

CS5310.000/002, Fall 2020
Computer Networks and Communication Systems
Final Exam

5:00pm – 7:30pm
Wednesday, 12/9/2020

General Instructions:

- This is an open book exam. However no any form of information exchange is allowed. You are not allowed to search Internet for hint of solutions.
- Do all three problems. Number them clearly. If you write and scan, then please write clearly.
- Please turn on your ZOOM video pointing to you so that you can be seen.
- No any form of communications allowed during the exams.
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Name: Zebo Xiong

Student #: A04907051

Problem	1	2	3	Total
Score				
Maximum	18	70	12	100

1. ($9 + 9 = 18$ pts) John Doe has a 42Kbps V9X modem XYZ, which supports protocols for fax/data transmission, compression, and error detection/correction, among others. The bandwidth of John's local PSTN is 3200Hz. After some initial excitement, he got frustrated with the fact that with his new modem he can only connect to his favorite ISP service at speeds significantly lower than 42Kbps. John complained about the problems to the modem's vendor. But the modem vendor claimed that the problems are caused by John's local PSTN.

- (1) To achieve 42Kbps transmission rate, what is the minimal *baud* rate needed?
- (2) To achieve 42Kbps transmission rate, what is the minimal *signal-noise* ratio S/N required? Answer please see attachment.

2. ($35 \times 2 = 70$ pts) Answer *true* or *false* only to the following statements. Please read carefully.

- F (1) In general the higher the baud rate, the higher the bit rate, but the reverse is not necessarily true.
- F (2) TCP connections and ATM virtual virtual connections are of the same nature except that TCP connections use IP addresses and port numbers while ATM virtual connections use ATP virtual path numbers.
- F (3) The *Network Layer* in the OSI reference model is not an *end-to-end* layer because two corresponding network layers on two different hosts not directly connected by a physical link cannot talk with each other.
- T (4) ATM adopted a single cell format to support modular and layer abstraction.
- (5) The CSMA/CD protocol (Ethernet) places a limit on the minimum size of a frame for better channel utilization. F
- (6) No communication channel can allow all the frequency components of any signal to pass through. T
- T (7) Some signals may only have finite number of frequency components when expressed using the Fourier series concept. T
- (8) TCP can negotiate optionally if sliding window will be used during three-way hand shaking. F
- (9) In sliding window protocols the sizes of the send window and receive window can be different. T
- (10) The sliding window concepts are used by some of connection-oriented protocols.
- (11) In the token ring protocol, the ring must have some minimum length so that some shorter frames can be transmitted over the ring. F
- (12) If the strength of the received signal is -10dBm, then the receiver cannot correctly receive the signal. F
- T (13) The host byte orders of two byte integers and four byter integers can be different. T
- (14) Both *Nyquist* fomula and *Shannon-Hartley* law predict the maximum theoretical data rates. T
- (15) When computers equipped with the so called *high speed Ethernet* card (100Mbps) are mixed with computers equipped with the classical Ethernet card (10 Mbps), the former have no collisions while the latter still have collisions. F (Didn't specify what kind of "collisions")
- (16) IP is not a transport layer protocol because it doesn't support port number. T

- (17) DSL and ADSL technologies break the 3000Hz bandwidth limit of analog telephone lines by placing high bandwidth cables connecting normal telephones to end offices of phone companies. **F**
- (18) In the TCP/IP suite, ICMP can still exist without IP. **F**
- (19) After a `select` function returns a positive integer that denotes the number of ready descriptors, if any of the ready descriptors is not handled, that descriptor will still be classified as ready when next call to `select` function returns. **T**
- T** (20) On the Internet a source computer can always use the ARP protocol to obtain the Ethernet address of its destination computer(s) in a TCP/IP communication.
- F** (21) One of the main reasons that TCP is called a stream protocol is TCP doesn't acknowledge incoming data by frame boundaries.
- T** (22) The network *endian* of different computer systems may be different.
- T** (23) The size of individual UDP datagrams in UDP can be negotiated between the sender and receiver at the beginning of each UDP send/receive exchange.
- F** (24) As HTTP is a TCP based protocol for each HTTP session in the Internet, there is a physical communication path dedicated exclusively to the session.
- T** (25) A port number can be shared by more than one process in TCP/IP communications to send and receive datagrams or data segments.
- F** (26) When a process terminates or is killed, all of its child processes which are zombie will be removed.
- F** (27) When a descriptor placed in the second parameter of `select` function has an error pending, that descriptor will be classified as *readable* by the kernel.
- T** (28) A single process can communicate with multiple other processes using both TCP and UDP protocols.
- F** (29) IP name to IP address mappings in DNS are many-to-many mappings.
- T** (30) A single process can manage many different port numbers.
- F** (31) A single port number can only be used and managed by a single process.
- F** (32) If a client and server processes are running on the same computer using TCP as transport protocol then TCP connection is optional.
- T** (33) When `connect` function is used by a UDP client, the kernel will allocate input/output buffers for the UDP descriptor.
- T** (34) When a function call
- `read(sockfd, &readBuf, 100)`
- is made where *sockfd* is an open TCP socket descriptor, the function will return 10 bytes if the TCP input buffer has only 10 bytes in it.
- F** (35) Reverse IP address mapping in DNS is an optional service.

3. ($6 \times 2 = 12$ pts) Mark only one choice that is *most applicable* to the statement. Only one choice is allowed.

- B** (1) A *slow function* is:
- an input function that can be blocked waiting for input data

- b. an input or output function that can be blocked waiting for data to become available
 - c. any function that the kernel hasn't assigned CPU cycle
 - d. any input or output function that can be blocked waiting for resources to become available
- A** (2) When the signal to noise ratio is one ($S/N = 1$), then
- a. communication can not be possible
 - b. communication efficiency drops by 50%
 - c. maximum data rate will drop by 50%
 - d. none of the above three is true
- A** (3) The maximum signal strength that a device can receive directly from each other is:
- a. as regulated by the sender
 - b. 0 dBm
 - c. 10 dBm
 - d. -10 dBm
- B** (4) The `sendto` and `recvfrom` functions can be
- a. used by UDP applications only
 - b. used by TCP applications as well, as long as the `sockaddr` parameter of the function is initialized by a TCP socket parameters
 - c. used by TCP applications as well, as long as the `sockaddr` and the length of the `sockaddr` structure (the 4th and the 5th parameters) are NULL
 - d. by TCP applications only when the TCP socket hasn't been connected yet
- D** (5) For a communication channel, if we know:
- a. the data rate that can be achieved, then we know the corresponding baud rate
 - b. the baud rate that can be achieved, then we know the corresponding bit rate
 - c. the bit rate that can be achieved, together with the signal to noise ratio, then we know the corresponding baud rate
 - d. None of the above three are true
- D** (6) Everything else unchanged, which of the following protocol's utilization benefits the most by increasing the frame size:
- a. Classical Ethernet (CSMA/CD)
 - b. Token bus
 - c. Token ring
 - d. None of the three will benefit