Computer Networks II

Course 24/25 :: Exam 2

Escuela Superior de Informática

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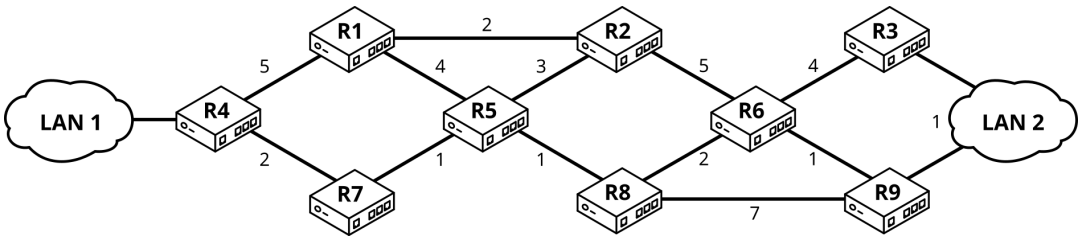
This exam has a total of 40 points. For every 3 multiple-choice questions with 4 options or fewer answered incorrectly, 1 point will be deducted. Only one option is correct unless stated otherwise in the statement. When prompted, it's required to check all correct options. The use of a calculator is not allowed. The exam duration is 90 minutes. ***Follow answer sheet instructions.***

A [8p] The following topology consists of 9 routers connected via serial links and 2 LANs. If there are multiple paths with the same cost, the numerically lowest neighboring node must always be chosen. Answer the following questions:



> **1** (2p) Using a distance vector protocol with hop count as a metric and assuming cost=1 for neighbors, mark **all** the elements that are NOT part of **R1**'s distance vector after the first iteration.

- ☐ **a)** R1:0:-
- ☐ **b)** R2:1:-
- ☐ **c)** R3:3:R2
- ☐ **d)** R4:1:-
- ☐ **e)** R5:1:-
- ☐ **f)** R6:2:R2
- ☐ **g)** R7:2:R4
- ☐ **h)** R8:2:R5
- ☐ **i)** R9:3:R2

> **2** (2p) Mark **all** the paths that are NOT part of the shortest-path tree rooted at **R2**, using hop count as the metric. The shortest-path tree includes the routes from one router to all others.

- ☐ **a)** R2 > R1 > R4
- ☐ **b)** R2 > R1 > R4 > R7
- ☐ **c)** R2 > R5 > R7
- ☐ **d)** R2 > R6 > R3
- ☐ **e)** R2 > R5 > R8
- ☐ **f)** R2 > R6 > R8
- ☐ **g)** R2 > R6 > R9

> **3** (2p) Using a link-state protocol and considering the costs indicated on the links, mark the message that is most likely to be the first link-state message sent by router **R9**.

- ☐ **a)** R9 | 0 | -
- ☐ **b)** R9 | 1 | 20 | R6:1, R8:7
- ☐ **c)** R9 | 1 | 10 | R9:1, R3:1
- ☐ **d)** R9 | 1 | 20 | R3:1, R6:1, R8:7

> **4** (1p) How many iterations are required for a distance vector protocol to converge if we consider only reachability to routers?

- ☐ **a)** 2
- ☐ **b)** 3
- ☐ **c)** 4
- ☐ **d)** 5

> **5** (1p) How many iterations are required for a distance vector protocol to converge if we consider reachability to the LANs?

- ☐ **a)** 2
- ☐ **b)** 3
- ☐ **c)** 4
- ☐ **d)** 5

6 [2p] What happens in Ethernet LANs that do not support IGMP snooping?

- ☐ **a)** It is not possible to implement VLAN or 802.1Q technology.
- ☐ **b)** The hosts must be responsible for sending IGMP messages.
- ☐ **c)** All multicast packets reaches all hosts.
- ☐ **d)** Broadcast storms may occur.

7 [2p] There is no one-to-one mapping between IPv4 multicast addresses and Ethernet multicast addresses. What is a consequence of this?

