1. Multiple Choice (30 points, 1.5 points for each question)

(1). Which of the following protocols is an application protocol? _____
A. CSMA/CD B. ICMP C. OSPF D. IMAP

(2). The 5-PDU is called___
A. message B. segment C. datagram D. frame

(3). In OSPF network, a _____ belongs to both an area and the backbone.
A. internal router B. area border router
C. boundary router D. backbone router

(4). Which of the following physical media belongs to unguided media? _____
A. Twisted-Pair Copper Wire B. Coaxial Cable
C. Fiber Optics D. Radio Channels

(5). Which of the following protocol layers is not explicitly part of the Internet Protocol Stack? _____
A. application layer B. session layer
C. data link layer D. transport layer

(6). Among the following applications, which one is not suitable for P2P architecture? _____
A. file sharing B. electronic banking
C. video streaming D. instant message

(7). A user requests a Web page that consists of some text and 5 images. The browser's cache is empty. For this page, the client's browser:
A. sends 1 http request message and receives 1 http response messages.
B. sends 1 http request message and receives 6 http response messages.
C. sends 5 http request message and receives 5 http response messages.
D. sends 6 http request message and receives 6 http response messages.

(8). The broadcast address of network 202.115.32.0/23 is_____
A. 202.115.32.255 B. 202.115.33.255 C. 202.115.255.255 D. 202.115.32.0

(9). The following networks all are instances of virtual network except _____
ATM B. X.25 C. frame relay D. Internet

(10). The source IP address in a DHCP discover message is _____.
A. the IP address of DHCP client B. the IP address of DHCP server
C. 255.255.255.255 D. 0.0.0.0

(11). If no free buffers in router, the arriving packets will be:
dropped B. queued C. returned D. marked

(12). HOL blocking happens on _____
A. input port B. output port C. switching frabrics D. all of above

(13). Cookies enable _____
A. a Web server to infect a user's machine with malware
B. a Web server to track a user's activity at its own Web site
C. a Web server to know all previous Web pages visited by the user
D. a Web server to learn a user's personal information.

(14). Which of the following network is NOT an example of random-access MAP? _____.
A. Ethernet B. Wi-Fi C. ALOHA D. Bule-tooth

(15). Which of the following sub-network masks is illegal? _____.
A. 255.255.32.0 B. 255.255.255.128 C. 255.255.192.0 D. 255.255.254.0

(16). Which of the following IP address belongs to 202.115.32.64/26? _____.
A. 202.115.32.65 B. 202.115.32.1 C. 202.115.32.63 D. 202.115.32.128

(17). When a user retrieve his email from mail server, which of following protocols can't be used?
A. POP3 B. HTTP C. SMTP D. IMAP

(18). Which of the following services CAN NOT be provided by the data link layer? _____
A. flow control B. congestion control C. error detection D. link access

(19). Let's assume there is 16-bit piece data 1000 1011 1001 1001, The 8-bit Internet checksum for this data should be _____
A. 00100101 B. 00100010 C. 11011010 D. 11011001

(20). For the data in (19), the CRC is applied to it with generator 1001. Thus the CRC bits should be _____
A. 010 B. 000 C. 111 D. 001

2. True or False (20 points, 2 point for each statement)

(1). Routers decrement the TTL field in the IP header
(2). IP fragment always happens on router.
(3). ADSL modem use TDM to tranfer nework signal over telephone network.
(4). With nonpersistent HTTP connection, multiple objects can be sent over single TCP connection between client and server.
(5). As a distance vector algorithm, OSPF plays an important role in LAN.
(6). A gateway router can obtain subnet reachability information from another gateway router in neighboring As by iBGP.
(7). Considering the bursty data transfering, a circuit switching network outperforms a packet switching network.
(8). In IP datagram, a checksum field in IP header is used to perform error detection for the whole datagram.
(9). There is no network congestion in ATM CBR.
(10). In recursive query, the root DNS server will response the local DNS server with the IP address of the TLD server.

3. please answer following questions briefly (33 points)

(1) Consider the network with 4 routers below, with link cost labled. Assume that a distance vector algorithm with poisoned reverse is used. Assume that each node initially know only the costs to their neighbors. Assume that the DV algorithm works in a synchronous manner, where all nodes simultaneously receive distance vectors from their neighbors, compute their new distance vectors, and inform their neighbors if their distance vectors have changed.

