

Internetworking (2G1305) Examination Friday 26-August-05 9:00-13:00

Instructor: G. Q. Maguire Jr.

- **No help material is allowed.**
- You may answer the questions in English or Swedish.
- The questions for *section A* should be answered **on the exam itself**, for the other sections the questions should **each** be answered on a **separate** page.
- For multiple-choice questions, selecting a wrong alternative will reduce the number of points (with a lower limit of 0 points for the problem).
- The **entire** exam must be turned in along with your answers.

The exam is divided into three sections:

- **Section A** consists of multiple-choice questions. Each question is worth two points - if all correct alternatives (*regardless of how many there are*) are selected. Each missed correct alternative will reduce the score by one point. Each selected alternative that is wrong will also reduce the score by one point. The total score for each question will not be lower than zero.
- **Section B** consists of questions for which a short answer is sufficient. Each correctly answered questions is worth 2 points.
- **Section C** consists of questions where a longer answer (essay) is required. A correct answer is worth four points.

The exam grades will be:

- Grade 3: at least 26 points in section A alone.
- Grade 4:
 - ◆ at least 28 points in section A and
 - ◆ at least 4 points in section B and
 - ◆ at least 4 points in section C
- Grade 5:
 - ◆ at least 30 points in section A and
 - ◆ at least 6 points in section B and
 - ◆ at least 8 points in section C

Results will be announced on the institution's announcement board - before 2005-09-16.

Name/Your name:

Personnummer/student number:

Utbildningslinje/Your major

If you are a student from 2G1507 or another version of the course please indicate the course number:

Initials/Initials:	Section A: Section B: Section C: Betyg/Grade:
Inlämnat/Handed in: :	
Antal sidor/Number of pages:	

Please check off which questions you have answered:

Fråga/Questions	Besvarad/Answered	Fråga är värd/ Question worth	Rättning/ Grading	Subtotals
1	<input type="checkbox"/>	2		
2	<input type="checkbox"/>	2		
3	<input type="checkbox"/>	2		
4	<input type="checkbox"/>	2		
5	<input type="checkbox"/>	2		
6	<input type="checkbox"/>	2		
7	<input type="checkbox"/>	2		
8	<input type="checkbox"/>	2		
9	<input type="checkbox"/>	2		
10	<input type="checkbox"/>	2		
11	<input type="checkbox"/>	2		
12	<input type="checkbox"/>	2		
13	<input type="checkbox"/>	2		
14	<input type="checkbox"/>	2		
15	<input type="checkbox"/>	2		
16	<input type="checkbox"/>	2		
Total section A:				
17	<input type="checkbox"/>	2		
18	<input type="checkbox"/>	2		
19	<input type="checkbox"/>	2		
20	<input type="checkbox"/>	2		
Total section B:				
21	<input type="checkbox"/>	4		
22	<input type="checkbox"/>	4		
23	<input type="checkbox"/>	4		
24	<input type="checkbox"/>	4		
Total section C:				
			Total	

Section A: Multiple choice

1. The maximum *theoretical* UDP datagram size is:
 - 576-28 = 548
 - $(2^{16}-1) - 28 = 65,507$ <-- answer
2. Is the UDP checksum mandatory?
 - Yes
 - No<--- correct answer
3. What does a router do when it receives a packet with the *destination* IP address 255.255.255.255?
 - forward it
 - drop it
 - process the packet for itself <-- answer
 - encapsulate it and forward it
 - encrypt it and forward it
4. The Domain Name Service has the following features:
 - Each DNS sever locally stores all mappings
 - It acts as a database<-- answer
 - It features caching<-- answer
 - It is centrally managed
 - It is structured as a tree<-- answer
5. TCP maintains a timer for:
 - each byte in a stream
 - each segment in a stream<-- answer
6. In TCP's sliding window flow control who specifies the *offered* window?
 - Sender
 - Receiver <-- answer

It has to be the receiver - since this indicates how much the receiver is prepared to receive.

7. Modern TCP implementations support “Per-Route Metrics” - how many full windows need to have been exchanged before the per-route metrics will be updated?

- 1
- 2
- 4
- 8
- 16 <-- answer
- 32
- 64
- 128
- 256

8. SCTP provides which of the following features

- Reliable byte streams without record markers
- Multihoming <-- answer
- Mobility
- Multiple streams <-- answer
- A 3-way handshake to establish an association

SCTP is a message oriented protocol, hence there are record markers. It does support multihoming and multiple streams, but has no explicit support for mobility. It requires a 4-way handshake to establish an association.

