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BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination : Semester Final
Duration: 2 Hours

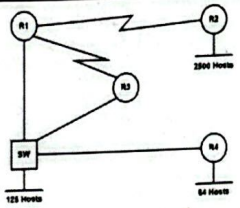
Semester: Spring 2025
Full Marks: 70

CSE421 / EEE465 : Computer Networks
Answer Sections A, B and C as per instructions given. (Pages: 3)
Figures in the right margin indicate marks

Name:	ID:	Section:

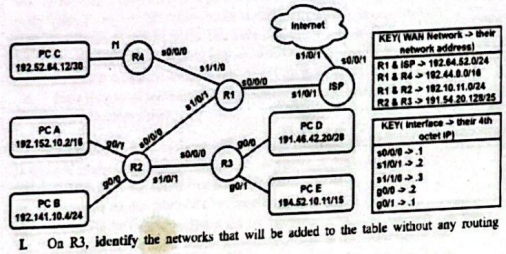
SECTION A [All questions of this section are MANDATORY] - 40 MARKS

Q1 Your company gave you a broadcast address of 7.16.255.255/18. Your company network needs to be divided into different subnetworks. The topology for your company network is shown on the side. **The number of hosts given in the topology only includes end devices.** — 3 + 10 + 2



[CO3] I. **Find** the network address.
[CO3] II. **Apply** VLSM using the network address from (I) to create the sub network addresses for the topology shown efficiently.
[CO3] III. **Calculate** the number of IP addresses that will be wasted for the R4 LAN.

Q2 — 3 + 4 + 4 + 3 + 3



[CO2] I. On R3, **identify** the networks that will be added to the table without any routing configuration.
[CO3] II. **Configure** a directly attached static route on R2 to reach R4 LAN with AD 50
[CO3] III. **Configure** a recursive route so that a S* entry is added in R1's routing table. **Identify** the significance of S*.
[CO2] IV. **Determine** the AD of a back up route for III.

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[CO2] V. R4 is discarding the packet whose destination IP is 172.42.10.4. **Deduce** the reason behind this.

Q3 A packet of size **2584 bytes** including **32 bytes** of header was fragmented for transmitting in a link with MTU=X **bytes**. The **9th** packet has a size of **272 bytes.** It also has its MF bit set. — 2 + 3 + 3

[CO3] I. **Calculate** the value of X.
[CO3] II. **Calculate** the fragment offset for the 7th packet.
[CO3] III. **Find out** the total number of fragmented packets.

END OF SECTION A

[CO3] SECTION B [Answer ANY TWO out of THREE in this section] - 12 MARKS

Q4 Refer to the topology given in Q2, all the routers are running **Distance Vector Routing** Algorithm. The routers are supposed to share their information with their neighbors. **Determine** how R2 will know about its neighbors to send its information. In the first iteration, **find out** what kind of information R2 will send. — 4 + 2

Q5 **Apply** your knowledge of IPv6 address formatting to transform and **simplify** the following addresses into their shortest possible form according to IPv6 rules. Also, **identify** the type of address and **explain** in one sentence the purpose of that address type. — 3 + 3

I. 2001:0db8:12af:0000:0000:0000:0a20:0004
II. 0000:0000:0000:0000:0000:0000:0000:0001

Q6 A university lab computer can successfully ping another laptop in the same building, but it fails when trying to ping a server on the internet. — 2 + 4

I. Give two possible reasons why the computer cannot ping the internet server.
II. Can a network admin use ICMP tools to determine whether the problem is inside or outside the campus network? **Explain** which ICMP tools are used to determine the external and internal issues.

END OF SECTION B

[CO2] SECTION C [Answer ANY THREE out of FIVE in this section] - 18 MARKS

Q7 In the IPv4 header, the **Total Length** field is 16 bits, while the **Fragment Offset** field is only 13 bits. — 6

I. How does the 13-bit Fragment Offset represent the position of a fragment accurately without losing information?
II. What is the purpose of the **Identification** field in fragmentation and reassembly?

