考试科目名称 计算机网络（期末）

题号	一	二	三	四	五	六	七	合计
分数								

得分 _____　一、（本题满分 12 分）

1. 什么是子网？分析采用 CIDR 划分子网的优势。

2. 请简要介绍链路层的主要功能？

3. 请简要对比一下 CDMA 和 CSMA/CD。

得分 [   ] 1、（Full Points: 12）

1. What is a subnet? What are the advantages of using CIDR to partition subnets?

2. Briefly describe what is the Link Layer for.

3. Briefly compare CDMA and CSMA/CD.

某局域网采用 CSMA/CD 协议实现介质访问控制，数据传输率为10Mb/s，主机甲与主机乙之间的距离是2km，信号传播速率是200,000km/s。

请回答下列问题，并说明理由或写出计算过程。

(1) 若主机甲和主机乙发送数据时发生冲突，则从开始发送数据的时刻起，到两台主机均检测到冲突为止，最短需要经过多长时间？最长需要经过多长时间？(假设主机甲和主机乙在发送数据的过程中，其他主机不发送数据)

(2) 假设在该信道上，主机甲和主机乙是距离最远的两个主机。若最小数据帧长度减少800bit，则主机甲与主机乙之间的距离至少变化多少才能保证网络正常工作？

Suppose a LAN network uses the CSMA/CD protocol for medium access control with a data rate of 10 Mb/s. The distance between host A and host B is 2 km and the propagation speed is 200,000km/s.

Answer the following questions. Try to justify your answer or show your calculations.

(1) Suppose there is a collision between Host A and Host B when they send data. Until both hosts detect the collision, what is the minimum time that must elapse since one of them has started transferring? What is the longest time that might elapse? Assume that only host A and host B are sending data.

(2) Assume that Host A and Host B are the two furthest hosts on the channel. If the minimum data frame length is reduced by 800 bits, to ensure that the protocol works properly, what is the minimum change in the distance between host A and host B?

CRC 计算：

(1) 假设输入数据码字为 10110011，约定生成码字为 11001，则校验码是多少？

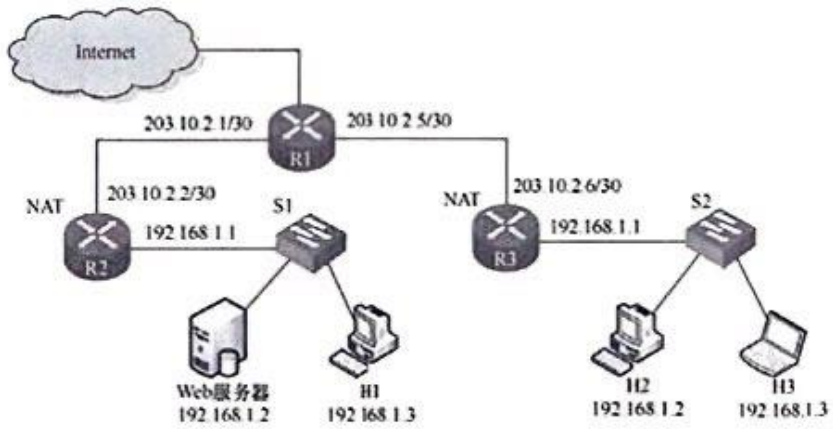(2) 如何用 CRC 校验码验证传输过程有无差错产生？

得分	

3、（Full Points: 15）

CRC Calculations :

(1) Suppose the data bits are 10110011 , and the generator is 11001 . What is the CRC code for the data?

(2) How can CRC check code be used to verify whether there are errors in the transmission process?

