Exam of *Computer Networks and Operating Systems*

Date: Fri 15 Oct
Time: 14:45 - 15:45

Instructor: Mahboobeh Zangiabady

Your name: (please <u>underline your family name</u>): _____

Your student number: _____

The test is 60 mins and it is a closed book exam

Allowed resources:

- You may use 1 A4 document with your own notes as a cheat sheet for this exam and a simple calculator.
- We will give you 1-page scrap paper. You do not need to hand in your scrap paper.

Notes: (please read carefully)

- Laptops, mobile phones, books, etc. are not allowed. Please put them in your bag!
- **No negative points** for wrong answers.
- You can score a total of 100 points for this exam, you need 55 points to pass the exam.

Achieved points: _____ / 100 points
Questions on Operating Systems (total 28 points)

Q1 [4 points] *(choose one, no explanation needed)*
In the context of operating systems, a "process" is:
    A. either memory management, file management, or I/O.
    B. a sequence of instructions to be executed by the processor.
    C. the consequence of insufficient protection against malicious software.
    D. a sequence of events coming in from the outside world, like key presses.
    E. a sequence of events for the outside world, such as data sent to a printer.

F. the sequence of actions the operating system takes when the computer is switched on.

Answer: B

Q2 [4 points] *(choose one, no explanation needed)*

When an operating system needs to move a process from the executing state to the waiting state, the operating system ….. (complete the sentence)

A. will overwrite the process's data in memory with data from another process.
B. will store in memory all information needed to resume the process later.
C. will store in the hard disk all information needed to resume the process later.
D. can't do so; it has to wait until the process goes into block state to wait
for input. E. can't do so; it has to wait until the process finishes by itself.

Answer: B.

Q3 [4 points] *(choose one, no explanation needed)*

An operating system runs two processes simultaneously by:
   A. Installing an extra CPU core for each process.
   B. Executing alternately one instruction from each process.
   C. Executing one process for a while, then the other for a while.
   D. At any time only executing the process the user is interacting with.
   E. Putting instructions from both processes in alternate memory locations.
   F. Putting instructions from the processes in the lower and upper half of memory, respectively

Answer: C

Q4 [4 points] *(choose one, no explanation needed)*

Suppose a process is just created as a new process. While being in execution, this process experiences one time-out and it requires I/O from the user once. Finally, the process completes successfully. How many *state transitions* (i.e., move from one state to another state) does this process experience from the "new state" till completion?

A. 4

B. 5

C. 6

D. 7

E. 8

F. 9

G. 10

Answer: E

Q5 [4 points] *(choose one, no explanation needed)*
Multiple users and programs can use the same computer. To protect users and programs from potentially malicious or unauthorized/undesirable activity, an OS implements various protection mechanisms. Which of the following is **not** a protection solution?

    A. Different access rights to files for different user groups
    B. Time-out event for CPU execution
    C. Two modes of operation, i.e., user mode and kernel mode
    D. There is a fetch- decode- execute cycle
    E. The memory space a process can access is restricted to a certain range

Answer: D.

Q6 [4 points] *(choose one, no explanation needed)*
Assume you have a Python program on your computer and you want to execute it. Which of the following represents the movement steps of the program from where it is stored till its execution?

    A. Secondary storage, job pool, main memory, CPU
    B. Secondary storage, main memory, job pool, CPU
    C. Secondary storage, CPU
    D. Main memory, job pool, CPU
    E. Main memory, secondary storage, CPU
    F. Main memory, CPU, secondary storage

Answer: A.

Q7 [4 points] (choose one, no explanation needed)
Which kinds of information are typically stored as metadata in the file system when a file is created? Select four from the following list:

    A. Current time, size of the file, name of the file, access rights of the file
    B. Size of the file, IP address of the computer, access rights of the file, name of the computer
    C. Size of the disk, password of the user, access rights of the file, name of the computer
    D. Password of the user, IP address of the computer, name of the computer, name of the file

Questions on Computer Networks (total 20 points)

Q8 [5 points] *(choose one, no explanation needed)*

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.

Q9 [5 points] *(choose one, no explanation needed)*
To specify which TCP connection a packet belongs to, which information would you need?

A. Source and destination MAC address, source, and destination port numbers
B. Source port number, destination port number
C. Source MAC address, destination MAC address
D. The packet length, packet sequence number, source, and destination IP addresses
E. Packet length and packet acknowledgement number
F. Source and destination IP addresses, source, and destination port numbers
G. Source IP address, destination IP address
H. The packet length, packet sequence number

Q10 [5 points] *(choose one, no explanation needed)*

Assume that a packet is 1000 bytes in size. But, the number of application layer bytes in this packet is 900 bytes. Why is this so?

    A. Because some bytes in a packet are dropped in the routers' queue.

B. Because a packet also includes some additional information in its headers for the delivery of the packet on the Internet.

C. Because this is a retransmitted packet.

D. This cannot happen. Packet size equals the number of application layer bytes. E. This can happen, but it is a mistake in the packet.

Answer: B.

Q11 [5 points] *(choose one, no explanation needed)*

Which of the following is FALSE?

