

Written examination in TDTS06 Computer networks 2010-08-28 at 14–18

Room

Ter2.

Support material

You are allowed to have with you a calculator and hand-written notes on four pages on A4 paper.

Results

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

Grading

The 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.

Teacher-on-duty

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

Instructions

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

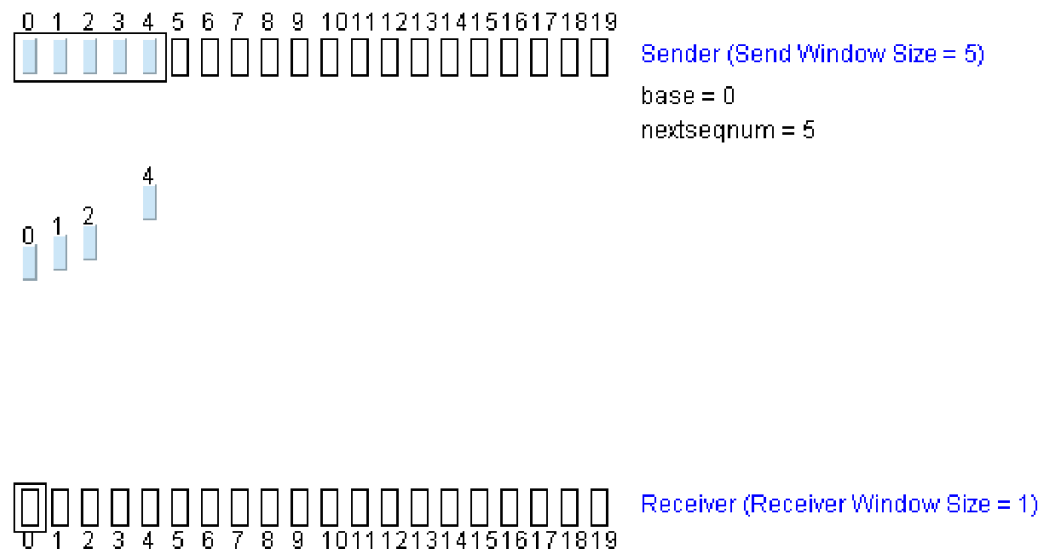
Good luck!

1. Protocols

- List two services that are both offered by the link layer as well as the transport layer. (2 p.)
- What layers does a web server need, in order to function correctly over the Internet? (1 p.)
- Give a network example of what is meant by the syntax, semantics and timing of a protocol. (2 p.)

2. Networking basics

- Assume a network consisting of three links between hosts A and B. Host A wants to transmit a packet to host B. The length of a link is 2 km and bandwidth 100 Mbps. The speed of light in the link medium is 2×10^8 m/s. What is the transmission delay at host A for a packet of size 2 MB? When will host B receive the first bit of this packet? What is the size of the pipe (for pipe-lining purposes) between A and B? (3 p.)
- What type of sliding protocol is shown in the example below? Packet number 3 has been lost. Explain what will happen next, when the remaining four packets are received by the sender. (2 p.)



3. Applications

- a. See the excerpt below from an e-mail message. For each of the following four smtp commands, list after which position(s) A-J that the command in question was executed at the sending side: DATA, RCPT TO, MAIL FROM and . (period).

(2 p.)

```
From juha.takkinen@liu.se Thu Jun 10 14:33:59 2010
MIME-Version: 1.0 ← A
Received: from mail.liu.se [130.236.8.134]
by mina2.ida.liu.se with IMAP (fetchmail-6.3.16)
for <juhta@localhost> (single-drop); Thu, 10 Jun 2010 14:33:59 +0200
(CEST)
[...]
Received: from xxx.se ([130.236.xxx.xxx] helo=xxx.se) by ← B
ASSP.nospam; Thu, 06 May 2010 14:31:40 +0200
From: Juha Takkinen <juha.takkinen@liu.se> ← C
To: tdts04-vt2010@student.liu.se ← D
Date: Thu, 10 Jun 2010 10:31:38 +0200
Subject: TDTS04: Sommarnytt
Content-Type: multipart/alternative;
boundary="_000_2A4B873F48D55F429F0CF1B4877F1BDF25051ELSIFBS01LSIFloca_"

--_000_2A4B873F48D55F429F0CF1B4877F1BDF25051ELSIFBS01LSIFloca_ ← E
Content-Type: text/plain; charset="iso-8859-1"
Content-Transfer-Encoding: quoted-printable

Hej alla! ← F

Ha det g=E5tt i sommar!

mvh
Juha Takkinen
. ← G

--_000_2A4B873F48D55F429F0CF1B4877F1BDF25051ELSIFBS01LSIFloca_ ← H
Content-Type: text/html; charset="iso-8859-1"
Content-Transfer-Encoding: quoted-printable

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN"> ← I
<HTML><HEAD>
<META http-equiv=3DContent-Type content=3D"text/html; charset=3Diso-8859-
1"=
>
</HEAD>
<BODY>
<DIV><FONT face=3DArial size=3D2><SPAN class=3D576290408-06052010>Hej=20
alla!</SPAN></FONT></DIV>
[...]
<DIV>&nbsp;</DIV></BODY></HTML>

--_000_2A4B873F48D55F429F0CF1B4877F1BDF25051ELSIFBS01LSIFloca_-- ← J
```

