2017-2018 Exam:

1)

a. Best effort provides no guarantees regarding whether the receiver has received the RPC. It is implemented using the primitive send RPC and we return true if we receive a reply, and false if we timeout.

Def bool bestEffort(message, destination):

Send(message, destination)

Return receive(destination, timeout)

At least once provides a guarantee that the RPC will be delivered at least one time successfully. It does this by repeatedly sending (within reason) the message until we get a positive response.

Def bool atLeastOnce(message, destination):

Int max = N

While (max > 0):

Send(message, destination)

If (receive(destination, timeout)):

return true

Return false

At-most-once ensures that the RPC is either never executed or executed exactly once. It does this by storing a record of previously called RPC’s to ensure no call is repeated.

b.

2a.

3a. Not in curriculum anymore

3bi. Link state algorithms can assume the ‘cost’ of the entire topology whereas distance vector only knows the ‘cost’ of traversing to its neighbor.

Link state algorithm:

* Pros:
  + Provides more efficient routing by calculating shortest path using Dijkstra's algorithm.
  + Can handle larger networks with more nodes and links.
  + Allows for more dynamic changes to the network topology.
* Cons:
  + Requires more processing power and memory.
  + Needs more communication between nodes to exchange link state information.

Distance vector algorithm:

* Pros:
  + Simple and easy to implement.
  + Less communication between nodes is required.
  + More suited to smaller networks with fewer nodes.
* Cons:
  + Can cause routing loops in the network.
  + Slower convergence time when there are changes to the network.
  + Limited to calculating the next hop based on distance, rather than the shortest path.

3bii)

Nobody in their right mind is drawing 16 tables.

3biii)

4a) Not super sure about this answer:

DNS was needed to find the mail server for which our email was intended. Without DNS, we would not be able to locate the destination address of our SMTP message.

The local machine makes a DNS request to the café's name server. If the café has the particular domain in its cache, it will return it. Otherwise, the café's name server will return the address of the TLD “.uk”. Our DNS resolver asks the “.uk” TLD to resolve “help.uk”. This TLD sends us the IP of the “help.uk” server, which we contact and query it for the mail server.

4bi) CSMA/CD refers to carrier sense multiple access with collision detection. The premise of this ‘algorithm’ is that if we sense that the channel is idle, we attempt to transmit our entire message. If the channel is busy, we wait. If the NIC transmits the entire message with no collision, we are done. However, if we collide with another transmission, we abort sending the message and start an exponential backoff. After the mth collision, NIC chooses K at random from {0,1,2, ..., 2m-1}. NIC waits 512K bit times, and we try sending again. Note: the more collisions we experience, the longer the backoff interval.

CSMA/CD is better than TDMA because we waste fewer resources. In TDMA, a node in the channel (with N nodes) could potentially be waiting for N-1 \* length of time division even though the channel is idle. In CSMA/CD if the channel is idle, we get a chance to access it – I.e., we use our resources fully. Additionally, CSMA/CD is more flexible. CSMA/CD does not require a fixed schedule or time slots, allowing users to transmit data as needed.

4c)

Live video streaming: UDP. Losing a couple of packets is not the worst issue when it comes to live video streaming, and the cost of setting up the connection handshake can prove to be costly.

DNS: UDP. TCP handshake would prove to be too costly for each DNS request. Thus, UDP.

SSH: TCP. The receiver should be expecting something to arrive from the sender, a good way to establish this connection is using TCP’s handshake protocol.

Email: TCP. The receiver should be expecting something to arrive from the sender, a good way to establish this connection is using TCP’s handshake protocol. Plus, we do not want to lose packets of an email – TCP is reliable.