1.	**?? = 255 = 11111111 = 1 byte: What is the hexadecimal where the ?? are?**	FF
2.	**Describe TCP.**	Connectioned oriented: slow because it has large headers. Reliable data transfer: data can't be "lost" across a TCP connection -- receiver will ask transmitter to resend. Persistent and consistent connections.
3.	**Describe UDP.**	Connectionless and fast. Provides no verifications for whether the data is received.
4.	**How does hexadecimal(Base 16) help us write Binary numbers in a short form?**	There are 8 bits in a byte, which means one byte can be expressed as two hexadecimal digits.
5.	**How does in-order traversal work with BSTs?**	It retrieves the keys in ascending sorted order. In-order traversal always visits the nodes in sequential order.
6.	**How do we add a value to a set?**	set.add(value)
7.	**How do we check to see if a set contains a value?**	set.has(value)
8.	**How do we remove a value from a set?**	set.delete(value)
9.	**How is IP data transmitted?**	IP data is transmitted using packets and IP's communication style is called packet switching: messages are split up into separate packets, delivered to a destination and reassembled.
10.	**How is the depth/level of a node in a tree determined?**	The distance between the root and the node in question.
11.	**How is the height of a tree determined?**	The height is the edge count between the farthest leaf to the root.
12.	**Is an empty tree a BST?**	Yes.
13.	**What are CNAMEs for?**	The CNAME record acts as an alies, linking one domain to another. For example: www.mywebsite.com should point to the same resource as mywebsite.com. Notice that www doesn't have a . after it. This means it's a relative reference, and the additional parts of the domain for this zone (mywebsite.com) are implied. When a domain in zone file ends in a . we can treat it as an absolute reference with no unwritten subdomains.
14.	**What are some names an ISP might call a single device when referring to a modem and why is that?**	Modem, router, gateway or access point. Because in current times your home has multiple devices. Consumers became frustrated by needing a router and/or switch to connect to all their computers. So ISPs integrated extra devices into modems to avoid this. This device can contain: a modem to translate the physical signal from the cable/phone line, a router to manage your internal and external IP address, a wireless antenna for wi-fi connections and a 5-connector switch for wired connections.
15.	**What are some things to note about using an adjacency matrix?**	When the edges have direction, matrix[i][j] may not be the same as matrix[j][i]. It is common to say that a node is adjacent to itself, so matrix[x][x] === true for any x.

16.	**What are the 3 actions a switch can perform?**	Flood: When a destination address is unknown, the switch will flood received data out to all connected devices, except where the data came from. When the intended recipient responds, the switch will update its MAC address table accordingly. Forward: When a switch already has the destination MAC address in its internal table, it can send data directly to that device. AkA forwarding the data. No other devices connected to the switch are aware of this data. Filter: Sometimes a switch will recieve data on the same connector the data is destined for. In these cases, the switch will filter, or drop, the data entirely. If data arrives on the same connector it would later be sent out of, then we can assume the data was handled by some other part of our network, and the receiving switch can't do anything to help. Very specifically related to the physical connector the data is received on: a switch will never act on data that comes in and goes out of the same connector.
17.	**What are the 3 main points of TCP?**	Connect-oriented. Slow. Reliable.
18.	**What are the 3 main points of UDP?**	Connectionless. Fast. Unreliable.
19.	**What are the 3 main types of networking hardware?**	Hubs. Switches. Routers.
20.	**What are the 8 fields of IPv6?**	Version. Traffic Class. Flow Label. Payload Length. Next Header. Hop Limit. Source Address. Destination Address.
21.	**What are the 13 headers of IPv4?**	Version. IHL. DSCP. ECN. Total Length. Identification. Flags. Fragment Offset. Time To Live(TTL). Protocol. Header Checksum. Source IP Address. Destination IP Address. Options.

