Försättsblad till skriftlig tentamen vid Linköpings universitet

(fylls i av ansvarig)

Datum för tentamen	*2009-08-25*
Sal	*Ter2*
Tid	*8-12*
Kurskod	*TDTS06*
Provkod	*TEN1*
Kursnamn/benämning	*Datornät*
Institution	*IDA*
Antal uppgifter som ingår i tentamen	*8*
Antal sidor på tentamen (inkl. försättsbladet)	*7*
Jour/Kursansvarig	*Juha Takkinen*
Telefon under skrivtid	*0731-500 393*
Besöker salen ca kl.	*kl. 9 och 11*
Kursadministratör (namn + tfnnr + mailadress)	*Madeleine Häger Dahlqvist 013-282360, madha@ida.liu.se*
Tillåtna hjälpmedel	*miniräknare med tömda minnen samt engelsk ordbok (ej elektronisk)*
Övrigt (exempel när resultat kan ses på webben, betygsgränser, visning, övriga salar tentan går i m.m.)	
Vilken typ av papper ska användas, rutigt eller linjerat	
Antal exemplar i påsen	

Written examination in TDTS06 Computer Networks 2009-08-25 at 8-12

Hall

TER2.

Support materials

A basic calculator with memory erased and an English dictionary (not electronical) 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.

Teacher on duty

Juha Takkinen, 0731 50 03 93, will visit the hall around 9am and at 11am.

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 question. Have the same order on your answers as the questions in the exam. You can answer in either Swedish or English.

Our mail will be handled by computers. They will open our letters, scan them, and transmit the contents via satellite to the post office in the town to which we are writing, rewrite them, and seal the new envelope. A postman will then carry it to the addressee. Now being developed, this process is called speed mail. - *Computers, From Sand Table to Electronic Brain by Vorwald Clark, 1961*

Good luck!

1. Protocols.

a) Describe the three-way handshake. What does it accomplish? (2 p.)

b) Give two reasons why a layered architecture often is used to organize a network. (2 p.)

c) In the context of the layered architecture, explain what the purpose of the protocol header is. (1 p.)

2. Networking basics.

Assume two hosts A and B that communicate with each other. The network between them consists of three links and two routers that forward packets from one link to another. Link 1 which is closest to A has a bandwidth of 2 Mbps while link 2 in the middle is 4 Mbps and link 3 is 1 Mbps and closest to B.

a) Assume that the delay in the links and routers can be ignored. Calculate the time to send an mp3 file of size 12 MB as 3 equally sized packets from A to B. (2 p.)

b) Assume now that the delay is 30 ms for each link with no delay in the routers. How large is the pipe between A and B, that is, how many bits can A transmit before the first bit reaches B? Will the mp3 file from a) above fit the pipe? (2 p.)

c) What exactly does the sliding part of the go back n sliding window protocol refer to, that is, when does the protocol slide and why? (1 p.)

3 Applications.

a) Does DNS use UDP or TCP for transmitting normal DNS requests? Why? (1 p.)

b) Skype makes use of peer-to-peer technology in two important functions in the programme when a connection is created. What are these functions? (2 p.)

c) In the trace shown on next page an http client has sent a request to an http server and received a response, with the response separated by an empty line. Explain what the client requested or wanted the server to do. Also explain two header fields of your own choosing from the trace and what function they serve in the http communication. (2 p.)

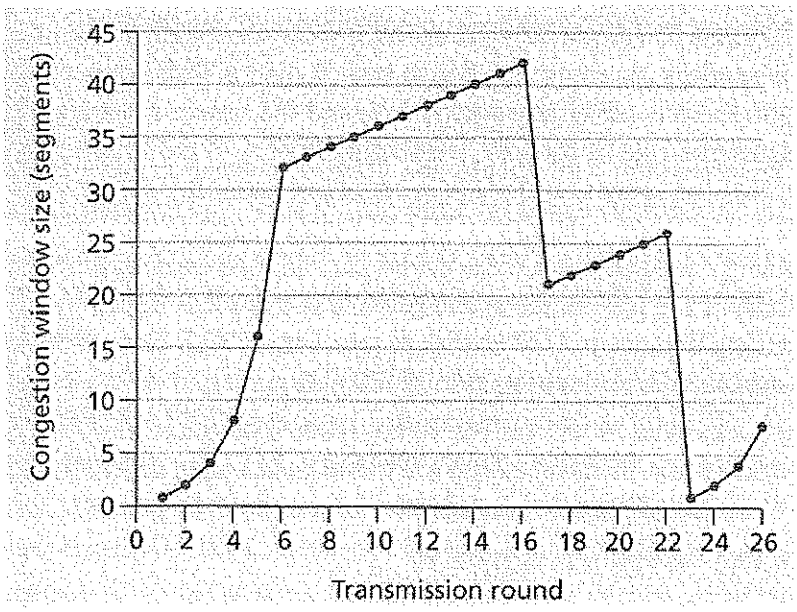
```
mina5.ida.liu.se-76% telnet gaia.cs.umass.edu 80
Trying 128.119.245.12...
Connected to gaia.cs.umass.edu.
Escape character is '^]'.
GET /cs453/index.html HTTP/1.1
Host: gaia.cs.umass.edu
If-modified-since: Tue, 18 Aug 2009 15:00:00 GMT

HTTP/1.1 304 Not Modified
Date: Tue, 18 Aug 2009 15:41:51 GMT
Server: Apache/2.0.52 (CentOS)
ETag: "112684-db1-5aad1d80"
```