我校校园网内有两个局域网，通过路由器 R1、R2 和 R3 互联后接入 Internet；S1 和 S2 为以太网交换机。局域网采用静态 IP 地址配置，路由器部分接口以及各主机的 IP 地址如下图所示。

假设 NAT 转换表的结构为

| 外网		内网	
IP 地址	端口号	IP 地址	端口号

请回答下列问题：

(1) 为使 H2 和 H3 能够访问 Web 服务器（使用默认端口号 80），R2 的规则中需要配置有怎样的一个条目？请参考 NAT 转换表的结构进行表示。

(2) 若 H2 主动访问 Web 服务器时，将 HTTP 请求报文封装到 IP 数据报 P 中发送，则 H2 发送 P 的源 IP 和目的 IP 地址分别是什么？经过 R3 转发后的源 IP 和目的 IP 地址分别是什么？经过 R2 转发后的源 IP 和目的 IP 地址分别是什么？

There are two LANs in our campus network, which are connected to the Internet through the interconnection of routers R1, R2 and R3. S1 and S2 are Ethernet switches. The LANs are configured with static IP addresses, and some of the router interfaces and the IP addresses of each host are shown in the following figure.
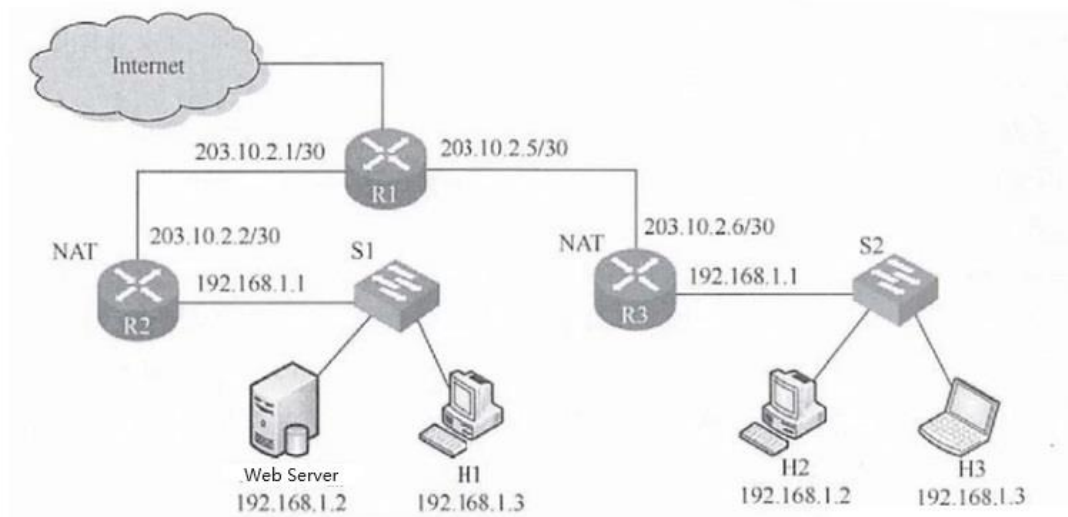
Assume that the structure of the NAT translation table is as follows:

| External		Internal	
IP Address	Port Number	IP Address	Port Number

Please answer the following questions:

(1) To enable H2 and H3 to access the Web server (using the default port number 80), what DNAT rule must R2 contain? Please represent your answer according to the structure of the NAT translation table.

(2) Suppose H2 actively accesses the Web server by encapsulating the HTTP request packet into an IP datagram P and sending it. What are the source and destination IP addresses of P sent by H2? What are the source and destination IP addresses after P is forwarded by R3? What are the source and destination IP addresses after P is forwarded by R2?

考虑下图所示的拓扑结构。将带有主机的三个子网（从 12 点方向顺时针开始）记为网络 A、B 和 C。将没有主机的子网记为网络 D、E 和 F。

(1) 为这六个子网分配网络地址，需满足以下条件：所有地址必须从 214.97.254/23 中分配；子网 A 应该有足够的地址支持 250 个接口；子网 B 应该有足够的地址支持 120 个接口；子网 C 应该有足够的地址支持 120 个接口。当然，子网 D、E 和 F 每个都应该能支持两个接口。对于每个子网，分配应采取 a.b.c.d/x 或 a.b.c.d/x - e.f.g.h/y 的形式。