22.	**What are the components of "https://open.appacademy.io/learn/js-py--aug-2020-online/"?**	- `https://` is the protocol that we are making the request with - `open.appacademy.io` is the domain. The domain can be composed of any number of subdomains. - The right-most domain is the top-level domain (TLD), which is maintained by domain registries. Common TLDs would be .com, .org, .gov, etc - Each preceding domain can be referred to as a second-level, third-level, fourth-level, etc., domain. In our example, `appacademy` is the second-level and `open` is the third-level domain. - We often combine a second-level and top-level domain to refer to a generic 'domain' term, such as `google.com`, `amazon.com`, `usa.gov`, `appacademy.io`, etc.
23.	**What are the OSI layers from top to bottom?**	Application: HTTP. Presentation: JPEG, GIF. Session: RPC. Transport: TCP, UDP. Network: IP. Data Link: Ethernet. Physical: DSL, 802.11.
24.	**What are the TCP header fields?**	Source Port. Destination Port. Sequence Number. Acknowledgement Number. Data Offset. Reserved. Control Flags. Window Size. Checksum. Urgent Pointer. Options.
25.	**What are the TCP/IP model layers from top to bottom?**	Application: HTTP, JPEG, GIF, RPC, FTP, SMTP. Transport: TCP, UDP. Internet: IP. Link: Ethernet, 802.11.
26.	**What are the three common ways to traverse trees in depth-first oder?**	In-order. Pre-order. Post-order.
27.	**What are the two key attributes of the TCP?**	Fault tolerant: data transmitted between networks can be cachced and resent. End-to-end: there is no single central systems that can take the whole network down
28.	**What are the two sections of the TCP prior to their bifurcation?**	Transmission Control Program(TCP): responsible for fault-tolerance. Internet Protocol: responsible for end-to-end nature.

29.	**What built-in method can you use on Number objects to convert different bases to decimals?**	toString()
		Example:
		Number(42).toString(16) // 2a
		Number(42).toString(2) // 101010

30.	**What does a zone file contain?**	Each name server maintains a zone file containing a text file with the following: Host names. IP addresses. Resource types. Each line in a zlf includes the affected domain, type of record on that line and the data for that record.
31.	**What does IP stand for?**	Internet Protocol.
32.	**What does ISN stand for?**	Initial Sequence Number.

33.	**What does MX stand for?**	MX stands for Mail Exchanger. DNS isn't just for websites. MX records are used by e-mail clients to direct messages to the appropriate mail servers. Instead of sending an email to friend@192.123.1.1 we send it to friend@gmail.com
34.	**What does OSI stand for and what is it?**	Open Systems Interconnection. OSI is a reference model that focuses on standardization. It has both conceptual layers and suggested protocols for each.
35.	**What does transport protocols use for forming addresses?**	Ports. Ports are virtual interfaces that allow a single device to host lots of different applications and services. There are 65536 separate ports available to each transport protocol.
36.	**What does UDP stand for?**	User Datagram Protocol.
37.	**What do we call physical sockets that cables plug into?**	Connectors. But can also be called ports instead. It can be confusing to know which is be spoken of when referring to a port, is it virtual used by transport protocols or physical used by hardware. For this we try to use the terms connector or jack when referring to a physical port.

38.	**What function can you use, with an optional second argument, to convert a Binary or hexadecimal string to a decimal number?**	parseInt()
		Example:
		parseInt('101010', 2) // 42
		parseInt('2A', 16) // 42