- ☐ **a)** Some nodes will receive multicast traffic that is not intended for them.
- ☐ **b)** Some nodes will not receive multicast traffic that is intended for them.
- ☐ **c)** Packets lost due to address overlap will need to be retransmitted.
- ☐ **d)** There is confusion between multicast and unicast addresses.

8 [2p] Select the correct statement about SSM:

- ☐ **a)** It requires all routers to maintain a list of all possible sources for each multicast group.
- ☐ **b)** It requires more complex and resource-intensive routing protocols.
- ☐ **c)** Receivers can specify the source when joining a multicast group.
- ☐ **d)** It is only available in IPv4 with IGMPv2.

9 [2p] Which of the following statements is false regarding the output of the following command?

```
$ ip maddr show dev eno1
2:      eno1
        link  33:33:00:00:00:01
        link  01:00:5e:00:00:01 users 2
        link  33:33:ff:a5:02:be
        link  33:33:00:00:00:fb
        link  01:00:5e:00:00:fb
        inet  239.0.0.1
        inet  224.0.0.251 users 2
        inet  224.0.0.1
        inet6 ff02::fb
        inet6 ff02::1:ffa5:2be
        inet6 ff02::ee
        inet6 ff02::1
        inet6 ff01::1
```

- ☐ **a)** Both ff01::1 and ff02::1 map to 33:33:00:00:00:01.
- ☐ **b)** Both 239.0.0.1 and 224.0.0.1 map to 01:00:5e:00:00:01.
- ☐ **c)** ff02::fb maps to 33:33:00:00:00:fb.
- ☐ **d)** There is an IPv6 address that is not mapped to a MAC.

10 [2p] IPv6 can automatically assign **unique** local-use addresses without requiring any auxiliary service. How is this possible?

- ☐ **a)** Each network card (NIC) contains an unique valid IPv6 address stored in ROM.
- ☐ **b)** Because it uses the physical address of the NIC as part of the generated address.
- ☐ **c)** In IPv6, each node comes with its own built-in DHCP server.
- ☐ **d)** IPv6 does not have that capability.

11 [2p] Why does not IPv6 use the ARP protocol?

- ☐ **a)** It is used, but only for *indirect deliveries*.
- ☐ **b)** The equivalence between physical and logical addresses is direct and can be deduced locally.
- ☐ **c)** A new protocol called *Neighbor Discovery* is used and it allows to discover local routers too.
- ☐ **d)** In IPv6 the problem is to find out the logical addresses, the physical ones are always known.

12 [2p] What is the IPv6 *neighbor discovery* concept related to?

- ☐ **a)** With dynamic routing protocols.
- ☐ **b)** IPv6 doesn't handle that concept.
- ☐ **c)** With path minimum MTU discovery.
- ☐ **d)** With the correspondence between physical and logical addresses.

13 [2p] Which of the following statements is true about IPv6?

- ☐ **a)** ARP disappears because it is barely used.
- ☐ **b)** The only advantage of IPv6 is that it supports a larger address range.
- ☐ **c)** IPv6 address assignment is based on the MAC address and is always direct.
- ☐ **d)** Global addresses are designed to facilitate routing based on geographic location.

14 [1p] What is an IP tunnel?

- ☐ **a)** A point to point virtual channel carrying IP datagrams between two distant networks.
- ☐ **b)** A security issue that allows access to a port of a computer within a private network.
- ☐ **c)** A type of Ethernet switch that allows you to define links between their ports through administrative rules.
- ☐ **d)** A virtual point-to-point link resulting of adding several parallel links between two devices given as to increase the bandwidth, for example a server or a switch.

15 [1p] What is a Virtual Private Network (VPN)?

- ☐ **a)** A private network made up of several sites connected through tunnels over a network managed by a third party.
- ☐ **b)** An application that allows you to emulate a virtual LAN between two or more computers connected through a shared connection.
- ☐ **c)** This concept is essentially equivalent to VLAN (Virtual LAN).
- ☐ **d)** A collection of computers that share a simplex link between routers.