(2) 使用你对(1)的回答，为三个路由器提供转发表（使用最长前缀匹配）。
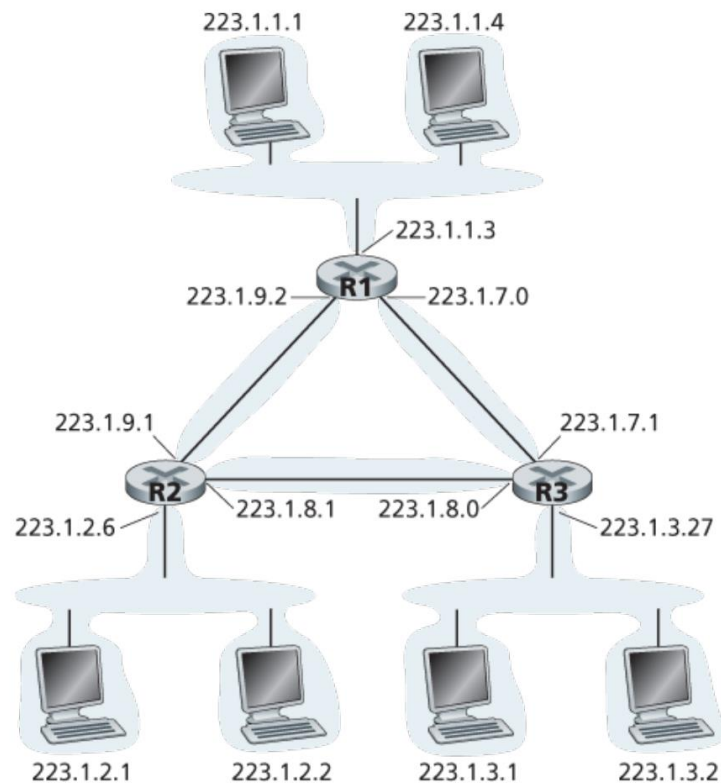
Consider the topology shown in Figure below. Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Networks D, E, and F.

(1) Assign network addresses to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Of course, subnets D, E and F should each be able to support two interfaces. For each subnet, the assignment should be of form a.b.c.d/x or a.b.c.d/x – e.f.g.h/y.

(2) Using your answer to part (1), provide the forwarding tables (using longest prefix matching) for each of the three routers.
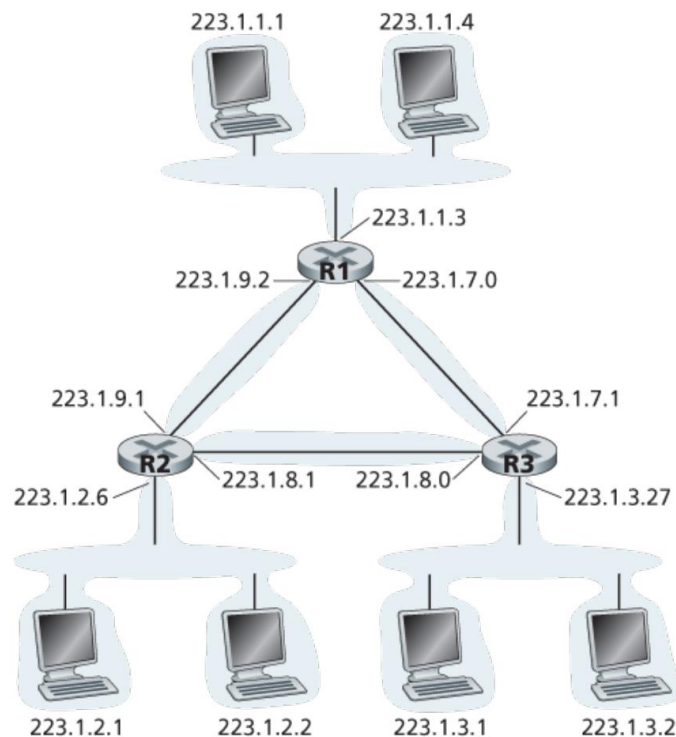
假定 4 个活跃结点 A、B、C、D 都使用时隙 ALOHA 来竞争某信道，且每个结点有无限个分组需要发送，每个结点在每个时隙中以概率 p 尝试传输；假定 p 为已知常量。第一个时隙编号为时隙 1，第二个时隙编号为时隙 2.··以此类推(请给出少量文字说明分析过程)

(1) 结点 A 的第一次成功传输发生在第 4 个时隙的概率是多少?

(2) 某个结点 (A、B、C 或 D 任一结点成功均可)在时隙 3 中成功的概率是多少?