Q8 When a PC connects to a DHCP-enabled network, it initially broadcasts a message to look for available DHCP servers. — 6

I. Why does the PC use a broadcast message instead of a unicast at this stage?
II. What kind of information does the PC receive in response, and how does it reply?

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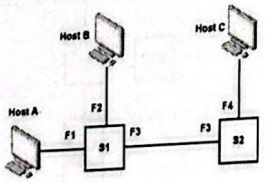
Q9 A student project web server is hosted inside a university computer lab at private IP address **10.10.5.50**, listening on **port 8080**. The lab is connected to the internet via a router that uses NAT with a public IP address. When the student shares the public IP with a recruiter to view the project remotely, the recruiter reports that the link does not work. — 6

I. Why can't the recruiter access the server using the public IP address?
II. What network configuration should be set up on the router to make the server accessible from outside the university?

Q10 IPv6 has a larger base header than IPv4 (40 bytes vs. 20 bytes), yet it is considered more efficient for modern networking. How does IPv6 improve processing compared to IPv4? — 6

Q11 — 6



Host A (IP: 192.168.1.10, MAC: AA-AA-AA-AA-AA-AA), Host B (IP: 192.168.1.12, MAC: BB-BB-BB-BB-BB-BB) and Host C (IP: 192.168.1.20, MAC: CC-CC-CC-CC-CC-CC) are connected according to the topology on the side. Initially, all ARP and MAC tables are empty. Host A wants to send a message to Host C.

I. What kind of ARP packet (mention source and destination MAC address) will Host A generate, and how will the switches process it?
II. Switches are termed "plug-and-play". Briefly explain the significance.

END OF SECTION C

THE END

Why did the network admin go broke?
Too many dropped packets.

Spring 25 : set A

TOPIC NAME : Assignment-2

DAY :

TIME : DATE : / /

Name: Nahi Mumtaj

ID : 18221052

Sec : 23

EEE465 / CSE 421

Assignment -2

Q-1/Ans: i) Given broadcast address : 7.16.255/18

Network address :

here /18 is subnet mask, 32 - 18 = 14 host bit

1111 1111. 1111 1111. 1100 0000. 0000 0000

subnet mask = 255.255.192.0 → /18 ; bit are for network

here in 3rd octate 1100 0000, 64 is the block size.

Broadcast 255 lies in this range 255 - 192

∴ Network address : 7.16.192.0/18

[here, network address always will be first value of the block.

Broadcast address always will be the last value of the block.

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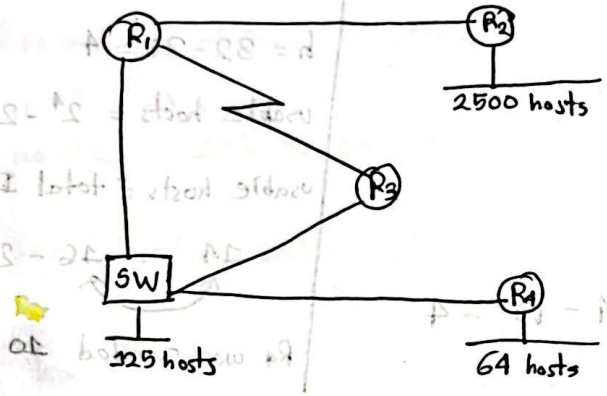
ii) Applying VLSM



Network	Required Hosts	Subnet	Usable Hosts
R_1	100	/25	126
R_2	50	/26	64
R_3	25	/27	30
R_4	10	/28	14
R2P Links	2 each	/30	2

Subnet Allocation :

Subnet	Address
R_1 LAN	7.16.192.0/25
R_2 LAN	7.16.192.128/26
R_3 LAN	7.16.192.224/28
R_1-R_2	7.16.192.240/30
R_2-R_3	7.16.192.244/30
R_3-R_4	7.16.192.248/30