4. TCP and UDP.

a) How does tcp detect duplicate segments in a data transmission and what is its response to such an event? (1 p.)

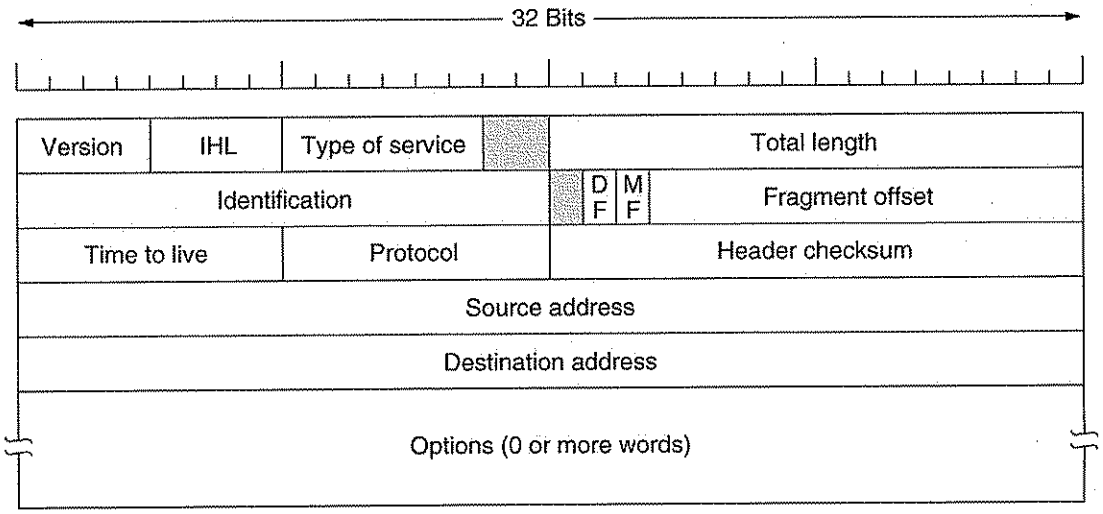
b) Explain why an application that uses udp can get better control over what data is being sent in a packet and *when* it is being sent, as compared to tcp. (2 p.)

c) How much data has been transmitted in the figure below since the connection started and until three duplicate ACKs were discovered? What will the threshold value be after this event? Assume that 1 MSS is 2 KB. (2 p.)



5. IP.

Answer the following questions related to the ip header below.



a) Assume an ip packet of size 2500 KB must be fragmented into fragments of size 1000 KB. Show how the fragmentation is done by referring to fields in the ip header in your answer. (2 p.)

b) What is the purpose of the header checksum in the ip packet? Where in the network is it used and why? (2 p.)