- b. Explain if the following statement is true or false: The network of nodes created by the tit-for-tat mechanism in the bittorrent protocol also includes the routers as nodes. (1 p.)
- c. In the example below, the DNS database was queried with the dig tool. What does a line in the Answers section correspond to in the DNS database? What is the purpose of the machines addressed ns1.facebook.com-ns5.facebook.com? (2 p.)

```
% dig facebook.com
```

```
;; QUESTION SECTION:
```

```
;facebook.com.          IN      A
```

```
;; ANSWER SECTION:
```

```
facebook.com.          1605    IN      A      69.63.189.11
facebook.com.          1605    IN      A      69.63.189.16
facebook.com.          1605    IN      A      69.63.181.11
facebook.com.          1605    IN      A      69.63.181.12
```

```
;; AUTHORITY SECTION:
```

```
facebook.com.          169872  IN      NS      ns4.facebook.com.
facebook.com.          169872  IN      NS      ns5.facebook.com.
facebook.com.          169872  IN      NS      ns1.facebook.com.
facebook.com.          169872  IN      NS      ns2.facebook.com.
facebook.com.          169872  IN      NS      ns3.facebook.com.
```

```
;; ADDITIONAL SECTION:
```

```
ns1.facebook.com.      672     IN      A      204.74.66.132
ns2.facebook.com.      672     IN      A      204.74.67.132
ns3.facebook.com.      672     IN      A      69.63.178.21
ns4.facebook.com.      672     IN      A      69.63.186.49
ns5.facebook.com.      672     IN      A      69.63.176.200
```

```
;; Query time: 3 msec
```

```
;; SERVER: 130.236.177.12#53(130.236.177.12)
```

4. TCP

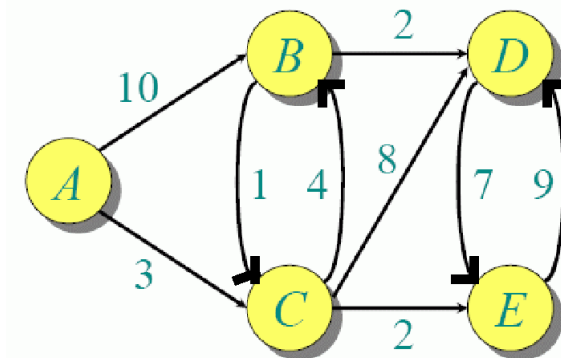
- a. Assume that an application is using UDP to transmit 40 KB of data. How many UDP packets will be created and how large will they be? (2 p.)
- b. State the purpose of duplicate ACKs and cumulative ACKs in TCP, respectively. (2 p.)
- c. Explain if the following statement is true or false: If the retransmission timer in TCP at the sending side times out during congestion control, then the threshold value will be set to half of the old value. (1 p.)

5. IP

- a. Assume a host A communicates with another host B via one LAN switch, two routers and one LAN hub. How many IP addresses will be used in the network between and including hosts A and B? How many subnets will be involved? (2 p.)
- b. Explain the purpose of address aggregation, as used in CIDR. (1 p.)
- c. Suppose an IP datagram that is 50 KB in size is fragmented. The MTU is 20 KB. How many fragments will be created? Also, show the related information stored in each fragment header. (2 p.)

6. Routing

- a. What is BGP? What information does it mainly distribute and how does it manage to maintain a loop-free network? (2 p.)
- b. Calculate the routing table for the network shown below by filling in the table, also shown below. Then, answer the following question: What links will *not* be used for routing packets? (3 p.)



