Computer Networks (CS30006)
Question Bank 2

1. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates $R1$ = 500 kbps, $R2$ = 2 Mbps, and $R3$ = 1 Mbps.
   a. Assuming no other traffic in the network, what is the throughput for the file transfer?
   b. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

2. We need to use synchronous TDM and combine 20 digital sources, each of 100 Kbps. Each output slot carries 1 bit from each digital source, but one extra bit is added to each frame for synchronization. Answer the following questions:
   a. What is the size of an output frame in bits?
   b. What is the output frame rate?

3. Assume that a voice channel occupies a bandwidth of 4 kHz. We need to multiplex 10 voice channels with guard bands of 500 Hz using FDM. Calculate the required bandwidth.

4. We have 14 sources, each creating 500 8-bit characters per second. Since only some of these sources are active at any moment, we use statistical TDM to combine these sources using character interleaving. Each frame carries 6 slots at a time, but we need to add four-bit addresses to each slot. Answer the following questions:
   a. What is the size of an output frame in bits?
   b. What is the output frame rate?
   c. What is the duration of an output frame?
   d. What is the output data rate?

5. Four channels, two with a bit rate of 200 kbps and two with a bit rate of 150 kbps, are to be multiplexed using multiple slot TDM with no synchronization bits. Answer the following questions:
   a. What is the size of a frame in bits?

b. What is the frame rate?
c. What is the duration of a frame?
d. What is the data rate?

6. Assuming even parity, find the parity bit for each of the following data units.
   a. 1001011
   b. 0001100
   c. 1000000
   d. 1110111

7. Given the dataword 1010011110 and the divisor 10111, Show the generation of the codeword at the sender site (using binary division).

8. Using 5-bit sequence numbers, what is the maximum size of the send and receive windows for each of the following protocols?
   a. Stop-and-Wait ARQ
   b. Go-Back-N ARQ
   c. Selective-Repeat ARQ

9. A system uses the Stop-and-Wait ARQ Protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000 Km and the propagation speed is 2×10^8 m/s? Ignore transmission, waiting, and processing delays.

10. Assume the propagation delay in a broadcast network is 5 ms and the frame transmission time is 10 ms.
    a. How long does it take for the first bit to reach the destination?
    b. How long does it take for the last bit to reach the destination after the first bit has arrived?
    c. How long is the network involved with this frame (vulnerable to collision)?The last bit is 10 ms behind the first bit.

11. Assume the propagation delay in a broadcast network is 3 μs and the frame transmission time is 5 ms. Can the collision be detected no matter where it occurs?

12. Assume the propagation delay in a broadcast network is 12 ms and the frame transmission time is 8 ms.
    a. How long does it take for the first bit to reach the destination?
    b. How long does it take for the last bit to reach the destination after the first bit has arrived?
    c. How long is the network involved with this frame (vulnerable to collision)?

13. We have a pure ALOHA network with a data rate of 10 Mbps. What is the maximum number of 1000-bit frames that can be successfully sent by this network?

14. To understand why we need to have a minimum frame size $Tfr = 2 \times Tp$ in a CDMA/CD network, assume we have a bus network with only two stations, A and B, in which $Tfr = 40$ ms and $Tp = 25$ ms. Station A starts sending a frame at time $t = 0.0$ ms and station B starts sending a frame at $t = 23.0$ ms. Answer the
    following questions:
    a. Do frames collide?
    b. If the answer to part *a* is yes, does station A detect collision?
    c. If the answer to part *a* is yes, does station B detect collision?

15. In a slotted Aloha network with $G = 1/2$, how is the throughput affected in each of the following cases?
    a. G is increased to 1. **b.** G is decreased to 1/4.

16. Answer the following questions:
    a. What is the polynomial representation of 101110?
    b. What is the result of shifting 101110 three bits to the left?
    c. Repeat part b using polynomials.
    d. What is the result of shifting 101110 four bits to the right?
    e. Repeat part d using polynomials.

17. Traditional checksum calculation needs to be done in one's complement arithmetic. Computers and calculators today are designed to do calculations in two's complement arithmetic. One way to calculate the traditional checksum is to add the numbers in two's complement arithmetic, find the quotient and remainder of dividing the result by 216, and add the quotient

and the remainder to get the sum in one's complement. The checksum can be found by subtracting the sum from 216 - 1. Use the above method to find the checksum of the following four numbers: 43689, 64463, 45112, and 59683.

18. This problem shows a special case in checksum handling. A sender has two data items to send: (4567)16 and (BA98)16. What is the value of the checksum?

19. Bit-stuff the following frame payload:

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000111111100111110100011111111110000111
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20. Unstuff the following frame payload:

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0001111100000111110111010011101111000001111
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