

**Written examination in
TDTS06 Computer Networks
and TDTS41 Computer networks
2008-01-15 at 14–18**

Hall

TER1.

Helping materials

A basic calculator with memory erased and an English dictionary (not electronic) are allowed.

Results

The results are published at latest twelve working days after the exam.

Points

Maximum is 40 points (44 if you passed the optional assignment). For grade 3, 20 points are needed. For grades 4 and 5, 28 points and 36 points, respectively, are needed. ECTS grades are given separately.

Teachers on duty

Juha Takkinen, 0731-50 03 93, will visit the hall around 15 and at 17 o'clock.

Instructions

Read each question carefully and make sure you have answered everything in the question. Justify your answers, if not told otherwise, and state explicitly your assumptions. The use of figures is encouraged, except where other instructions apply. Answers that are not legible will not be graded. You can use either English or Swedish. Be thorough and to the point with your answers. You should convince the examiner that you understand what you are writing about. However, “shotgun” answers will not score any points.

Put only one problem on each sheet of paper, with the exception of subproblems a, b, etc., which can be on the same sheet. Use only one side of each answer sheet. Note: We will only grade one side of each sheet!

Make sure that you keep *the same order* of each alternative and table entry when you copy answers from the examination paper to your answer sheet.

“Mosaic is the 1990s equivalent of forcing friends to sit through slides of your trip to Florida—painful for everyone but the host.”—Steve Steinberg

Good luck!

1. Protocols

- a. Briefly explain the following terms:
 - i. Protocol stack (1 p.)
 - ii. Multiplexing. (1 p.)
- b. Construct a finite state machine (FSM or state transition diagram) describing the general operation of a sender when running the CSMA/CD protocol. Explain your notation and also describe the protocol states in full sentences. (3 p.)

2. Networking basics

- a. List and explain four causes for packet delay in a packet-switched (datagram) network. Also, give rough estimates of typical values for each type of delay when transferring a file from Linköping to New York. (2 p.)
- b. Explain if the following statement true or false: “Since there can be only one message in transit when one uses a stop-and-wait protocol for implementing reliable delivery, no sequence numbers are needed.” (2 p.)
- c. Suppose there is a 100-Mbps point-to-point link between Earth and a lunar colony. The distance to the moon is approximately 385,000 km and data travels over the link at the speed of light of 3×10^8 . How many bits can a sender transmit before the first bit arrives at the receiver?(1 p.)

3. Applications

- a. Explain how addressing is done in a web application: What information is used by a process running on one host on the Internet to identify a process running on another host? (1 p.)
- b. Explain if the following statement true or false: “The DNS root server is a single point of failure in the DNS system and therefore very much susceptible for denial-of-service attacks.” (2 p.)
- c. In the four items below, tick off True, False, or none of the two. Do not justify your answer. *Copy your answer to your answering sheet.* (2 p.)

