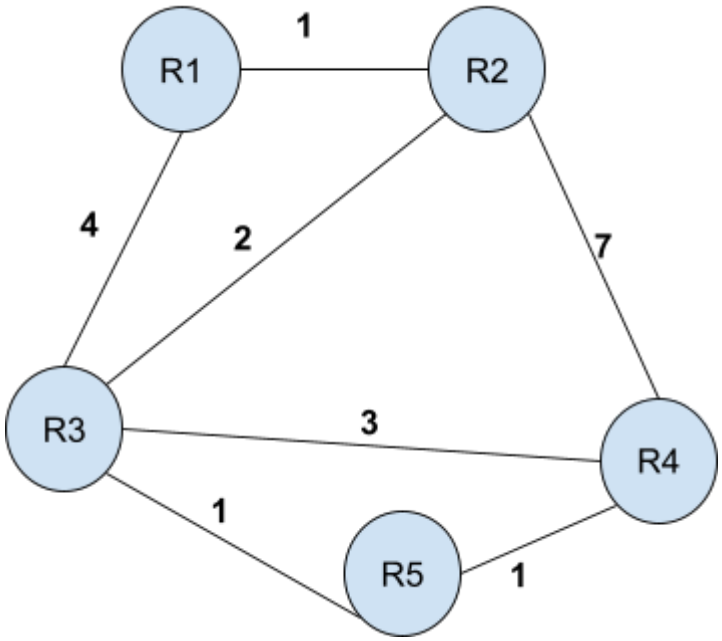
(b) CIDR (Classless Inter-Domain Routing) allows: (i) Arbitrary subnet mask lengths (not restricted by class A/B/C), (ii) Transmission of subnet masks in routing updates, (iii) Efficient IP address space utilization through VLSM (Variable Length Subnet Masking). CIDR-enabled protocols like RIPv2, OSPF, etc. include the subnet mask with every route advertisement. This eliminates ambiguity — routers know exactly which subnet is being referred to. There's no need to infer subnet boundaries or mask lengths based on class. Since all subnets are now clearly defined with explicit masks, the first (all-zeros) and last (all-ones) subnets are treated just like any other.

4. (a) You are given the following Link-State Advertisements (LSAs) received by router R1. Each LSA describes the advertising router and the list of routers it is directly connected to, along with the cost of the link.
   - R1: R2 (cost 1), R3 (cost 4)
   - R2: R1 (cost 1), R3 (cost 2), R4 (cost 7)
   - R3: R1 (cost 4), R2 (cost 2), R4 (cost 3), R5 (cost 1)
   - R4: R2 (cost 7), R3 (cost 3), R5 (cost 1)
   - R5: R3 (cost 1), R4 (cost 1)

   Draw the network topology graph based on the LSAs. From router R1, use the link-state database to compute the shortest path to R5 (based on total cost)

   (b) Why distance vector routing form a source-rooted tree rather than a sink tree? **[4+3+2 = 9 Marks]**

(a)



The shortest path is R1-R2-R3-R5 (Cost 1+2+1 = 4)

[The steps for the Dijkstra's Algo need to be shown, else two marks will be deducted. The question is asking to compute the shortest path from the Link state database – so, how Dijkstra's algo uses the link state database to compute the path needs to be shown.]

(b) The routing table is constructed from the router perspective – the shortest path from the current router (source) to other subnets – therefore, a source tree is more practical. Also, routers advertise what they know about reaching other destinations. So each node builds a map of how to reach others, not how others reach it. Finally, as we lack the information about the global topology, it cannot compute a tree rooted at a destination (sink) because it doesn't know who is connected to whom across the whole graph. Consequently, it cannot simply use the convergence criteria for Bellman-Ford (loop n-1 rounds for n nodes) to reach the convergence.