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Short Answer

1. • Application Layer
   • Transport Layer
   • Network Layer
   • Link Layer
   • Physical Layer

2. UDP is unreliable data transfer while TCP is.

3. Cable, DSL, Fiber, Wifi, Ethernet, LTE

4. HTTP = Port 80 SMTP = Port 25

5. Server is an alway-on device with a constant IP that waits to be contacted. A Client is not always-on, IP changes & initates communication

6. Type A: Name is hostname & value is IP
   Type NS: Name is domain, value is hostname of authoritative DNS server
   Type CNAME: Name is alias, value is canonical name
   Type MX: Name is mail server, value is IP of mail server.

7. Because the encoding rate & server chosen rely on this value.

8. Peers are periodically informed what chunks each peers have. Chunks are requested rarest first.

9. Enter Deep: Communicate with a single server
   Bring Home: CDN nodes scattered around the internet.

10. Conditional GET allows a cached web object to be refreshed only if it changed. This reduces response time, & traffic on link.

True/False: If false give Correct Answer

1. True
2. False: IP address & Port number is required
3. False: Chunks are encoded at different rates.
4. False: DNS is a distributed service
5. False: TCP includes congestion/flow control
6. False: L/R is transmission delay.
7. False: SMTP is a "push" protocol & only sends messages.
8. False: P2P model is used for BitTorrent
9. False: IP Spoofing is a technology to send message with a fake source address.
10. True

Multiple Choice

1. (D:) All of the above
2. (B:) Packet-switching uses "store & forward" to deliver packets to source destination.
3. (B:) Both Client & Server must be always On.
4. (C:) It is designed to be stateful, that is web server keeps state information about clients.
5. (C:) L/2R
6. (B:) Arbitrary end systems in P2P architecture can directly communicate with each other
7. (C:) Top-level domain servers
8. (B:) Packet sniffer is to modify address of packet in broadcast media
9. (B:) UDP provides unreliable service for applications.
10. (C:) Web cache acts as both client & server.

Long Answer Questions

1. TCP server

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_STREAM)
serverSocket.bind(("", serverPort))
serverSocket.listen(1)
print("The server is ready to recieve")
while 1:
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()
    captilizedSentence = sentence.upper()
    connectionSocket.send(captilizedSentence.encode())
    connectionSocket.close()
```

2. Consider the following Scenario

1. What is the maximum number of circuit switched users?

$$100/20 = \text{5 users}$$

2. Probability 1 user is transmitting & others not.

$$9 * (0.3) * (0.7)^{9-1} = 0.1556$$

3. Probability that >5 are transmitting simultaneously?

$$\sum_{k=6}^{n=9} (0.3)^{k} * (0.7)^{N-k}$$

$$(0.3)^{6} * (.7)^{3} + (0.3)^{7} (.7)^{2} + (0.3)^{8} (.7)^{1} + (0.3)^{9}$$

$$= 4.23 \cdot 10^{-4}$$

3. $RTT_0 = 1ms$ $RTT_1 = 34$ $RTT_2 = 49$, $RTT_{HTTP} = 7ms$

1. How much time elapses from click to object recieved?

$$RTT_0 + RTT_1 + RTT_2 + 2(RTT_{HTTP}) \qquad 98ms$$

2. 6 small objects, non-persistent, no parallel

$$RTT_0 + RTT_1 + RTT_2 + 14(RTT_{HTTP}) \qquad 182ms$$

3. Same as above but 5 parallel connections & persistent HTTP

$$RTT_0 + RTT_1 + RTT_2 + 4(RTT_{HTTP}) \qquad 112ms$$