1. 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 $2^{16}$, 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 $2^{16} - 1$. Use the above method to find the checksum of the following four numbers: 43,689, 64,463, 45,112, and 59,683.

2. Given the data word 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site (using binary division)

3. **Answer to the following subnetting questions:**

   - **Target IP address: 19.49.125.150/23**

   Network Address:

   First Host Address:

   Last Host Address:

   Broadcast Address:

   Next Subnet Address:

   Subnet Mask in Binary:

   Subnet Mask in Dotted Decimal:

   Total Number of Hosts:

1. 传统的校验和计算需要使用一的补码算术进行
   现代计算机和计算器设计为使用二的补码算术进行计算。一种计算传统校验和的方法是：先用二的补码算术将数字相加，然后将结果除以$2^{16}$，，得到商和余数，再将商与余数相加，从而得到一的补码形式的和。最后通过从$2^{16} - 1$中减去该和即可得到校验和。请使用上述方法计算以下四个数的校验和：43,689、64,463、45,112 和 59,683。

2. 给定数据字 101001111 和除数 10111，请演示在发送端站点如何通过二进制除法生成 CRC 码字

3. **回答以下子网划分问题：**

   - **目标 IP 地址：19.49.125.150/23**

   网络地址：

   第一个主机地址：

   最后一个主机地址：

   广播地址：

   下一个子网地址：

   二进制形式的子网掩码：

   点分十进制形式的子网掩码：

   主机总数：

- **Target IP address: 66.113.191.94/9**

Network Address:

First Host Address:

Last Host Address:

Broadcast Address:

Next Subnet Address:

Subnet Mask in Binary:

Subnet Mask in Dotted Decimal:

Total Number of Hosts:

4. In an IPv4 packet:
    a. the value of HLEN is $(1000)_2$. How many bytes of options are being carried by this packet?
    b. the value of HLEN is 5, and the value of the total length field is $(0028)_{16}$. How many bytes of data are being carried by this packet?
    c. A packet has arrived with an M bit value of 0. Is this the first fragment, the last fragment, or a middle fragment? Do we know if the packet was fragmented?
    d. A packet has arrived in which the offset value is 100. What is the number of the first byte? Do we know the number of the last byte?

5. Router A sends two RIP messages to two immediate neighboring routers, B and C. Do the two datagrams carrying the messages have the same source IP addresses? Do the two datagrams have the same destination IP addresses?



- **目标IP地址：66.113.191.94/9**

网络地址：

第一个主机地址：

最后一个主机地址：

广播地址：

下一个子网地址：

子网掩码（二进制）：

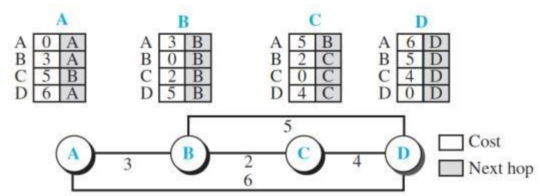
点分十进制子网掩码：

主机总数：

4. 在 IPv4 数据包中：
    a. HLEN 的值为 $(1000)_2$。该数据包携带了多少字节的选项?
    b. HLEN 的值为 5，总长度字段的值为 $(0028)_{16}$。该数据包携带了多少字节的数据?
    c. 一个数据包到达时 M 标志位的值为 0。这是第一个分片、最后一个分片，还是中间分片？我们能否知道该数据包是否被分片过?
    d. 一个数据包到达时，其偏移值为 100。第一个字节的编号是多少？我们知道最后一个字节的编号吗?

5. 路由器 A 向两个直接相邻的路由器 B 和 C 发送两条 RIP 消息。承载这些消息的两个数据报具有相同的源 IP 地址吗？这两个数据报具有相同的目的 IP 地址吗?

6. In distance-vector routing, good news (decrease in a link metric) will propagate fast. In other words, if a link distance decreases, all nodes quickly learn about it and update their vectors. In the figure below, we assume that a four-node internet is stable, but suddenly the distance between nodes A and D, which is currently 6, is decreased to 1 (probably due to some improvement in the link quality). Show how this good news is propagated and find the new distance vector for each node after stabilization.

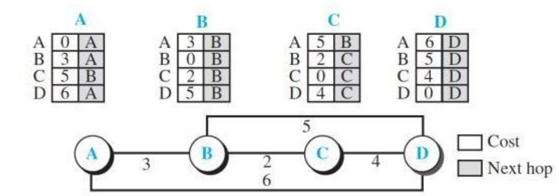



7. Compare the range of 16-bit addresses, 0 to 65,535, with the range of 32-bit IP addresses, 0 to 4,294,967,295. Why do we need such a large range of IP addresses, but only a relatively small range of port numbers?



6. 在距离向量路由中，好消息（链路度量的减少）会快速传播。换句话说，如果链路距离减小，所有节点将迅速得知这一变化并更新它们的向量。在下面的图中，我们假设一个四节点的网络原本是稳定的，但突然之间节点 A 和 D 之间的距离从当前的 6 减少到 1（可能是由于链路质量有所改善）。展示这一好消息是如何传播的，并找出新的距离

稳定后每个节点的向量。




7. 比较 16 位地址范围（0 到 65,535）与 32 位 IP 地址范围（0 到 4,294,967,295）。为什么我们需要如此大范围的 IP 地址，但却只需要相对较小范围的端口号?