

-----以下为试题区域，共四道大题，总分100分，考生请在答题纸上作答-----

一、概念题（共10小题，每小题3分，共30分）

Please explain the following concepts or technologies in details on the meaning, functions, basic design idea and/or operations. (请详细解释以下概念或者技术的意思、功能、基本设计思想或者操作方法。)

1. OSPF Protocol 2. Persistent HTTP 3. HTTPS Protocol 4. CSMA/CA
5. VLAN 6. ICMP Protocol 7. TCP flow control 8. CDMA
9. Virtual Circuit Switching 10. IP forwarding table

二、问答题（共2小题，每小题10分，共20分）

1. Please explain the design of the traceroute program. 请解释traceroute的设计原理。

2. Figure 1 shows a simple network consisting of two subnets interconnected by a router. The IP address and MAC Address are marked for each network interface. The subnet IP is 111.111.111.0/24 for the subnet on the left side, 222.222.222.0/24 for the subnet on the right side respectively. Suppose now the host 111.111.111.111 wants to send an IP datagram to the host 222.222.222.222. Please explain how each host or network component in the Figure 1 reacts to fulfill the above task. 图1显示了由一个路由器连接的2个子网形成的网络。它标志了每个网络接口的IP地址和MAC地址。111.111.111.0/24子网在左边，222.222.222.0/24在右边。现在假设主机111.111.111.111要发送IP数据包给主机222.222.222.222。请解释图1中的每个主机或者网络设备如何工作以完成前续任务。

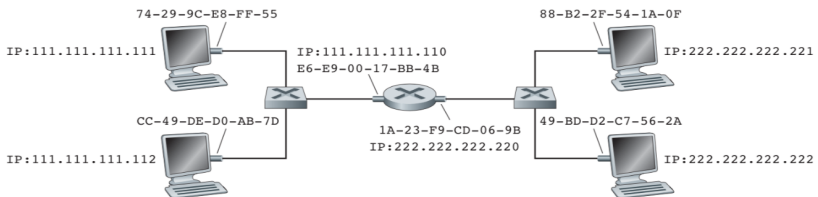


Figure 1 Two subnets interconnected by a router (图1 由一个路由器连接的2个子网)

三、计算、解释题（共3小题，1~2小题各6分，3小题8分，共20分）

1. Consider a datagram network using 32-bit interface IP addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows: 考虑一个采用32位IP地址的互联网。假设一个路由器有四个链路接口，标号为0~3。数据包将按以下规则转发数据：

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

Figure 2 A packet forwarding Requirement 图2：一个数据包转发要求表

a. Provide a forwarding table, use longest prefix matching that is consistent to the Figure 2 requirement to forwards packets to the correct link interfaces. 请构建一个与图2一致的，采用最长前缀匹配算法的转发表。

b. Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses: 请描述你的转发表如何正确地确定将以下终点地址的数据包转发到正确的数据链路接口上。

11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

2. Consider a CRC code using a 6-bit generator, $G=110011$, and suppose that D has the value 10101010101. What is the value of R ? Please show how you get the result. 考虑采用6位生成器 ($G=110011$) 的CRC码。给定一个 D 值10101010101，请计算其 R 值，并展示计算过程。

3. Consider the network shown below in Figure 3. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4. Please answer following questions: 请看图3所示部分互联网络拓扑图。假设AS3和AS2自治系统内运行OSPF路由协议，AS1和AS4自治系统内运行RIP协议。自治系统间的路由协议采用BGP（包括eBGP和iBGP）。假设AS2和AS4之间没有直接相连的物理链路。请回答以下问题：

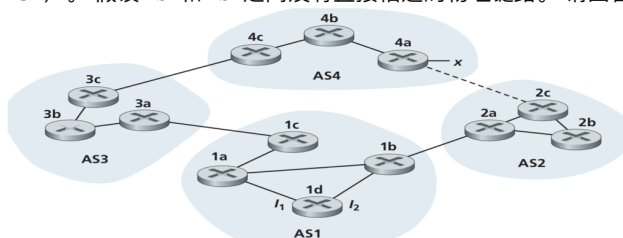


Figure 3 An interconnect network topology (图3 一个互联网络拓扑图)。

(a) Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP? 路由器3c采用OSPF, RIP, eBGP, or iBGP中的哪个路由协议获得子网 x 的可达信息?

- (b) Router 3a learns about x from which routing protocol?
路由器3a采用哪个路由协议获得子网x的可到达信息?
- (c) Router 1c learns about x from which routing protocol?
路由器1c采用哪个路由协议获得子网x的可到达信息?
- (d) Router 1d learns about x from which routing protocol?
路由器1d采用哪个路由协议获得子网x的可到达信息?

四、综合题（共5小题，每小题各6分，共30分）

Suppose a student Xiaomin takes a power off laptop to our classroom with Wi-Fi service enabled. He turns on the computer, opens the Internet Explorer and enters the following URL address in the address field and press enter.

<http://www.tsinghua.edu.cn/>

Then the webpage is displayed. Please explain from the laptop's perspective, and only consider network related operations and protocols:

学生Xiaomin带着她已经关机的笔记本电脑到教室。这电脑支持wifi 服务。她打开计算机电源，开机启动完成后，打开Internet Explorer，输入以下URL地址并回车：

<http://www.tsinghua.edu.cn/>

之后，网页就正常显示了。请从这个笔记本电脑运行的角度解释与网络相关的操作和协议，并回答以下问题：

1. How can the computer connect to the Internet? 这计算机是如何连到互联网的?
2. At the application layer, what protocols are involved? Please explain how these protocols are involved and cooperate to support the above operation. 在应用层，什么协议参与了以上操作？请解释这些协议如何参与并协作以完成以上任务。
3. At the transport layer, what protocols are involved? Please explain how these protocols are involved and cooperate to support the above operation. 在传输层，什么协议参与了以上操作？请解释这些协议如何参与并协作以完成以上任务。
4. At the network layer, what protocols are involved? Please explain how these protocols are involved and cooperate to support the above operation. 在网络层，什么协议参与了以上操作？请解释这些协议如何参与并协作以完成以上任务。
5. At the data link layer, what protocols are involved? Please explain how those protocols are involved and cooperate to support the above operation. 在数据链路层，什么协议参与了以上操作？请解释这些协议如何参与并协作以完成以上任务。