LiTH, Tekniska högskolan vid Linköpings universitet   1(4)
IDA, Institutionen för datavetenskap
Juha Takkinen
2009-08-18

Written examination in
TDTS06 and TDTS41 Computer Networks
2009-01-16 at 14-18

Hall

KÅRA.

Support materials

A basic calculator with memory erased and an English dictionary (not elec-tronical) 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, respec-tively, are needed.

Teacher on duty

Juha Takkinen, 0731-50 03 93, will visit the hall around 3pm and at 5pm.

Instructions

In addition to the common instructions on the exam wrapper, the following apply: Write clearly. State any assumptions that you make in addition to what is stated in the question, but you are not allowed to change the ques-tion. Have the same order on your answers as the questions in the exam. You can answer in either Swedish or English.

"What do you get when you cross a mobster with an international standard?
– Someone who makes you an offer you can't understand."

Good luck!

1. **Protocols**

   a. Define the terms *peer*, *service* and *protocol*, in the context of a standardized network architecture. (2 p.)

   b. Explain in what layer that each of the following protocols mainly operates, out of the five layers used in the course: CSMA/CA, FTP, OSPF, and UDP. (2 p.)

   c. Consider the finite-state machine for TCP's three-way handshake. Show the last action/event pair sent by the server. (1 p.)
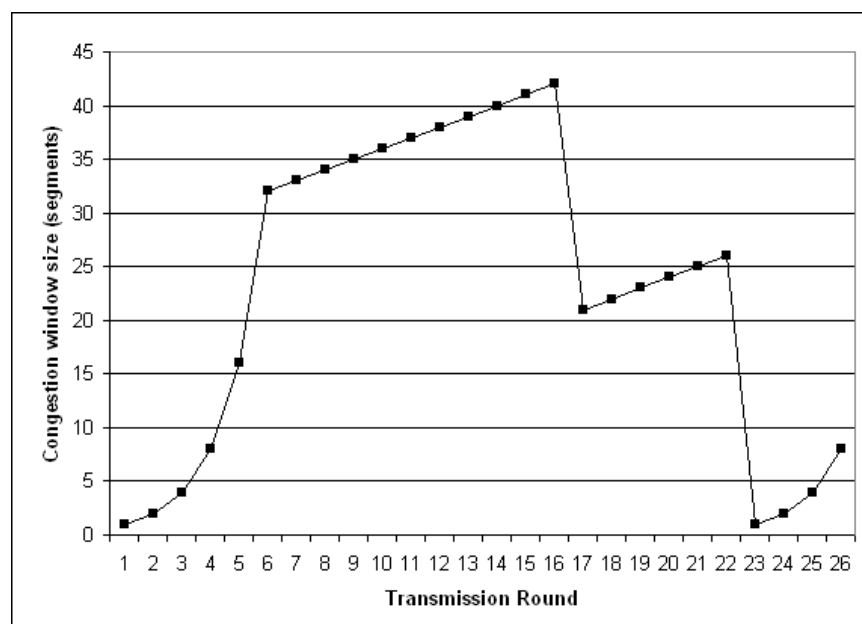
2. **Networking basics**

   a. Explain how the selective-repeat protocol implements flow control. (2 p.)

   b. Consider a network with a distance of 2 km between two nodes and a speed-of-light of 2×10^8 m/s.

      i. At what bandwidth would the propagation delay between these nodes equal the transmission delay for a 100-byte packet and 512-byte packet, respectively? (1 p.)

      ii. How much data is required in order to fill the pipe between the two nodes in the two cases in i)? (1 p.)

   c. Explain what statistical multiplexing is. (1 p.)

3. **Applications**

   a. Describe the basic steps of the operation of the HTTP protocol. (2 p.)

   b. Explain what MIME is and why it was developed. (2 p.)

   c. What information does the DNS database contain? Give an example query. (1 p.)

4. **TCP**

   a. Consider the congestion control scenario below:

Assume that TCP Reno is used. In what intervals in the plot does TCP operate in the slow-start mode and congestion-avoidance mode, respectively? Where is a segment assumed to be lost? (2 p.)

b. Does TCP handle duplicate ACKs? What about duplicate DATA segments? Explain your answer. (2 p.)

c. What additional service(s) does UDP provide compared to IP? What information in the UDP header make this possible? (1 p.)

5. **IP**

a. Explain what is the purpose of the TTL field in the IP header. How and where is it used? (2 p.)

b. IP operates according to the best-effort service model. Explain what this means. (2 p.)

c. Assume the netmask for a network is 255.255.255.0 and that a *host* in this network has the IP address 130.236.177.124. What is the address of the *network* and how many hosts can the network accommodate? (1 p.)
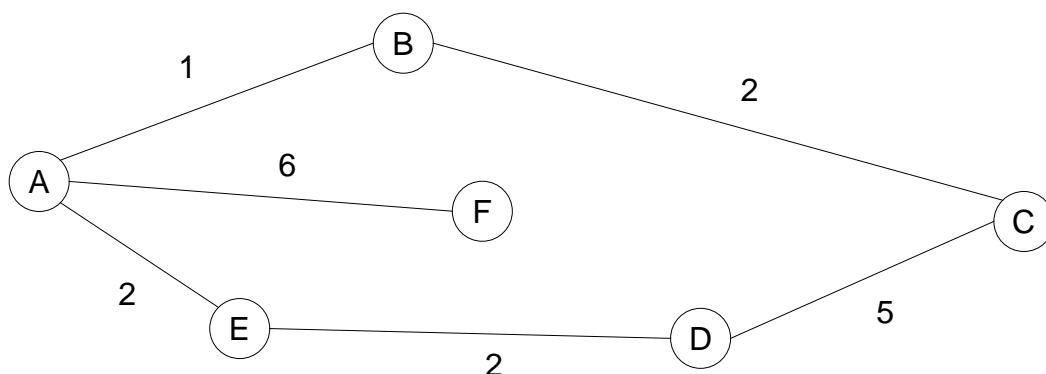
6. **LANs**

a. Assume a CSMA/CD-based LAN. Explain which one (or several) of the following network components would extend the *broadcast domain* if added to the network: a hub, a wireless access point, a switch or a router. (2 p.)

b. Explain step-by-step the mechanism that makes it possible to translate 130.236.177.124 into 0:3:ba:82:36:d5. Why is this function needed? (2 p.)

c. List four frame types that are used in the IEEE 802.11b standard. (1 p.)

7. **Routing**

a. Using the figure below, calculate the shortest paths to all other nodes from node A, using Dijkstra's algorith. Show you calculations. (2 p.)

b. Describe the distance vector (DV) algorithm. If you do not know the formal notation, you may use natural language. (2 p.)

c. What does the DV algorithm create as a result: Is it a *routing*

table or a *forwarding* table? Explain your answer. (1 p.)

8. **Network security**

a. Explain what is meant by network security. You may want to use Alice, Bob and Trudy as your example users. (2 p.)

b. In the four items below, tick off True, False, or none of the two. You are not required to motivate your answer. (2 p.)

True False

i. ❏ ❏ PGP enforces a rigid hierarchy of key certificates and makes use of CAs.

ii. ❏ ❏ DES is a typical public-key encryption algorithm.

iii. ❏ ❏ MD5 is used for creating a cryptographic checksum of a message.

iv. ❏ ❏ SSL is used to secure IP connections.

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

c. In one sentence, describe a digital signature. (1 p.)