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iii) for LAN – R4 ; need least 10 usable IP

Subnet : /28 → 16 IPs total

usable : 14

Required : 10

∴ wasted IPs = 14 – 10 = 4

/28 → here usable hosts = $2^h - 2$ ← total IP

1 network address

1 broadcast address

h = 32 – 28 = 4

usable hosts = $2^4 - 2 = 16 - 2 = 14$

usable hosts = total IP – 2

14 = 16 – 2

R4 was needed 10 hosts

Ans. No-2(i) R3 will automatically adds on because R3 is directly connected to routes ; it requires no configuration.

→ Directly connected to LAN

→ Point to Point Links.

Three active interface of R3 :

1. g0/0 → R2 ; WAN ; 194.54.20.128/25
2. g0/1 → PC E ; LAN : 194.52.10.0/25
3. s0/0/0 → R1 ; WAN ; 192.44.50.0/24

(ii) Directly attached static route on R2 to reach R4

Toward R1 ; interface s0/0/0

Next hop IP : .1

~~Toward R1 ; interface s0/0/0~~

~~Next hop IP~~ :

ip route 192.52.64.12 ~~255.255.255.224~~ 255.255.255.252 <next-hop> 50

destination subnet interface AD

ip route 192.52.64 255.255.255.255 s0/0/0 50

here, PC – C ip : 192.52.64.12/30

∴ Network IP ; 192.52.64.12

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iii) here, R_4 LAN : 192.52.64.12/30 is the destination

ISP side → 192.64.52.1 is next hop

∴ Recursive static routing on R_1 :

ip route 192.52.64.12 255.255.255.252 192.64.52.1

Routing table entry will be : S* 192.52.64.12/30 [1/0] via 192.64.52.

we know, S* is for default static route. Default static routing usually used when no more specific route is available.

Default static route indicates recursive loop-up, so that next hop IP must be resolved.

iv Here, backup route must have higher AD than primary route. From given if interface, primary route AD is 1.

here, ip route 192.52.64.12 255.255.255.252 192.64.52.1

static route AD = 1, primary AD = 1

Backup ~~AD~~ route will be higher AD than primary route

Valid backup AD can be 2, 10, 50, 100, any value higher than 1 is connect.

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vi) R4 discarding the packet whose destination IP is 172.42.10.4

here, no matching routes exists for 172.42.10.4/16, and default route 0.0.0.0/0 was configured on R4. The packet's IP is outside of all known networks which are given. So, due to absense of a route, and for having no default route, R4 discarded the packet.

vi

Que-3 (i)

Given, total packet = 2584 bytes

header = 32 bytes

Payload = 2552 bytes

3rd fragment size = 272 bytes

MF = 1

bytes fragment payload = 272 - 32 = 240 bytes

∴ MTU = 272 bytes

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ii) Payload per fragment = 240 bytes

fragment offset of 7th packet :

$$\text{offset} = (6 \times 240) / 8 = 180$$

∴ fragment offset = 180

iii) total number of fragmented packets :

Packet size = payload = 2554 bytes

Packet size per fragment = 240 bytes

$$\therefore \frac{\text{packet size}}{\text{packet size per fragment}} = \frac{2554}{240} = 10.63 \rightarrow 11$$

total number of fragmented packets = 11

Q-4(i) In distance vector routing, routers send periodic updates every 30s. R_2 knows neighbours via direct interface connection.

In the first iteration, R_2 sends via direct network, it across 0 hops. 1st iteration = directly connected network + metric 0

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R_2 sends information about its directly connected networks along with a hop count zero, during the first iteration of distance vector routing.