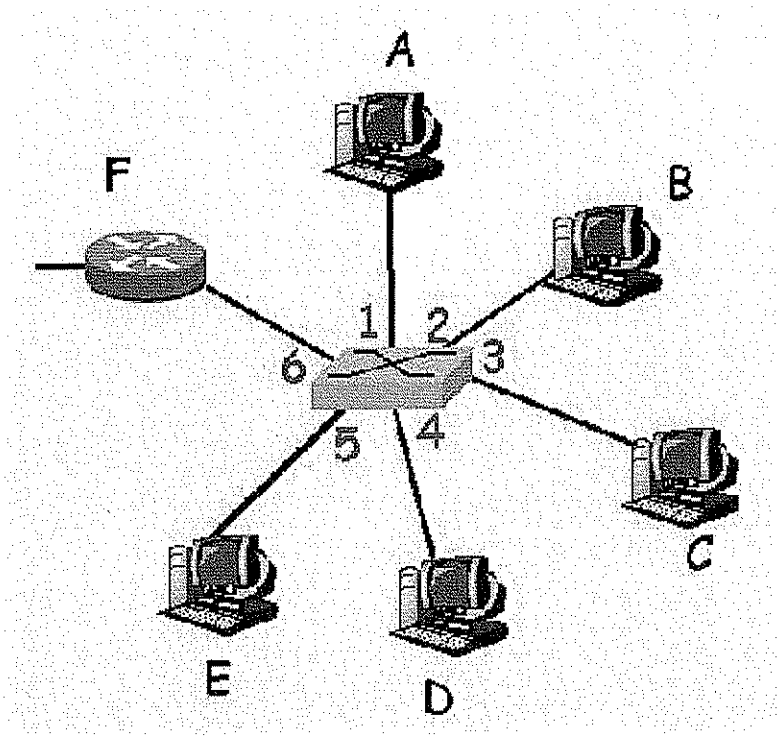
c) Name one option as used in either the ipv4 protocol or ipv6. (1 p.)

6. LANs.

a) Describe the role of beacon frames in IEEE 802.11. (1 p.)

b) CRC and MAC are two crucial components for the basic functioning of LAN protocols. Explain why. (2 p.)

c) See the figure below consisting of a router F, five hosts A E and a LAN switch in the middle. Assume that the forwarding table of the switch is empty at start. A begins by transmitting an ethernet frame to D. D responds with a frame to A. C then sends a frame to D and D answers with a frame to C. Assume now that router F is going to forward an ip packet to host D. Describe step by step how this packet is delivered to the right host. (2 p.)

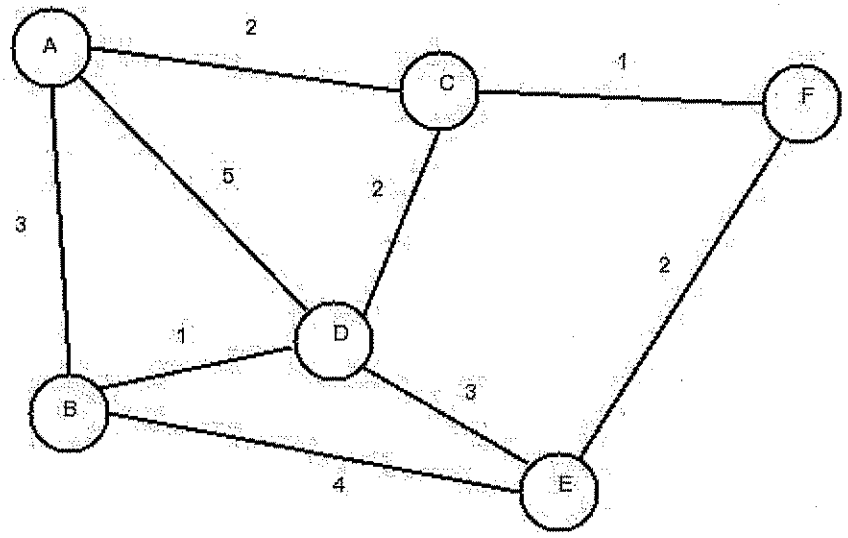


7. Routing.

a) Suppose a router has four interfaces numbered 0-3 and is able to forward ip packets according to the intervals listed below. Construct a forwarding table that has four rows, uses longest-prefix matching and forwards packets to the correct interface. Use the a.b.c.d/x notation. Then show how the router forwards a packet with the address 225.0.195.60. (2 p.)

Address interval	Interface
11100000 00000000 00000000 00000000 up to 11100000 11111111 11111111 11111111	0
11100001 00000000 00000000 00000000 up to 11100001 00000000 11111111 11111111	1
11100001 00000001 00000000 00000000 up to 11100001 11111111 11111111 11111111	2
otherwise	3

b) Show how router A builds a list of the shortest paths in the below network, which uses link state routing. Select the path with the lowest ID (where A < B etc.) if several paths have the same cost. (2 p.)



c) Why are different inter-AS and intra-AS routing protocols used in the Internet? (1 p.)

8. Network security

a) Explain what is meant by a man-in-the-middle attack. Do you think that the PGP (Pretty Good Privace) framework can protect against this type of attacks or not? Motivate your answer. (2 p.)

b) The BGP routing protocol uses a MAC rather public key encryption to sign BGP messages. Explain what a MAC is, in the context of network security. Why do you think a MAC was chosen over public key encryption? (2 p.)

c) Assume you wish to authenticate a client application that wants to connect to your server. Name a protocol and corresponding layer(s) that would solve your problem. (1 p.)