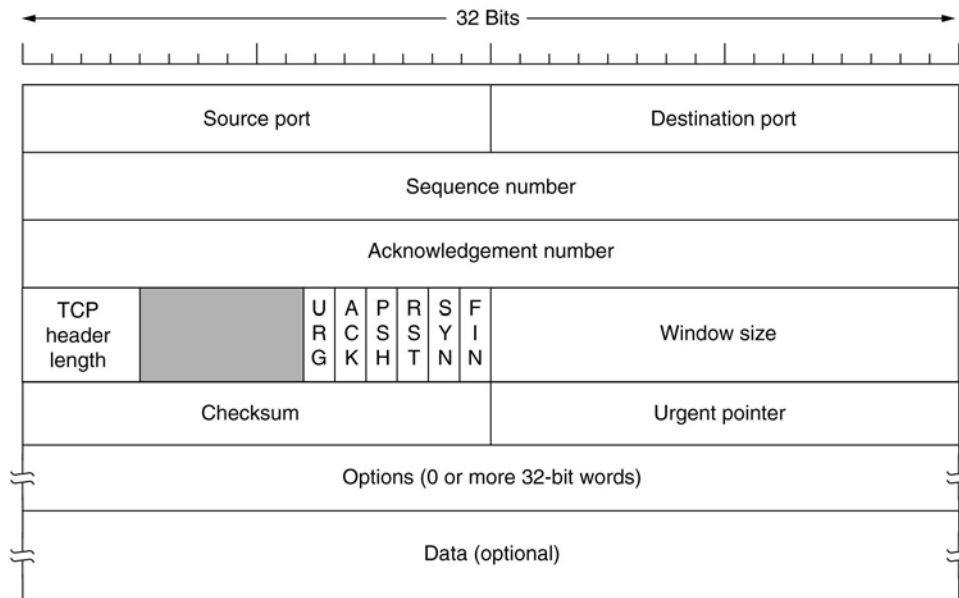
True False

- i. ☐ ☐ The two main types of DNS messages are queries and responses.
- ii. ☐ ☐ SMTP is asynchronous and therefore a connectionless protocol.
- iii. ☐ ☐ HTTP is the language used to describe documents on the web.
- iv. ☐ ☐ An FTP session needs two TCP connections.

(+0.5 p. for each correct, -0.5 p. for each wrong, 0 p. for no answer, and min. 0 p.)

4. TCP

- a. What is the difference between flow control and congestion control in TCP? What fields in the TCP header are used for flow control? What fields are used for congestion control? (3 p.)



- b. With regard to the QoS architectures designed for IP networks by the IETF, describe two general techniques used in either of the two models to improve quality of service. (2 p.)

5. IP

- a. Explain briefly the following terms:
- Best-effort delivery (1 p.)
 - Tunneling (1 p.)
- b. Define fragmentation and explain why IPv4 and IPv6 protocols need to fragment some packets. Is there any difference between the two protocols in this matter? (2 p.)
- c. In a block of addresses, we know the IP address of one host is 25.34.12.56/16. What is the network address of this host? What is the subnet mask? (1 p.)

6. LANs

- a. LAN broadcasts are used by for example ARP to provide its services. Assume there are 20 PCs in total in a network. 5 PCs are connected to one Ethernet hub and 5 other PCs are connected to another hub. Each hub is connected to a separate switch and both switches are connected to a separate router. 5 PCs are connected to one of these two switches. The two routers are connected to each other via a third switch. 5 PCs are connected to this switch. Explain how many broadcast domains there are. (1 p.)

b. In the four items below, tick off True, False, or none of the two. Do not justify your answer. *Copy your answer to your answering sheet.* (2 p.)