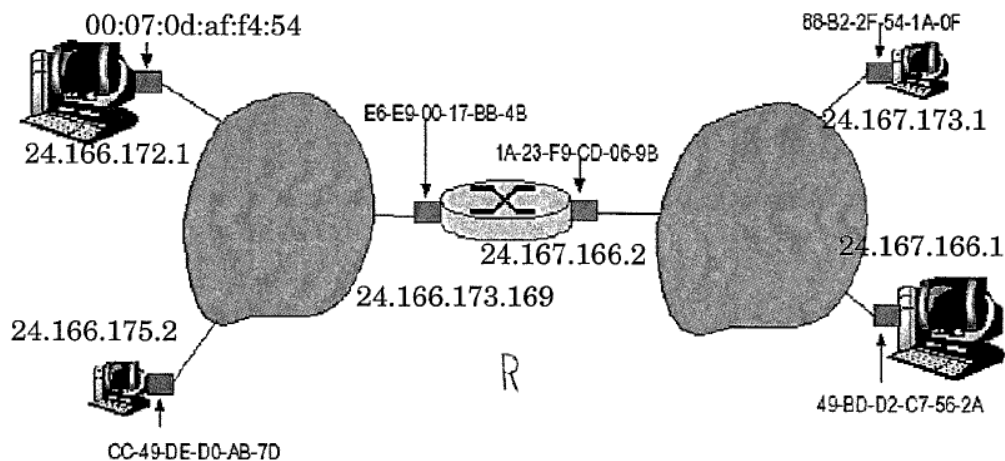
Steg	N'	D(B), p(B)	D(C), p(C)	D(D), p(D)	D(E), p(E)
0	A				
1					
2					
3					
4					

7. LAN

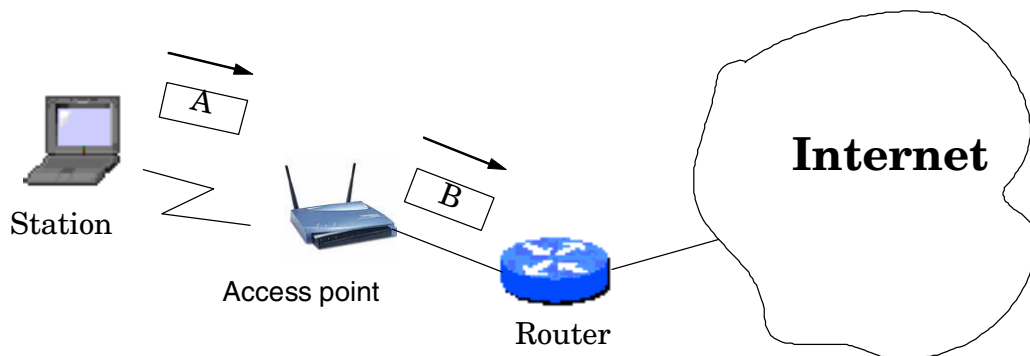
- a. The figure below shows an ARP packet and the network from where this packet has been extracted. The ARP packet has been put in an Ethernet frame. Explain what will happen next in the scenario, until the ARP-related communication has been fully resolved. (2 p.)

```

▼ Ethernet II, Src: Cisco_af:f4:54 (00:07:0d:af:f4:54), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  ▷ Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  ▷ Source: Cisco_af:f4:54 (00:07:0d:af:f4:54)
  Type: ARP (0x0806)
  Trailer: 050104000000040201000302000005010341
▼ Address Resolution Protocol (request)
  Hardware type: Ethernet (0x0001)
  Protocol type: IP (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: request (0x0001)
  Sender MAC address: Cisco_af:f4:54 (00:07:0d:af:f4:54)
  Sender IP address: 24.166.172.1 (24.166.172.1)
  Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
  Target IP address: 24.166.173.169 (24.166.173.169)
  
```



- b. Explain if the following statement is true or false: When an Ethernet adapter discovers an error in the CRC field, the frame is dropped and the sender is notified about the error. (1 p.)
- c. Assume an IEEE 802.11b network at LiU with an ESS (Extended Service Set), that is, a BSS with a distribution system (IEEE 802.3 protocol) connected to the Internet. The wireless station has previously received a packet from a user at Uppsala universitet. The figure on the next page shows the first two hops of the reply that the station has sent. Explain what MAC addresses and IP addresses that can be found in frames A and B, respectively. (2 p.)



8. Security

- a. Explain the full purpose of the handshake in SSL/TLS and if it is part of the TCP handshake or not. (2 p.)
- b. Explain what a known-plaintext attack is. (1 p.)
- c. When we ask what it means for entities to communicate securely, we specify a number of desired properties, called security goals. Name and specify four security goals. Be as precise as possible. (2 p.)

PS! Please read all the instructions for the examination once more before handing in the answers; there are instructions both on the wrapper that you put your answer papers in and also on the first real page of this examination (under Instructions). Thanks.