16 [1p] What is CG-NAT?

- ☐ **a)** Carrier-Grade NAT, used by some ISPs to save IP addresses on the client side.
- ☐ **b)** A system used in mobile communications to avoid assigning global IPs to customers' mobile devices.
- ☐ **c)** A configuration used by some internet providers that prevents certain LAN communication setups.
- ☐ **d)** All of the above are correct.

B [5p] An organization has a private LAN composed of 30 devices with IP addresses in the 192.168.1.0/24 block. The border router has a private interface (address 192.168.1.1), a public interface (address 203.0.113.5), and runs NAPT using synthetic ports.
An employee from their computer (192.168.1.30) attempts to simultaneously access three different websites that use HTTP (port 80) and HTTPS (port 443). The websites are located at the following addresses: 198.51.100.25 (port 443), 203.0.113.7 (port 80), and 192.0.2.5 (port 443). The router is configured to log and modify outgoing connections as follows:
The connection to 198.51.100.25 (port 443) is logged with synthetic port 40001. The connection to 203.0.113.7 (port 80) is logged with synthetic port 40002. The connection to 192.0.2.5 (port 443) is logged with synthetic port 40003.
The initial requests for each connection are sent at 10:00, 10:01, and 10:02 respectively.

> **17** (1p) What is the purpose of using NAPT in the described scenario?

- ☐ **a)** To block Internet access from the internal network.
- ☐ **b)** To allow the organization to use multiple public IP addresses.
- ☐ **c)** To allow each device in the network to have a unique public IP address.
- ☐ **d)** To allow multiple devices to share a single public IP address to access the Internet.

> **18** (1p) Mark **all** items that the router must maintain in its NAPT table to properly handle incoming responses from the Internet? (mark **all** that apply)

- ☐ **a)** Internal IP adresses
- ☐ **b)** Destination ports
- ☐ **c)** Remote IP addresses
- ☐ **d)** Source ports
- ☐ **e)** Synthetic ports
- ☐ **f)** Remote URLs
- ☐ **g)** Internal MAC addresses

> **19** (1p) If another device on the internal network tries to access the same website (198.51.100.25) using the same port (443), what should the router do?

- ☐ **a)** Reject the connection because the port is already in use.
- ☐ **b)** Assign the same synthetic port if available.
- ☐ **c)** Assign a new synthetic port for the new connection.
- ☐ **d)** Redirect the connection to a different port on the website to avoid collision.

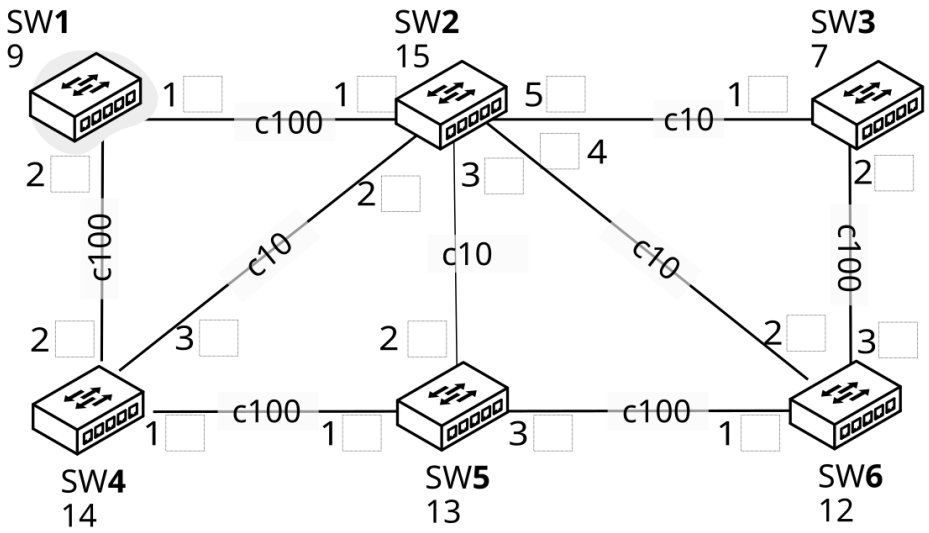
> **20** (1p) How would the use of applications that require multiple simultaneous connections, such as video conferencing, affect the organization?

