



Försättsblad Prov Original

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|-------------|---------------------------|---------------------|
| Kurskod | Provkod | Tentamensdatum |
| D T 0 5 2 A | T 1 0 1 | 2 0 2 3 - 0 1 - 1 0 |
| Kursnamn | Datateknik AV, TCP/IP-nät | |
| Provnamn | Tentamen | |
| Ort | Sundsvall | |
| Termin | | |
| Ämne | | |

Final Exam

DT052A / DT066A TCP/IP Internetworking

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Instructions

Carefully read the questions before you start answering them. Note the time limit of the exam and plan your answers accordingly. Only answer the question, do not write about subjects remotely related to the question. The questions are *not* sorted by difficulty. Clearly show which answer you are giving your solution to, *Always motivate your answers and show your calculations..*

Time 4 hours.

Exam Aids Non-programmable calculator.

Maximum points 30

Questions 10

Preliminary grades

The following grading criteria applies: $E \geq 50\%$, $D \geq 60\%$, $C \geq 70\%$, $B \geq 80\%$, $A \geq 90\%$.

Questions

- (3p) 1. Answer the following questions while motivating your answer.
- Which three important characteristics differentiate wireless links from wired links?
 - Describe the hidden node problem in wireless local area networks. Which mechanism is employed by IEEE 802.11 (WiFi/WLAN) to eliminate the hidden node problem?
 - Why can collision detection not be adopted for medium access in wireless LANs? Which mechanism is adopted instead, and how does it work?
- (3p) 2. Answer the following questions.
- A handoff occurs when a mobile station changes its association from one base station (BS) to another during a call. List two reasons for the need for a handoff.
 - What is the basic difference between 3G and 4G/5G cellular network architectures?
- (3p) 3. Explain the concept of cookies used by websites. Elaborate on benefits and drawbacks using examples and illustrations.
- (3p) 4. What is meant by congestion at the transport layer and how does it affect the network performance? Also, what are the congestion control techniques used by TCP and explain those in detail?

- (3p) 5. How could two hosts behind NAT communicate with each other if neither side can set up port-forwarding on their gateways?
- (3p) 6. What is Software Defined Networking (SDN)? Discuss the control plane and data plane concepts related to SDN architecture. Provide the basic SDN architecture figure. Describe the benefits and advantages of SDN compared to traditional networking.
- (3p) 7. Explain how the following problems affect a transport layer protocol that should achieve reliable delivery over an unreliable channel. For each of the problems, explain the mechanisms used to manage the problem.
- Packet Loss.
 - Duplicate Acknowledgement.
 - Congestion.
- (3p) 8. Answer the following questions briefly.
- Why do we need Error Detection and Correction at the data link layer? Explain how does it work using an example?
 - Explain why Error Detection and Correction is preferred in WLANs and not in Ethernet. Justify from reliability and overhead perspectives.
- (3p) 9. Consider a data stream between two workstations A and B . The data stream consists of packets generated at workstation A at a rate of 100 packet/s and immediately transmitted to workstation B . A and B are able to communicate via a router that stores and forwards the packets. Assume that all packets are correctly received by B and that there is no packet loss. Finally, the measured average end-to-end delay between A and B is $T = 200$ ms.
- Find N , the average number of packet that are in transit from A to B .
 - Model the system as an M/M/1 queue (i.e. exponential service time and inter-arrival time) with arrival rate $\lambda = 100$ packet/s, and average end-to-end delay $T = 200$ ms. Calculate the service rate μ , the utilization factor ρ , and the average queuing delay W .
- (3p) 10. At home, I noticed that in one of my rooms, I had a loss rate of $L = 40\%$ when I tested the link. The RTT I got was 0.5 ms and I use a standard maximum segment size (MSS) for an Ethernet connection.

$$\text{Avg. Throughput} = \frac{1.22 \times \text{MSS}}{\text{RTT} \sqrt{L}}$$

With the help of the above relationship, answer the following:

- What average throughput did I get from that connection? Give the answer in bits per second (b/s) and bytes per second (B/s).
- Luckily it was just because of a bad cable, and once I changed it, I got a throughput of 1 Gbps. What loss rate is tolerated to get that speed? Explain this loss rate in percentage and in terms of X packets lost per Y packets sent.