Computer Networks

Example, 8 October 2026

Student name

Employee number | Date

Time | Place

7 questions, 22 points in all. 6 multiple choice (one option is correct; mark one) and 1 open question (explain your answer in your own words; name the mechanisms and the layers). The points of each question are printed beside its number.

The grade is calculated using the formula: $grade = 1 + 9 \cdot \frac{score-3}{22-3}$, where $score$ is the points scored and the 3 points a candidate would score by guessing every multiple-choice question are taken out first. The grade runs from 1 to 10.

Thirty minutes. Textbook allowed. No electronic devices, no calculator, no lecture slides, no notes.
Answers in Dutch and in English are both acceptable.

Example. This is not an examination but an example of one: it shows what the paper looks like and how the questions are put. The examination itself has 33 questions and 90 points.

Learning outcomes. Upon successful completion of this course, the student is able to:

LO1 Describe, using logical and mathematical principles, computer networks and the layered network architecture, and thereby understand the operational continuity of vital, military, and safety-critical computer networks. (3 points)

LO2 Describe the functions and interrelations of the five layers of the TCP/IP model and analyse the relevant standards. (1 points)

LO3 Identify the components at the physical layer (transmission media and network hardware), the data link layer (wired and wireless access protocols), the network layer (IP addressing and routing protocols), the transport layer (transmission protocols and connection quality), and the application layer (essential applications and network security), and explain their operation and disruption. (5 points)

LO4 Analyse the performance and security risks of ad-hoc mesh networks, cellular and satellite networks, and the Internet, and survey attack strategies and the corresponding countermeasures. (13 points)

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Q1
2 pt

Identify the collision domains and the broadcast domains in a local network of one bridge with eight ports, where each port is connected using a dedicated STP Ethernet cable to a host?

A One collision domain and one broadcast domain.

B Eight collision domains and one broadcast domain.

C Eight collision domains and eight broadcast domains.

D One collision domain and eight broadcast domains.

Q2
3 pt

Two stations collide on a classic Ethernet segment (coax medium, vampire tap) and both back-off by choosing a random slot number from a range $(1, n)$ that doubles n after each collision. What does the doubling accomplish?

A It guarantees that the two stations choose different slots on the second attempt.

B It adapts the retransmission rate to the observed load, so that a busy segment spreads attempts over a longer interval.

C It makes the delay proportional to the frame length, so that long frames wait longer.

D It prevents the capture effect, in which one station transmits repeatedly.

Q3
2 pt

The end-to-end argument says most functions should be implemented at the host end-points, and use basic and reusable building blocks within the network. Which deployment follows that argument most closely?

A A router that retransmits any packet it cannot deliver (ICMP snooping), so that the end hosts need no recovery of their own.

B End hosts perform a checksum (CRC) and retransmit lost packets, while links add their own error discovery checksum to prevent transmitting corrupt frames further.

C A world-wide network that guarantees ordered packet delivery, so that the transport layer can be omitted entirely.

D Hosts that delegate encryption to the first router, as in many data center deployments, which is better placed to protect every flow at once and allows easy implementation of lawful intercept.

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Q4
1 pt

A ‘layered architecture’ assigns each layer a service it offers to the layer above, by using a service from the layer below. What does this give the designer of a protocol at the transport layer?

A The transport layer can assume the network layer delivers every packet in order and without loss.

B The transport layer may be changed without changing the layers above or below it, as long as the service interface stays the same.

C The transport layer can communicate with individual hosts without using any functionality from the network layer, using directly quantum properties at the physical layer.

D The transport layer may assume that the path between two hosts does not change for the duration of a connection.

Q5
1 pt

Which pair correctly describes where OSPF and BGP operate?

A OSPF between autonomous systems, BGP within one autonomous system.

B OSPF within one autonomous system, BGP between autonomous systems.

C Both within one autonomous system, at different layers.

D Both between autonomous systems, for IPv4 and IPv6 respectively.

Q6
3 pt

Why does a message authentication code (MAC) give no non-repudiation, while a signature does?

A Because a MAC is shorter than a signature.

B Because both ends of a MAC hold the same shared key, so either could have produced the tag. In signatures, only one party holds a private key.

C Because the MAC address is computed over the ciphertext and a signature over the plaintext.

D Because a signature is checked by a certification authority and a MAC is not.

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Q7
10 pt

A laptop joins a network it has never used before, and the user opens a web page using HTTPS. Name, in order, the protocols that run before the first byte of the page arrives, and state for each what it contributes and what an attacker on the same segment could do to it.

End of the examination.