True False

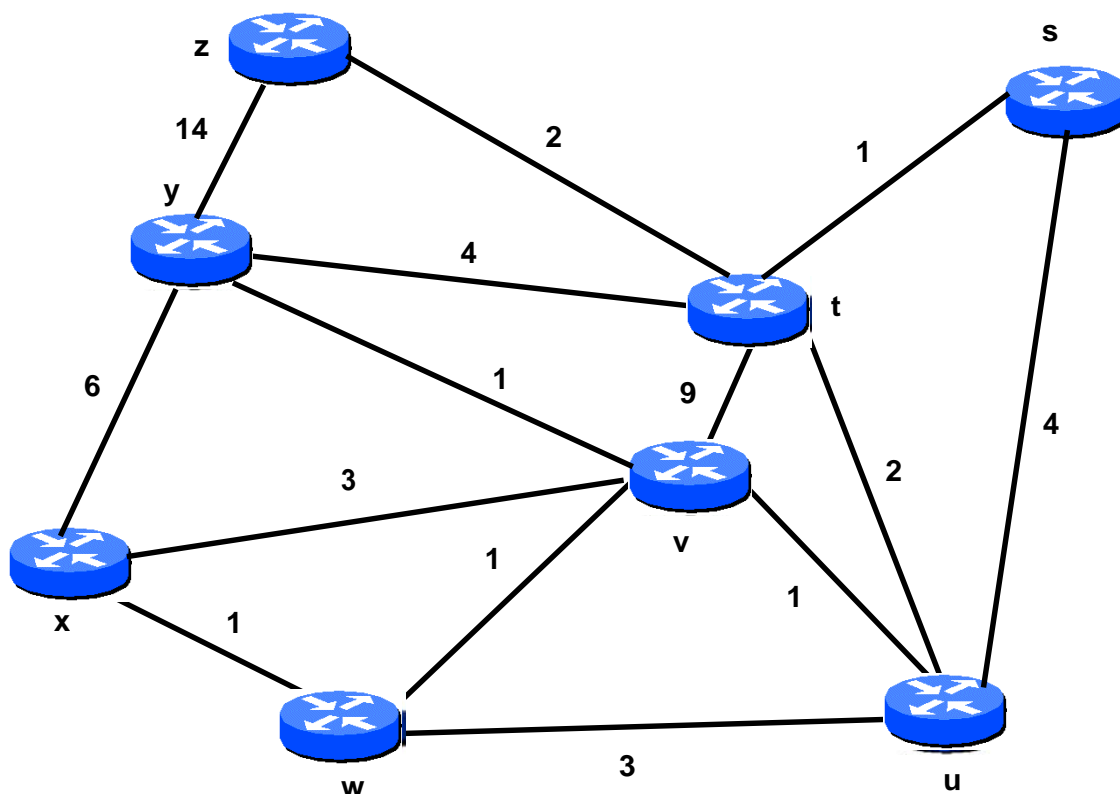
- i. ☐ ☐ A LAN switch regularly examines frame addresses.
- ii. ☐ ☐ Ethernet makes use of CRC for error detection.
- iii. ☐ ☐ With a hub, each outgoing line becomes its own collision domain.
- iv. ☐ ☐ A typical service provided by Ethernet is reliable delivery.

(+0.5 p. for each correct, -0.5 p. for each wrong, 0 p. for no answer, and min. 0 p.)

c. Explain if the following statement is true or false: "An IEEE802.11b-enabled station can be associated with more than one access point at one time." (2 p.)

7. Routing

a. Complete the table shown in the appendix using Dijkstra's algorithm. Compute the shortest path from node w to all other network nodes. Possible ties in least-cost paths are broken in favour of the leftmost column. (2 p.)



- $D(v)$: cost of least-cost path from the source node to destination v as of this iteration of the algorithm
- $p(v)$: previous node (neighbour of v) along the current least-cost path from the source to v
- N' : subset of nodes, where v is in N' if the least-cost path from the source to v is definitely known.

- b. Assume router A in a network has the following forwarding table, as created by running the distance-vector routing algorithm:

Dest.	Cost	NextHop
W	4	B
X	2	C
Y	1	F
Z	5	G

What would be the new contents of the table if router A received the following message from router C? (1 p.)

Dest.	Cost
W	2
X	1
Y	3
Z	7

- c. Motivate which one of RIP and OSPF you think is preferred as an intra-AS routing protocol. (1 p.)
- d. What is the purpose of the Border Gateway Protocol? (1 p.)

8. Network security

- a. Explain if the following statement is true or false: “When an SSL connection has been established, each router along the message path will authenticate the messages being sent between the sender and the receiver”. (2 p.)
- b. Explain how an e-mail message is authenticated in PGP. (2 p.)
- c. Name two protocols defined by IPsec. (1 p.)

Appendix: Question 7

S	N'	D(s), p(s)	D(t), p(t)	D(u), p(u)	D(v), p(v)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	w	∞	∞	3, w	1, w	1, x	∞	∞
1	wv	∞	10, v	2, v	done	1, x	2, v	∞
2	wvx	∞	10, v	2, v		done	2, v	∞
3								
4								
5								
6								