39.	**What is A/AAAA?**	A records are the most important DNS records present. They map a resource directly to an IP address. This is the core of what DNS is for: connecting the domain directly to a machine. A records are used for IPv4 addresses, while AAAA records perform the same function for IPv6.
40.	**What is a base?**	A number base is the number of digits or combination of digits that a system of counting uses to represent numbers. A base can be a whole number greater than 0.
41.	**What is a bit?**	A single digit.
42.	**What is a BST(Binary Search Tree)?**	Given any node of the tree, the values in the left subtree must all be strictly less than the given node's value. The values in the right subtree must all be greater than or equal to the given node's value. The left subtree contains values less than the root. AND the right subtree contains values greater than or equal to the root. AND the left subtree is a BST. AND the right subtree is a BST.
43.	**What is a cycle? What data structures can contain them?**	A cycle is an edge that loops between nodes. Graphs are the only DS that can have a cycle, if there is a cycle, it's an invalid tree.
44.	**What is a depth-first search?**	Recursively searching the first adjacent node of each vertex found. The search tree is deepened as much as possible on each child before going to the next sibling.
45.	**What is a domain registry?**	An organization that have demonstrated the ability to handle the workload involved in managing TLDs.
46.	**What is a formal name (subdomain or third-level domain, etc.)?**	Additional domains to the left of the second-level domain. Often referred to as subdomains. The best known subdomain is www, although not used as often on newer sites.
47.	**What is a graph?**	A graph is any collection of nodes and edges. A graph may: lack a root node, have cycles, or have any number edges leaving a node.
48.	**What is a hub?**	A hub is the simplest networking device you're likely to find in service. It performs no network management and might be better known as a "signal splitter". When a hub receives data, it duplicates that data and broadcasts it to all connected devices. Often considered a "dumb" device because it just repeats and rebroadcasts data.
49.	**What is a huge disadvantage of using an adjacency matrix?**	The space required. To represent a graph of n nodes, we must allocate n2 space for the 2D array.
50.	**What is a leaf of a tree?**	A node without children.
51.	**What is an adjacency list?**	It is similar to the adjacency matrix, but it uses an object where keys represent the node labels. The values associated with the keys will be an array containing all the adjacent nodes.

52.	**What is an adjacency matrix?**	It is often the preferred way to represent a graph by mathematicians. You use 2D arrays to represent edges. You map each node's value to an index. As in: A -> 0, B -> 1, C -> 2, etc.
53.	**What is an advantage of using an adjacency matrix?**	Allows us to refer to the entire graph by simply referring to the 2D array.
54.	**What is an "all interfaces" address?**	This address is used to catch any incoming requests regardless of intended destination. It's only used by the local machine: you would never send a packet to it, but a server that is listening on that address would see all the incoming packets.
55.	**What is an internal node?**	A node that has children.
56.	**What is another word for Base 10?**	Decimal.
57.	**What is a path?**	A series of nodes that can be traveled through edges.
58.	**What is a router?**	Routers are a high-level device that connect separate networks with each other. Instead of identifying devices via MAC address, they use IP addresses to make decisions about data. A router, like a switch, maintains an internal table of addresses. This routing table is used to pass received data on trhough the network. Can connect to external networks whereas hubs/switches operate only on the local network. Routers utilize NAT (Network Address Translation) - single IP address for all external communication then uses IP ports to map incoming data to internal device IP addresses in its routing table.
59.	**What is a second-level domain?**	It is the place to the left of the TLD, seperated by a dot. It is often lumped together with the domain. This is the name most people associate with a website. - Side note: These can be purchased through domain registrars. The registrar maintains a listing of each purchase.
60.	**What is a switch?**	A step up from the hub, we find a network switch. Switches are "intelligent" hubs, they track devices connected to them, help manage network load and can manage to separate internal networks.
61.	**What is a Tree?**	A tree is a graph that does not contain any cycles. A cycle is defined as a path through edges that begins and ends at the same node. It is a data structure where a node can have zero or more children. Each node contains a value. A tree is a type of graph.
62.	**What is Base 2?**	It is a counting system that contains digits 0 through 1.
63.	**What is Base 10?**	It is a counting system based using 10 digits; from 0 to 9.
64.	**What is Base 16?**	Aka hexadecimal. It is a counting system of digits 0 through F, where A is 10 decimal and F is 15.
65.	**What is Data Offest?**	Defines how long the segment header is. This lets us know if there are options later on in the header or not.
66.	**What is DNS?**	The Domain Name System. It is a distributed approach to providing easily-understood names for internetworked devices. DNS allows us to look up a specific IP address by its domain. Refers to the "friendly" name for the website's host or the server providing the site's content.

