1. solution:
   a. non-persistent
      i. if idle, transmit
      ii. if busy, wait random amount of time
   b. 1-persistent
      i. If idle, transmit with probability 1
      ii. If busy, wait till it becomes idle
      iii. If collision, wait random amount of time
   c. In 1-persistent CSMA, station will sense the channel after a collision.
      Then, it will send if it is become idle. However, non-persistent will always
      wait random time if it is busy. Thus, in light traffic load, the 1-persistent will
      outperform than non-persistent.

2. solution:
   a. The generator could be derived from the function as 10101, thus the R(enminder)
      should equal to 4.
   b. As calculation shown in following figure, R is 0000.
c. Thus, by attaching the R to the original message, the string of bits is 1100110011001010100000

3. solution:
   a. Token passing protocol have better performance than CSMA/CD when the channel is busy.
   b. In token passing protocol, only one host with the token can transmit data. However, in CSMA/CD, the host will stop while the collision happens. Thus, if the channel is busy, collision happens frequently. Thus, the token passing protocol will be more efficient.

4. solution:
   a. Token Ring frames have two fields that control priority: the priority field and the reservation field.
   b. Token carries priority bits: Only stations with frames of equal or higher priority can grab the token.
c. station can make reservation: When a data frame goes by if a higher priority has not been reserved.

5. When Ethernet speed increases, CSMA/CD becomes worse because it needs larger packet size to detect collision. New technologies such as Carrier Extension and Packet Bursting are adopted.


Another direction is to avoid collisions, so that we do not need to use CSMA/CD. We adopt full duplex mode in Ethernet. Full-duplex mode can be applied to point-to-point Ethernet connection and Fast Ethernet connection, because they use different lines of twisted pair cable, there will be no collision.