True or False: A `bind()` command must be called before a socket can send data.

- False! An implicit bind can occur with a command such as `sendto()` for UDP sockets.
**Sockets - $200**

- When sockets were being developed, ______ were already being widely used, so sockets are accessed through the same interface.

- File Descriptors

**Sockets - $300**

- If a socket’s port is chosen by the OS, which system call can be used to determine the port?

- `getsockname()`
Sockets - $400

- There are 3 elements that make up a socket’s “name”. What are they?
  - Class (family/type), IP Address, Port Number

Sockets - $500

- For a TCP socket to begin waiting for a connection, which commands in order should it call?
  - socket(), bind(), listen(), accept()
TCP/UDP - $100

- True or False: TCP uses a constant Timeout value.

- False! TCP’s timeout is calculated from sampling Round Trip Times. EstimatedRTT and DevRTT are calculated and used to determine timeout.

TCP/UDP - $200

- Fill in the blanks: TCP is a _______ protocol, whereas UDP is _______.

- reliable; unreliable
  - Follow-up: Can using UDP be reliable? How?

- Also accepted: connection-oriented; connectionless
TCP/UDP - $300

- How does TCP handle loss differently for a timeout versus loss due to Triple-duplicate acks?

- Loss due to Triple-duplicate acks means data was lost, but network isn’t necessarily congested. Fast retransmit resends data without waiting for timeout.

TCP/UDP - $400

- What are TCP’s two sending phases and when does each occur?

- Slow start (grow exponentially): \( \text{cwnd} < \text{thresh} \)
- Congestion Avoidance (grow linearly): \( \text{cwnd} \geq \text{thresh} \)
Name 2 advantages of UDP over TCP.

- No delay due to connection setup
- Smaller/simpler packet header
- No state stored
- No congestion control

True or False: IP is a connection-oriented service.

- False! IP is a connectionless service.
How many bits are in an IPv4 address? How about IPv6?

IPv4 address is 32 bits. IPv6 is 128.

Name 3 of the header fields of an IPv4 packet.

Header length
Datagram length
Upper Layer
TTL
Header Checksum
Fragment Offset
Your organization has been assigned a Class-C address block of 195.35.84.0/24 by ICANN. What does the /24 indicate?

Number of bits in the “subnet” part of the address. Assuming IPv4, we have 32-24=8 bits to divvy up however we’d like.

What is the purpose of a subnet mask?

The network mask indicates which bits are to be used for the subnet portion of the address (indicated with 1) and the host portion of the address (indicated with 0).
Routing - $100

- What are the two key functions of routers?
  - Routing and Forwarding

Routing - $200

- What does NAT stand for and what was the motivation that led to NAT?
  - Network Address Translation; Motivation: local network uses just one IP address as far as outside world is concerned. Outside and inside can change without notifying each other.
Routing - $300

- Where can queueing occur in a router?

  - Input port (Head-of-line blocking): queued datagram at front of queue prevents others in queue from moving forward
  - Output port: queueing (delay) and loss due to output port buffer overflow!

Routing - $400

- What are the three types of switching fabrics?

  - Memory, bus, crossbar (interconnection network)
Routing - $500

- Briefly describe the count to infinity problem with distance vector algorithms.

- A ---- 1 ---- B ----- 2 ------ C

- In DVA, nodes broadcast their distances to their neighbors. If B----C gets disconnected, but A sends an update to B before B sends update to A, each will think they can get to C in one more hop, and it’ll continuously count up to inf.

Link - $100

- True or False: Is 100% reliability built into the link layer? Why or why not?

- False! Reliability is implemented at the higher levels, so 100% reliability doesn’t need to be implemented at the link layer.
Which protocol is used to determine the MAC of another node if an IP address is known?

- ARP – Address Resolution Protocol

What is an advantage/difference of MAC addresses compared to IP Addresses?

- Portability!
If error correction is possible in the Link layer, why is it not always used?

- Takes time and computational power. Sometimes all we need is error detection.

What percentage of burst errors can a single parity bit catch?

- A single parity bit can catch only 50% of burst errors.