



UPPSALA
UNIVERSITET

Institutionen för Informationsteknologi

Datakom I, (IDT052)
15 oktober 2010: kl 9–14
Polacksbacken 1406

INSTRUCTIONS TO CANDIDATES

- This is a FIVE (5) hour examination
- The examination comprises 13 questions on 4 pages.
- Answer all questions.
- Questions can be answered in Swedish or English.
- 3 = G in at least seven questions in Section A and 3 for at least two questions in Section B
- 4 = G in all questions in Section A, and average of 4 in sections B and C
- 5 = G in all questions in Section A, and average of 5 in sections B and C

Section A : Networking Fundamentals, (Grade U/G)
(Write approximately half an A4 page per question)

Question 1

For each of the following protocols describe briefly what they do and at what level of the TCP/IP stack they are located.

DNS TCP UDP
IP BGP FTP

Question 2

Suppose that a link connecting host A with host B has fixed size data frames and frames experience a transmission delay of α and a propagation delay of β .
Derive a formula for RTT in terms of α and β .

Derive a formula for the smallest window size that achieves 100% utilisation of the link during data transfer between A and B.

Question 3

A router F using a distance vector route discovery algorithm receives the following information from its directly connected peers A and E. Show and explain the calculation used to update F's cost and next hop to C.

HINT: Costs for F to reach A and E are shown in the vectors.

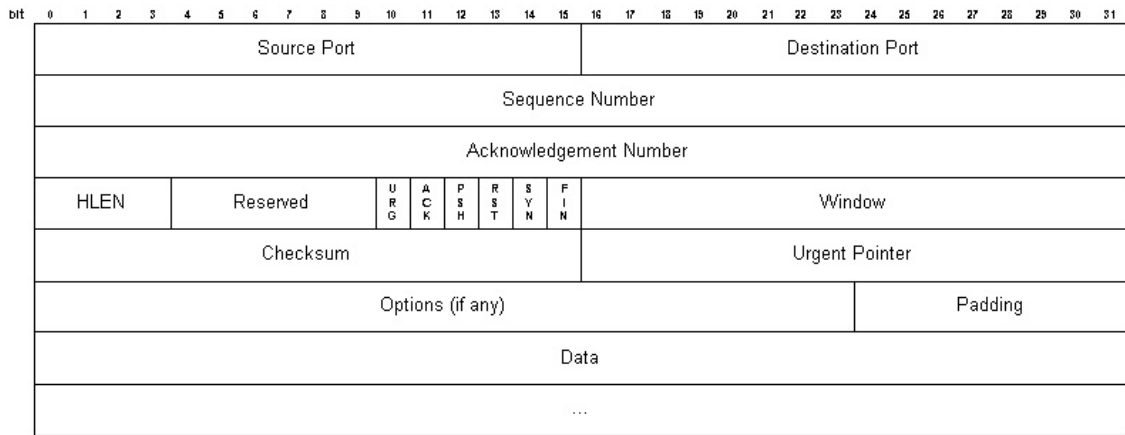
A's vector		E's vector	
dst	cost	dst	cost
A	-	A	2
B	4	B	1
C	2	C	5
D	3	D	3
E	2	E	-
F	1	F	2

Question 4

What is Network Address Translation(NAT), and what issue with IPv4 does NAT help to solve?

Question 5

The TCP header is depicted in the picture below. Each field in the header has a purpose, briefly explain the purpose of as many fields as you can.



Question 6

Discuss how SYN flooding attacks can be used against an Internet server to cause it to deny service to legitimate users. Why/How does this attack work?

Question 7

Explain the difference between flow control and congestion control in TCP.

Question 8

Ethernet is a shared medium protocol. How does Ethernet handle multiple interfaces on the same segment that attempt to transmit at the same time? Explain.

Section B : Theory and Application, (Grade U,3,4,5)
(Write approximately one to two A4 pages per question)

Question 9

Describe the OSI 7-layer protocol stack. You should draw a diagram of the stack structure and describe the main responsibilities of each layer.

Question 10

Describe the operation of the sender and receiver logic of the alternating bit protocol using state transition diagrams.

Explain using time diagrams and sequence numbers what happens when,

- A. a data packet is lost.
- B. an ack packet is lost.

Question 11

Draw an annotated graph, with window size on the Y-axis and time on the X-axis, to illustrate how the size of the TCP window can vary over time. Show in the graph how the window size is adjusted during connection startup, steady state operation with occasional packet loss, and when timeouts occur as a result of congestion.

Question 12

Draw a graph depicting the stream of bits 10111001010010101 and a corresponding simple binary encoding which uses voltages 0 and 5. Explain how your signal coding represents 1 and 0 bits. Further, explain in what situations this simple encoding approach can fail due to base line wander and clock drift.

Describe an encoding that addresses these problems. Show how the bit stream would be represented in your graph, and discuss what bit rate can be achieved in comparison to the simple encoding.

Section C : Practical Applications (Grade U,3,4,5)
(Your answer should be approximately four to five A4 pages.)

Question 13

You are to design an application level protocol for a peer to peer overlay instant messaging system, which provides some services similar to ICQ. The operations that the peers want to propagate among themselves have the following types.

MSG - Deliver an enclosed text message to another peer

ACK - A message was successfully delivered.

STS - A peer status indicator, one of AVAILABLE, BUSY, OFFLINE, ONLINE

Assume that all online peers are able to communicate directly with each other. The system should detect and recover from application PDU loss.

- A. Draw a state/transition diagram for the operation of each peer system showing states, transitions in response to received packets from other peers. Each transition should be labeled with the message that triggers it and the response actions (in terms of sending other messages, where necessary).
- B. Define a common header format for the PDU's to be used by the system. List the fields you think are necessary, and specify how they will be represented.
- C. Specify how the data section of the packet (if any) will be formatted for each of the packet types listed above.