A. In circuit switching, first, a path (or circuit) is established between the sender and the receiver.

B. In-circuit switching, the information sent by the sender does not experience any queuing delay while traveling to the receiver.

C. A circuit switching system can support a lower number of users compared to a packet switching system.

D. In packet switching, all resources between the sender and the receiver are reserved for communication.

E. In packet switching, while traveling towards the receiver, packets experience propagation delay, nodal processing delay, and sometimes queuing delay.

F. Internet is a packet-switching network.

Answer: D

Questions on TCP (total 25 points)

Q12 [5 points] (choose one, no explanation needed)

When a web browser (client) talks to a web server, the TCP port number on the server side normally is 80. What can we say about the client-side port number?

A. It must also be 80 since that's the port for web traffic.
B. It must not be 80, since the client is not a web server.
C. It is some random number, and different for every next connection.
D. It is some random number, but stays the same when multiple connections are made.

Answer: C

Below you see a few consecutive network packets as displayed by Wireshark running on host 130.89.13.213. Answer the following questions according to this trace.

Packetnr	Source IP	Destination IP	Src/Dest. Port	TCP seq/ack numbers
1	130.89.144.74	128.119.245.12	1161 > 5543	Seq=500, Ack=1270, Len=30
2	130.89.144.74	128.119.245.12	1161 > 5543	Seq=530, Ack=1270, Len=40
3	130.89.144.74	128.119.245.12	1161 > 5543	Seq=570, Ack=1270, Len=30
4	130.89.144.74	128.119.153.13	1389 > 5543	Seq=1270, Ack=580, Len=0
5	128.119.245.12	130.89.144.74	5543 > 1161	Seq=1270, Ack=530, Len=30

Q13 [5 points]

In the above trace, how many hosts can you recognize?
    A. 2
    B. 3
    C. 4
    D. 5
    E. 6

   Answer: 3 hosts

Q14 [5 points]
 In the above trace, how many connections can you recognize?
    A. 1
    B. 2
    C. 3
    D. 4
    E. 5

Q15 [5 points]

How much application layer data does Packet-2 carry?

A. 40 bits
B. 40 bytes
C. 530 bits
D. 530 bytes
E. 1270 bits
F. 1270 bytes
G. We cannot know from this trace

Q16 [5 points]

Packet-4 has Len=0. What does this signify?

1. It is an error, Len cannot be zero
2. Packet-4 does not contain any application layer data
3. Packet-4 does not contain any information
4. Packet-4 was dropped in the router's queue while being transmitted
5. Packet-4 was lost
6. Packet-4 is just created

Questions on delay calculation (total 27 points)

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 2 megabit/s, from B to C 1 megabit/s, and from C to D 2 megabit/s.
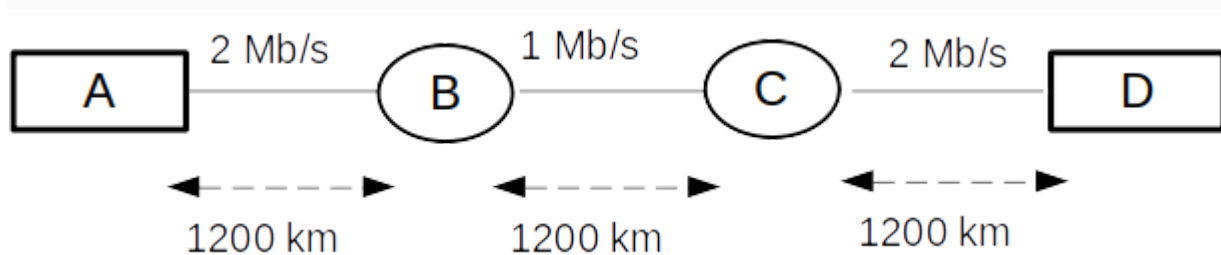
We assume that the computation time needed by routers B and C to decide where to send the packet, is negligible. We also assume that each cable is 1200 km long, and the signals travel over it at 200 000 km/s.

An application on host A generates 2 packets of 2000 bits each (incl. headers), at times t_1 = 0 ms, t_2 = 10 ms. There is no other traffic in this network.

Q17[4 points]

Calculate the transmission delay on link A–B (The result must be in ms).

Answer: 1 ms

Q18 [4 points]
Calculate the transmission delay on link B–C (The result must be in ms).

Answer: 2 ms

Q19 [4 points]
Calculate the transmission delay on link C–D (The result must be in ms).

Answer: 1 ms

Q20 [5 points]
Calculate the propagation delay on link A–B (The result must be in ms).
Answer: 6 ms

Q21 [5 points]
At what time will the first packet have arrived completely at host D? (The result must be in ms.)

       A. 19 ms
       B. 20 ms
       C.   22 ms
       D.   32 ms

Answer: C t=22ms

Q22 [5 points]
At what time will the second packet have arrived completely at host D? (The result must be in

ms.)

        A. 19 ms
        B. 20 ms
        C. 22 ms
        D. 32 ms

Answer: D t = 32 ms.