9. The If-Modified-Since header in HTTP is used to avoid:

- Caching a page
- Use of a stale cached page <-- answer
- Unnecessarily fetching a cached page <-- answer
- An extra round trip time

If the document is cached, then the If-Modified-Since header can be sent to check if the document has changed since the copy was cached - thus saving a transfer - but costing a round trip time and some processing time. This is called a conditional GET.

10. IGRP Route Poisoning allows the use of a zero hold-down time?

- True <-- answer
- False.

11. Which of the following that is **not** included in an IPv6 fragment, but is included in an IPv4 fragment:

- Fragment offset
- Do not fragment flag <-- answer
- More fragments flag

12. Can user data be carried in the second segment of a **TCP** open?

- Yes
- No <-- answer

13. Mobile IP **must** or **may** tunnels packets in which of the following situations:

Must	May	
<input type="radio"/>	<input type="radio"/>	From a corresponding node to the Home Agent
<input checked="" type="radio"/>	<input type="radio"/>	From the Home Agent to a Foreign Agent
<input type="radio"/>	<input checked="" type="radio"/>	From a Foreign Agent to the Home Agent
<input type="radio"/>	<input type="radio"/>	From the Home Agent to a corresponding node

14. A NAT may perform which of the following:

- Network address translation <-- answer
- Port address translation <-- answer
- Type of Service translation

15. DNS has which of the following features:

- caching <-- answer
- flat name space
- hierarchical name space <-- answer
- a single copy of any item of information

16. In link state routing protocols each node knows:

- the state of **all** links in the network <-- answer
- only** the state of links to its neighbours
- only** the state of links on the shortest path tree

Section B: Short Answers

17. Describe the purpose of a AAAA Resource Record in DNS.

The AAAA resource record stores an IPv6 address.

18. Describe the function of the SCTP cookie.

The use of a cookie reduces the risk of a denial of service attack based simply only opening new session. Unlike the case of TCP, SCTP does not need to utilize significant resources until there has been a COOKIE ECHO has been received.

19. For an incoming IP packet - the Version, Protocol, and Source & Destination IP addresses fields are all used for what purpose?

Demultiplexing

20. Why are IPV4 options rarely used?

As there are only 40 bytes of space available and the internet has a large diameter there is rarely enough room for tracing or time stamping information. Additionally, many routers have to process packets with options via their slow path - rather than their fast forwarding path - thus the handling of packets with options will be different than packets without options (hence rendering some of the information which one might derive from the options of less use).

Section C: Essay Answers

21. Describe the problems for TCP in terms of the Bandwidth-Delay Product for a “long fat pipe”? What solution does TCP adopt?

(1) Because TCP's maximum window size is specified by a 16 bit field, if the bandwidth delay product is greater than 65535 bytes, then unless we use the window scale option the utilization of the link will be poor and the throuput unnecessarily low. (2) TCP also adds a Timestamp option - putting a time stamp in each segment allows better computation of RTT. (3) With large windows you could have sequence number wrap around and not know which instance of a given sequence number is the correct one, hence TCP implements “Protection Against Wrapped Sequence Numbers” (PAWS) - using timestamps (which must simply be monotonic). (4) Additionally there is TCP extension for Transactions (T/TCP) to avoid the need for a three way handshake on connection setup and shorten the TIME_WAIT state.

22. Give an example of a stateless server and explain what advantages it derives from being stateless.

An NFS server is designed to be stateless:

- the server does not keep track of what clients are accessing which files
- there are no open or close procedures; just LOOKUP

- being stateless simplifies server crash recovery
- clients don't know if the server crashes
- only the client maintains state.

23. Contrast the transport and tunnel modes for Encrypted Security Payloads (ESP) as used in IPv6.

In transport mode the TCP segment or UDP datagram is encrypted and placed in an IPv6 packet. While in tunnel mode an entire IPv6 packet is encrypted and placed in another IPv6 packet. Thus in tunnel mode there are two headers, the outer which is unencrypted and the inner header which is encrypted. Tunnel mode is often used to provide a VPN between two or more networks, while transport mode is frequently used to provide a protected end-to-end path between peers.

24. Contrast Protocol Independent Multicast in sparse mode vs. dense mode.

PIM-DM, dense mode, is used when *most* routers are involved in multicasting (for example in a campus LAN), while PIM-SM, sparse mode, is used when it is *unlikely* that each router is involved in multicasting (for example in a WLAN). PIM-DM uses a source-based tree with Reverse Path Forwarding and pruning/grafting; while PIM-SM uses a group-shared tree with a rendezvous point as the source of the tree.