Test of Pearl 101 — Operating systems and computer networks

Pearls of Computer Science (201300070) / Introduction to BIT (201300073)
Bachelor module 1.1, Technical Computer Science, EWI

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- You may use 1 A4 document with your own notes for this exam and a *simple* calculator.
- Scientific or graphical calculators, laptops, mobile phones, books etc. are not allowed. ***Put those in your bag now!***
- Write your answers on this paper, in the provided boxes, and hand this in.

Total number of points: 100.
Total number of pages: 4.

Your name:

Your student number:

1. Operating systems

7 pt (a) In the context of operating systems, "swapping" means:
(multiple choice, no explanation needed)

A. Plugging out one USB memory stick and plugging in another.
B. Replacing the contents of a window on the screen by something else.
C. Letting the CPU stop executing one program and start executing the next.
D. Temporarily moving some data from memory to hard disk and vice versa.
E. Replacing e.g. the American QWERTY keyboard by a French AZERTY one.

9 pt (b) Processors often have special features allowing the operating system to take action if a program tries to access a specific part of memory. For which function(s) of the operating system is this useful?
(select **1, 2 or 3** functions from the following list, no explanation needed)

A. Process management
B. Memory management
C. File management
D. Input/Output
E. Protection

7 pt (c) Suppose a process is started, waits *once* for a keypress, then does some computations and finally terminates. During the computations, it is interrupted by an operating system timeout *three times* for other processes to run.
How many times does this process pass through the "blocked" state?
(one number, no explanation needed)

7 pt (d) Consider the same situation as in the previous question. How many times does the process undergo a "dispatch"?
(one number, no explanation needed)

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2. Networks – protocols

7 pt (a) Layer X is *above* layer Y means that:

A. layer X does not need layer Y.
B. layer X works faster than layer Y.
C. layer X uses the service of layer Y.
D. layer X provides a service to layer Y.
E. layer X is less important than layer Y.
F. layer X is more important than layer Y.

7 pt (b) What is the reason the IP addresses of all computers in e.g. one university start with the same digits?

A. It makes it easier to remember them.
B. It makes forwarding/routing tables shorter.
C. It makes automatic translation of hostnames to IP addresses possible.
D. Every country has a block of IP addresses, for all computers in that country.
E. It is just how it was done historically, there is no good reason for it anymore.

Here you see a few consecutive network packets as displayed by Wireshark running on host 130.89.13.213:

nr.	source IP	destination IP		source/dest.port	TCP seq./ack.numbers
1	130.89.144.74	130.89.13.213	TCP	7701 > 56922 [ACK]	Seq=200 Ack=2001 Len=30
2	130.89.13.213	130.89.144.74	TCP	56922 > 7701 [ACK]	Seq=2001 Ack=230 Len=200
3	130.89.144.74	130.89.13.213	TCP	7701 > 56922 [ACK]	Seq=250 Ack=2001 Len=50
4	130.89.13.213	130.89.144.74	TCP	56922 > 7701 [ACK]	Seq=2201 Ack=230 Len=0
5	130.89.144.74	130.89.13.213	TCP	7701 > 56922 [ACK]	Seq=300 Ack=2401 Len=0

Note: the setting up and tearing down of the connection(s), using SYN and FIN packets, has been omitted here for clarity.

9 pt (c) One packet in this trace is wrong; it should never have been sent like this. Which one (nr. 1, 2, 3, 4 or 5) is this, and what is wrong about it?

9 pt (d) Also, a packet has been lost. What must have been the contents of this missing packet?

source IP =

destination IP =

Seq =

Ack =

Len =

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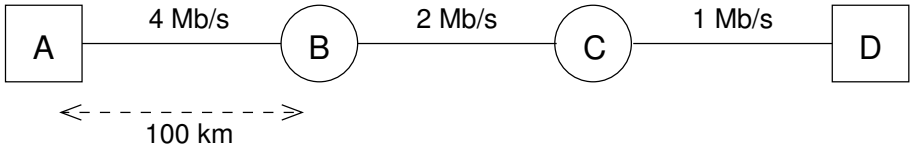
3. Networks – delay

Consider a network consisting of an endhost A, two routers B and C, and an endhost D. The only path from A to D is via B and C. The link from A to B is 4 megabit/s, from B to C 2 megabit/s, and from C to D 1 megabit/s.



An application on host A generates 3 packets of 4000 bits each (incl. headers), at intervals of 3 ms, destined for host D. There is no other traffic in this network.

We assume that the computation time needed by routers B and C to decide where to send the packet, is negligible. We also assume that B, C and D are geographically close together; the cable from A to B is 100 km long, and the signals travel over it at 200 000 km/s.

15 pt (a) Calculate the transmission and propagation delays for one packet on each of the links, or indicate why it is negligible:

Transmission delay on link A–B:

Propagation delay on link A–B:

Transmission delay on link B–C:

Propagation delay on link B–C:

Transmission delay on link C–D:

Propagation delay on link C–D:

7 pt (b) At which node(s) in this network does queueing delay occur, if any? (multiple choice, no explanation needed)

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16 pt (c) Calculate how long it takes until all packets have arrived at host D, i.e., how much time elapses between the moment host A generates the first packet, and the moment host D receives the last bit of the last packet?
Make your reasoning clear.

End of this test