67.	**What is in-order traversal? What are the steps it takes?**	Accessing the value of the node after descending to the left but before descending to the right. - Recursively visit the left sub tree. - Access the data of the current node. - Recursively visit the right sub tree.
68.	**What is IPv4?**	Best known version of IP: used when TCP/IP finalized by DARPA in 1983 and still most used. IPv4 packet's header consists of at least 13 fields(i.e. sequences of binary bits) and start with a version identifier 0100. IPv4 addresses composed of 4 octets or 8-bit binary numbers such as 192.18.1.1 and can support 4 billion unique addresses.
69.	**What is IPv6?**	New protocol that allows more addresses. Different packet header format: only uses 8 header fields and starts with version identifier 0110. IPv6 addresses uses 128 bits compared to 32 bits and uses eight colon-ed hexadecimal. Supports 350 undecillion addresses(billion times a billion).
70.	**What is NAT?**	Network Address Translation. NAT helps minimize IP address overload by giving a router a single IP address to use for all external communication. The router then uses IP ports to map incoming data to internal device IP addresses in its routing table.
71.	**What is NS?**	NS records point to name server for the zone. Most zones will have at least two NS records for redundancy.
72.	**What is pre-order traversal? What are the steps it takes?**	Accessing the value of the node before recursively descending. - Access the data of the current node. - Recursively visit the left sub tree. - Recursively visit thr right sub tree.
73.	**What is represented as off in Binary?**	0
74.	**What is represented as on in Binary?**	1
75.	**What is SOA?**	SOA stands for Start Of Authority. This record lets us know which name server is the master, or primary authority, for the domain we're querying.
76.	**What is TCP?**	Transmission Control Program. A complex process that allows for multiple networks to communicate with each other.
77.	**What is TCP and what does it do?**	Transmission Control Protocol. TCP uses data units called segments. Segments are formed from application data: TCP receives this data, breaks it down into transmittable units, and attaches a header to each unit. This header contains everything we need to ensure a reliable connection is established.
78.	**What is the 0x notation in hexadecimal?**	Sometimes you will see hexadecimal numbers represented by prepending a 0x to the front of them. For instance 42 in hexadecimal may be represented as 0x2A.
79.	**What is the advantage of using an adjacency list?**	It is easy to implement and allows us to refer to the entire graph by simply referencing the object. The space required for an adjacency list is the number of edges in the graph. Since there will be at most n2 edges in a graph of n nodes, the adjacency list will use at most the same amount of space as the matrix.
80.	**What is the Application layer of TCP/IP?**	The Application layer includes protocols related to user-facing data. HTTP and FTP operate in this layer. The TCP/IP model doesn't care what type of application is used; whatever is transmitted from the Transport Layer is considered Application Layer data.
81.	**What is the Application layer of the OSI model?**	The OSI Application Layer includes information used by client-side software. Data transmitted on this layer will interact directly with applications, as the name suggests, and can be displayed to the user with limited translation. HTTP is an example of a common Application Layer protocol.
82.	**What is the biggest thing that separates a hub from a switch?**	MAC address table.

83.	**What is the breadth-first search order?**	Traversing level-by-level, where you visit every node on a level before going to a lower level. As you search the tree it is broadened as much as possible on each depth before going to the next depth.
84.	**What is the Data Link layer of the OSI model?**	Protocols at the OCI Data Link layer deal with connections directly from one machine's network interface to another. Frames targeting different MAC addresses are transferred here, and the Data Link layer is primarily used by machines in local networks. The most recognizable protocol on this layer is Ethernet.
85.	**What is the Destination Address of IPv6?**	Where the packet is heading.
86.	**What is the difference between OSI and TCP/IP reference models?**	TCP/IP is mostly focused on practical networking concepts and isn't tightly tied to particular protocols. OCI however, has both cenceptual layers and suggested protocols for each.
87.	**What is the Flow Label of IPv6?**	An experimental option used for adding packet sequencing into IP.
88.	**What is the Hop Limit of IPv6?**	A means of preventing packets from being passed around routers forever, this field will be decremented by one every time the packet passes through an intermediary(like a router).
89.	**What is the Internet?**	A loose definiteion is a series of internetworked systems. "A series of tubes."
90.	**What is the IPv4 "all interfaces" address?**	0.0.0.0
91.	**What is the IPv4 loopback address?**	127.0.0.1
92.	**What is the IPv6 "all interfaces" address?**	::
93.	**What is the IPv6 loopback address?**	::1
94.	**What is the loopback address?**	This is the identifier for your current machine. It is also referred to as localhost.
95.	**What is the Network layer of the OSI model?**	The OSI Network layer mirrors TCP/IP's Internet layer. This layer manages connections between remote networks, transferring packets across intermediary devices. The best-known protocol at the Network layer is IP.
96.	**What is the Next Header of IPv6?**	Usually identifies the protocol type of the packet's data, but may indicate the first extension header(if present).
97.	**What is the number 42 in Binary?**	00101010.
98.	**What is the number 42 in hexadecimal?**	2A
99.	**What is the Payload Length of IPv6?**	Lets the receiver know how large the data in the packet will be.
100.	**What is the Physical layer of the OSI model?**	OSI's Physical layer goes a little deeper than the TCP/IP reference model. Physical layer protocols have to do with translating from raw electrical signals to bits & bytes of data. You may recognize Wi-Fi(technically known as 802.11) as common Physical layer protocols.
101.	**What is the post-order traversal? What are the steps it takes?**	Accessing the value of the node after descending to both branches. - Recursively visit the left sub tree. - Recursively visit the right sub tree. - Access the data of the current node.

