1. In a computer network, end systems are usually connected with each other using packet switches and communication links. Connections between end systems are running network application. Communication links include fibre, copper, radio, satellite and others. Packet switches forward packets, which is chunks of data. Example of packet switches include routers and switchers. There are 5 components of data communication which is message, sender, receive, transmission medium, protocol. End system connect to edge router through residential access network, institutional access network and mobile access network. Host send function and takes application message. Then breaks it into smaller chunks called packets. Transmits packets into access network at transmission rate.
2. Bandwidth = 10Mbps / 24(slot/second)

= 4.617 Mbps

Time = 10,000 bytes / 4.167 Mbps

= (10,000\*8) / (4.167\*1024\*1024)

= 0.0183 s

Total time = 0.01s + 0.0183s

= 0.0283s

1. 1. R1 = 500kbps, R2 = 2Mbps, R3 = 1Mbps

Min throughput = R1, 500kpbs

* 1. Time = file size / throughput

= (4\*106\*8)/ (500\*1024)

= 62.5 seconds

* 1. R1 = 500kbps, R2 = 100kbps, R3 = 1Mbps
     1. Min throughput = R2, 100kbps
     2. Time = file size / throughput

= (4\*106\*8)/ (100\*1024)

= 312.5 seconds

1. 1. Transport layer
   2. Network layer
   3. Application layer
   4. Physical layer
   5. Presentation
   6. Data link layer
   7. Session layer
2. Advantages of TCP/IP protocol suite are scalable, which is client-server architecture. It allows network added without disrupting of current services. Second, it is an open protocol suite. It can used by any individual or organization. Disadvantage of TCP/IP protocol suite is it originally designed for wide area network. It does not optimize for those small networks such as LAN and personal area network. Next, it not clearly disparate the concept of services, interfaces, and protocols. It is not suitable to describe new technology in new network
3. Use UDP. It transfers reliable data between sending and receiving process. With UDP, the transaction can be done in one roundtrip time (RTT) which is the client send the transaction request into UDP socket, while the server send reply to the client’s UDP socket. While with TCP, minimum there are two RTTs are needed. One of it is to set-up the TCP connection while another is for client to send request and server to send reply to client.
4. No, all communication session has a client and a server side. In P2P file-sharing application, the peer which is receiving a file is the client while another peer which sending thee file is the server
5. 1. HTTP is hypertext transfer protocol. It is a web application layer protocol which allow fetching of resource such as HTML documents. Client and server communicate by exchange individual messages. The browser at client side using HTTP protocol request, receives and “display” web objects. While at server side, web server sends objects in response to request by using HTTP protocol. Purpose of protocol is to provide a standard way for web browser of client and server-side talk and communicate.
      1. Non-persistent HTTP connections
      2. 22 Jun 1998 18:26:33
      3. Can
6. FTP sends control information “out-of-band" as FTP uses two different and separate parallel connections when transfer a file. Control and data connection are uses with TCP in parallel. Control connection is using to send information for example identification, “put” and “get” file’s commands. While the data connection is used to send the file.
7. TCP is more reliable compare with UDP as it is a connected-oriented network which guaranteed the transmitted packet reach destination. UDP only will send the datagram which does not stand in manage retransmission, sequence of data or either the connection. All application data able to receive without any gaps with correct order but UDP does not. The data transmission in TCP protocol also accurate.
8. TCP (transmission control protocol) - a connection-oriented protocol which create the connections between computer before sending data.

UDP (user diagram protocol) - a connectionless protocol where data is sent to destination(computer) without any checking whether the system is ready to receive the data.

1. Yes, add reliability at application layer and application will specify error recovery.
2. 1. 100110101110111110
   2. If checksum have 0, error detected.
4. 1. 16
   2. 10
5. 0-1000, 1001-1500, 1501-2000
6. Sequence number are needed for receiver to determine whether an arriving packet contains new data or a retransmission in RDT protocol.
   1. ACK = 359 + 50 = 409, source port number = 1028, destination port number = 80
   2. ACK = 409, source port number = 80, destination port number = 1028
   3. ACK = 359