- ☐ **a)** There is no impact because synthetic ports are used.
- ☐ **b)** We must enable port forwarding on the router to manage multiple ports.
- ☐ **c)** It removes the need to use NAPT by delegating port management to the application.
- ☐ **d)** It is not possible to use such applications when NAPT with synthetic ports is in use.

> **21** (1p) If a service that must be accessible from the outside, such as a web server, is to be implemented, what NAPT configuration should be adjusted?

- ☐ **a)** Disable NAPT for the server's private IP address.
- ☐ **b)** Configure a static port translation (port forwarding) for the server.
- ☐ **c)** Assign an additional public IP address only for the server.
- ☐ **d)** No changes are needed in the NAPT configuration since synthetic ports are used.

C [4p] Given the following LAN topology whose switches are using STP, answer the following questions. The links show costs:



> **22** Root switch ID:

☐ **a**) 7 ☐ **b**) 9 ☐ **c**) 12 ☐ **d**) 13 ☐ **e**) 14 ☐ **f**) 15

> **23** Root ports, using the format *switch-ID.port*:

☐ **a**) 7.1 ☐ **c**) 9.2 ☐ **e**) 12.2 ☐ **g**) 13.2 ☐ **i**) 14.2 ☐ **k**) 15.1 ☐ **m**) 15.5
☐ **b**) 9.1 ☐ **d**) 12.1 ☐ **f**) 13.1 ☐ **h**) 13.3 ☐ **j**) 14.3 ☐ **l**) 15.2

> **24** Designated ports, using the format *switch-ID:ports*:

☐ **a**) 7:1,2 ☐ **c**) 9:1,2 ☐ **e**) 12:3 ☐ **g**) 13.2 ☐ **i**) 14:2 ☐ **k**) 14:2,3 ☐ **m**) 15:1,2,3,4
☐ **b**) 9:1 ☐ **d**) 12:1 ☐ **f**) 13.1 ☐ **h**) 13:1,2,3 ☐ **j**) 14:3 ☐ **l**) 15:1,5

> **25** Blocked ports, using the format *switch-ID.port*:

☐ **a**) 7.2 ☐ **c**) 12.1 ☐ **e**) 13.1 ☐ **g**) 13.3 ☐ **i**) 14.2 ☐ **k**) 14.4 ☐ **m**) 15.5
☐ **b**) 9.2 ☐ **d**) 12.3 ☐ **f**) 13.2 ☐ **h**) 14.1 ☐ **j**) 14.3 ☐ **l**) 15.1

26 [1p] The entries in the MAC address table of a switch have a *expiration* (about 5 minutes) in order to:

☐ **a**) Increase network security.
☐ **b**) Because it's required for ARP to work.
☐ **c**) Enable device mobility.
☐ **d**) None of the above.

27 [1p] How should you interconnect workstations so that they all share the same collision domain?

☐ **a**) Each station is connected to a different interface of the bridge/switch.
☐ **b**) Each station is connected to a different VLAN.
☐ **c**) All stations are connected to a hub.
☐ **d**) All stations are connected to a router and the router to a bridge/switch interface.

28 [1p] Which statement is FALSE?

☐ **a**) Trunking allows significant savings on copper or fiber depending on the type of switch.
☐ **b**) VLANs with trunking significantly increase LAN speed.
☐ **c**) Trunking and VLANs allow saving equipment while maintaining efficient LAN management.
☐ **d**) By using VLANs, a single switch could have several virtual LANs connected to a single router.

29 [1p] What is the most accurate statement regarding the use of VLANs?

☐ **a**) It allows saving on cables and physical connections.
☐ **b**) It enables easier management of devices according to their profile.
☐ **c**) It increases LAN security through frame encryption.
☐ **d**) All of the above are correct.