(3) 首次成功传发生在时隙 4 的概率是多少?（即，此前三个时隙没有任何节点成功传输）

(4) 这个 4 结点系统的效率是多少?以"分组每时隙"为单位回答。

Assume that 4 active nodes A, B, C, and D are all competing for a channel using slotted ALOHA, and that each node has an infinite number of packets to send. Assume that each node attempts to transmit in each time slot with probability p, which is a known constant. The first time slot is numbered as slot 1, and the second time slot is numbered as slot 2, etc.

Answer the following question, and explain your answer or show your calculations.

(1) What is the probability that first successful transmission of node A happens in slot 4?

(2) What is the probability that some node (A, B, C, or D) succeeds in slot 3?

(3) What is the probability that the first successful transmission occurs in slot 4? (This means that in the first three slots, there is no successful transmission for any node)

(4) What is the efficiency of this 4-node system? Answer with "packets per slot".

得分 [ ] 七、（本题满分 15 分）

1. 请简要介绍 Dijkstra 最短路径算法的基本原理。

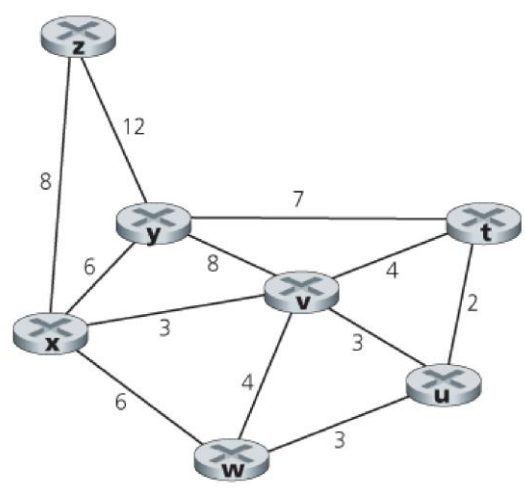2. 使用下图中指定的链路成本，使用 Dijkstra 最短路径算法计算从 x 到所有网络节点的最短路径。通过给出的表格来展示算法的工作方式。

符号定义：

$D(v)$：在此迭代算法中，从源节点到目标节点 v 的最小路径成本。

$p(v)$：在从源到 v 的当前最小成本路径上，v 的前一节点（v 的邻居节点）。

N'：节点的子集；如果已确定了从源到 v 的最短路径，则 v 位于 N' 中。

$Step$：算法迭代次数。

$Step$	N'	$D(t),p(t)$	$D(u),p(u)$	$D(v),p(v)$	$D(w),p(w)$	$D(y),p(y)$	$D(z),p(z)$

7、 （Full Points: 15)

1. Briefly describe the main idea of Dijkstra's shortest path algorithm.
2. Consider the network displayed in Figure below. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes. Show how the algorithm works by completing the provided table.
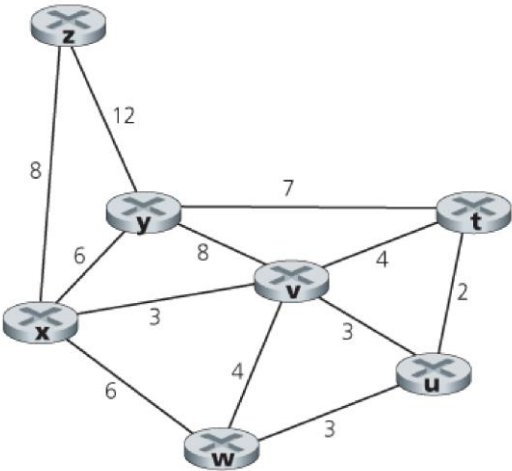
Symbol Definitions：

$D(v)$: Cost of the least-cost path from the source node to v to this iteration of the algorithm.

$p(v)$: Previous node (neighbor of v) along the current least-cost path from the source to v.

N': Subset of nodes; v is in N' if the least-cost path from the source to v is definitively known.

$Step$: Number of algorithm iterations.

Step	N'	$D(t), p(t)$	$D(u), p(u)$	$D(v), p(v)$	$D(w), p(w)$	$D(y), p(y)$	$D(z), p(z)$