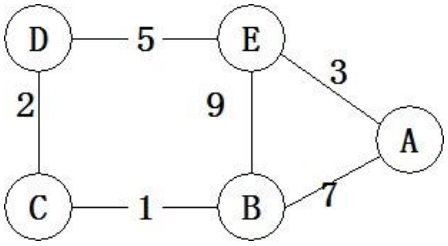

Fig 1

a) Please show the distance entries at the node E (6 points).

b) After the DV algorithm converged, the link cost between node C and node D increases from 2 to 10. Once detecting this change, node C has to update its distance vector and inform its new distance vector to B. What's this new distance vector C sends to B?(2 points)

c) As soon as B received C's update, B will recalculate its own distance vector. If B has computed a new distance vector, B will inform C this new distance vector. Will B update its distance vector? If so, what's the new distance vector B will send to C?(3 points)

d) Let's assume that the network in Figure. 1 is an autonomous system in the Internet with AS number 0. Node A is the BGP gateway of this AS. Is A the only router in this network that runs BGP and DV algorithm simultaneously? (2 points)

(2) Consider a campus network as shown in Figure 2, where there two routers R1 and R2, a HUB H1, and a switch S1 that connect 3 Ethernet LANs. The numbers (1,2, or 3) besides the routers indicate their interfaces, and the IP address block (e.g., 128.101.0.0/18) near an Ethernet represents the IP address block assigned to the corresponding Ethernet (thus hosts on the Ethernet).

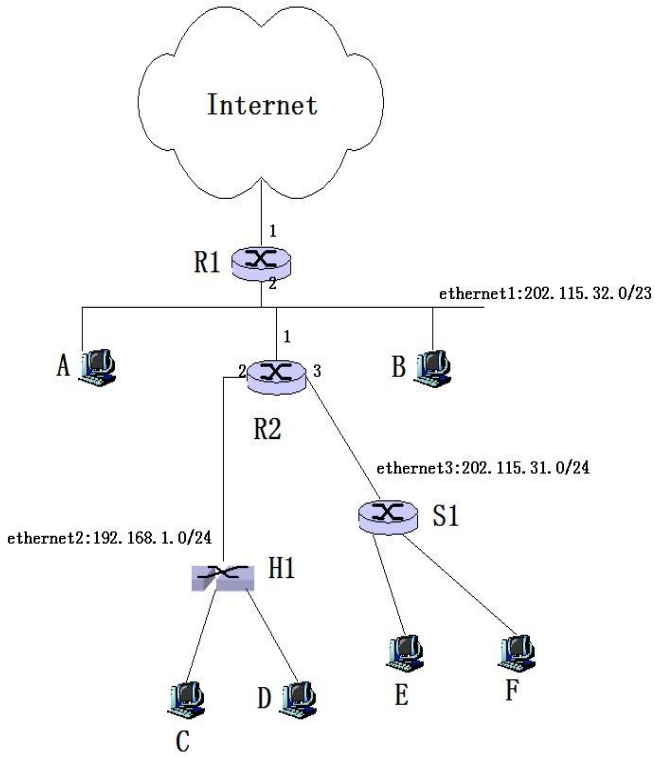

Figure 2

a) To make sure each host (from A to F) to access the Internet, what services has to be provided by R2? (2 points)

b) Suppose host E wants to send an IP datagram packet to host F. Host E will send a packet like below. How does host E knows that it can directly forward the packet to host F instead of asking for its default router R2 to help deliver it.(2 points)

The packet from E to F

Source MAC	*Destination MAC*	*Source IP*	*Destination IP*
E's MAC address	*F's MAC address*	*E's IP address*	*F's IP address*

c) Now suppose host E want to send an IP datagram to A. Let's assume the ARP caches of all the nodes in this network is empty. List the source and destinations IP and MAC addresses of all the frames to transfer this IP datagram from E to A.(12 points)

d) Now suppose host C want to send an IP datagram to A, what are the source and destinations IP and MAC addresses in the frame sent by C and what are the source and destinations IP and MAC addresses in the frame received by A? (4 points)

4. Analytic (17 points)

Host A wants to send a 12KB file F over a TCP connection.

Several assumptions:

- This TCP connection uses the slow-start congestion control scheme with an initial THRESHOLD value of 4 KB
- The MSS is 1KB.
- The receiver's advertised window is initially 4 KB.
- Unless indicated otherwise, all segments were received properly and received in the same order as they were sent
- The receiver will send ACK immediately, once receiving one data segment.
- The receiver will buffer all the out-of-ordered segments.
- It takes the sender 10 ms to "push" the segment onto the network. This means that if the first data segment is pushed onto the network starting at time 0, then the second segment can started to be pushed onto the network at 10 ms.
- Unless indicated otherwise, each successfully transmitted segment has a round trip time of exactly 60ms (30 ms each way). This time includes transmission time.
- The timer on host A of this TCP connection is always set as 100 ms.
- The seq number and ack number of the first data segment are 0 and 100, respectively.

Under the set of assumptions above, Find the seq number, ack number and the time to send of each data segments if:

- The ACK of the second data segment is slow, taking 50 ms(instead of 30ms as mentioned above).
- The first transmission of the 4th data segment is not received by the receiver.
- In the ACKs for the 8th data segment and subsequently, the receiver's advertised window is reset to 2 KB

Sending time	seq	ack
0	0	100