Q-5 (i) Given,

2001 : 0db8 : 12af : 0000 : 0000 : 0000 : 0a20 : 0004

⇒ 2001 : 0db8 : 12af :: a20 : 4

it is global unicat type and global unicast usually used for internet routable address.

i) 0000 : 0000 : 0000 : 0000 : 0000 : 0000 : 0000 : 0001

⇒ :: 1

it is loopback type and usully used for local host networking.

Q-6 (i) There may have NAT or firewall blo- that blocks ICMP ping. There may not have any

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default gateway is which can also cause fail to ping.

ii) ICMP tools :

→ Ping = used for reachability

→ Traceout = finds where failure occure

A network administrator can use ICMP tools to determine the problem. Admin will use ping to test connectivity. If PC can not ping the default gateway on internal servers, the problem might be inside the campus network. If, gateway responds but public IP address does not respond, problem might be with ISP or outside campus.

For next testing, admin will use Traceroute, which shows the path taken by packets. If trace stops within campus routers, the issue maybe internal. If trace stops after leaving campus, the issume maybe internal.

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Q-7(i) IPV4 header, total length feild is 16 bits.

fragment offset is only 13 bits.

offsets measured in 8byte units.

It allows large packet positioning with fewer bits.

ii Identification feild tags all the fragment of same packet. It also used for reassembly.

Identification feild in IPV4 header is used for identifying uniquely all the ~~data~~ fragments that belong to same original IP packet. When langer IP packet is fragmented, each fragmentation carries same identification value, so destination host can recognize which fragment should be grouped together.

During reassembly, the recive host uses identification feild along with fragment offset and More Fragment (MF)

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bit correctly reorder the fragment and reconstruct the original packet.

Q-8(i) PC connects to DHCP-enables network.

here PC has no IP address.

the PC initially broadcasts a message to look of available DHCP servers, here DHCP is unknown.

This is why PC used broadcast ; instead of unicast.

ii PC connects to DHCP-enable networks.

PC broadcasted a message to look for available DHCP servers. The PC will recive in response DHCHOFFER and PC will reply DHCP REQUEST.

Q-9(i) Private IP address : 10.10.5.50

Listening port 8080.

Lab uses NAT with a public IP address.

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Recruiter could not access the server using public IP address, because NAT blocks inbound traffic. Also, there is no port forwarding switch on router available, which caused failed to access the server.

[ii] To make server accessible from outside of the university, there should ba have port forwarding (static NAT) configuration done by network admin on the router. The router should be configured port forwarding, so that any incoming request to public IP address on port 8080 is forwarded to private IP address 10.10.5.50 on port 8080.

Public_IP : 8080 → 10.10.5.50 : 8080

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Q-10 | IPV4 → 32 bits

IPV6 → 64 bits

IPV6 has larger base header than IPV4, which improves processing efficiency in such ways:

IPV6 header has a fixed length, unlike IPV4 which has a variable header size; this allows routers to process packets faster than to calculate header length.

IPV6 removes header checksum. IPV6 moves optional information to extension headers. IPV6 simplifies fragmentation by allowing only source host to fragment packets.

Q-11 (i) Given, Host A : IP : 192.168.1.10

MAC : AA-AA-AA-AA-AA-AA-~~AA-AA~~

Host B : IP . 192.168.1.12

MAC - BB-BB-BB-BB-BB-BB-~~BB-BB~~

Host C : IP = 192.168.1.20

MAC = CC-CC-CC-CC-CC-CC

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All the host are in same LAN and connected through S1 and S2.

Host A doesn't know MAC address of Host C; it will send ARP request (broadcast), here

Source MAC = AA - AA - AA - AA - AA - AA

Destination MAC = FF - FF - FF - FF - FF - FF

destination MAC is broadcast, S1 will flood the ARP request out of all the ports.

ii] Switches do not need manual configuration.

Switches automatically learns MAC address by observing source MAC of incoming frame.

Switches build and update its MAC address table dynamically.

Switche forward frames based on learned information.

These ares the reason why switches are called plug and play.

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