102.	**What is the Presentation layer of the OSI model?**	The Presentation layer is where data gets translated into a presentable format. This is often called the syntax layer since data is converted between machine-readable & human-readable syntax here as well. As a result, the Presentation Layer may include data compression, encryption and character encoding. Many image formats, including JPEG and GIF, use well-known Presentation Layer protocols.
103.	**What is the root of a tree?**	The top-most node.
104.	**What is the Session layer of the OSI model?**	The OSI Session layer includes protocols responsible for authentication and data continuity. Session layer protocols may authorize a client with the server or re-establish a dropped connection. An example protocol you may find on this layer is RPC(Remote Procedure Call), a mechanism for one device to initiate a command on another.
105.	**What is the Source Address of IPv6?**	Where the packet originated.
106.	**What is the TLD of a URL?**	Top-Level Domain. It is the last part of the domain before the URL begins pointing at application routes (usually indicated by /'s) or query parameters (indicated with ? and &). The best known examples are .com, .net and .org.
107.	**What is the Traffic Class of IPv6?**	Used to identify different types of packets, like video or phone data.
108.	**What is the Transport layer of the OSI model?**	The OSI Transport layer, like the layer of the same name in TCP/IP reference model, utilizes transport protocols. Processes here are focused on data integrity and connectivity. Our old friends TCP and UDP are the two most-used transport protocols.
109.	**What is TTL?**	TTL refers to Time To Live of our records. This is a measure of how long a record should be cached by a DNS name server.
110.	**What is Version of IPv6?**	0110 or "6" in binary notation.
111.	**What kind of protocol is TCP?**	Connection-oriented protocol. This means that it establishes a long-running line of communication between two points instead of just shouting into the internet void like UDP.
112.	**What layers does Link represent on the OSI model of the TCP/IP model?**	Data Link, Physical.
113.	**What layers of the OSI model does Application represent on the TCP/IP model?**	Application, Presentation, Session.
114.	**What sort of tree is a linked list?**	A binary tree.
115.	**What ways may a tree be traversed?**	Depth-first order or breadth-first order.
116.	**When is a tree considered a binary tree?**	When a tree has at most two children.
117.	**When is it good to use the OSI reference model?**	OSI is good for understanding concepts, but too restrictive for building new protocols. OSI is conceptual, so its practical uses are limited. We can see this when we look at protocols that cross layers.
118.	**When is it good to use the TCP/IP reference model?**	TCP/IP is almost purely practical. It was extracted from real, functional networks used by DARPA in the 1970s. It is most often used when building new systems or analyzing real networks.

119.	**When you join an IP address and a port what is that called? Example: 192.168.1.1:5500**	Socket.
120.	**Why were TCPs developed?**	IP is a very low level protocol: there isn't much more information than the destination address in a packet; packets can show up at a computer but the computer doesn't know which application to give the data payload to. Transport protocols were developed to help with that final step. They use their own form of addressing called ports. Every application will request a unique port. When packets arrive, the computer checks the port and sends the data to the application that requested it.