CS224m Tutorial 12 Answers

1. TDMA, polling, random access have additional delays as they use the time dimension for multiple access. FDMA and CDMA do not have such delays.
2. In FDMA, since the receiver is 'tuned' to the sender's frequency, it cannot receive packets from other senders using other frequencies. Likewise, in CDMA, a receiver uses (knows) only its own code to demodulate.
3. Q bits are sent every $(d_p + Q/R)$, so the maximum system throughput is $Q/(d_p+Q/R)$; this maximum is achieved when all nodes have traffic to send.
4. [practical exercise]
5. You can find out the PHY data rate being used; software like inssider should tell you this.
6. [practical exercise]
7. Expected transmission time (ETT) = DIFS + (15/2)*slotTime + PHYPreambleTime + (MACHeader+IPHeader+UDPHeader+1400)/DataRate + SIFS + ACKTime
   Max DataRate for 802.11b is 11Mbps, and the other parameters can be found from a standard 802.11 reference or google search.
   Max throughput is 1400/ETT
8. [repeat]
9. [practical exercise]
10. For 802.11g, the max data rate is 54Mbps; other parameters can be found by searching
11. Find the relevant parameters by searching; the formula remains the same.
12. With frame aggregation at PHY layer (called A-MPDU), there is exactly one PHYPreambleTime per transmission. So we'll have 20*(MACHeader+IPHeader+UDPHeader+1400)/DataRate in ETT, and max throughput will be 20*1400/ETT
13. RTS/CTS questions
    a. Same as when DATA is sent without using RTS/CTS (DIFS followed by random backoff)
    b. Gap will be SIFS, so that no other node in the system can get access to the channel before this RTS-CTS-DATA-ACK exchange is complete
    c. Same as above
    d. Yes, for the same reason there can be collision between two DATA frames
    e. RTS/CTS will still work; it requires only symmetry in communication (A can hear B if-and-only-if B can hear A)
    f. No, the same example as in the slides for the exposed node scenario can be used to show this easily
14. [practical exercise]
15. [practical exercise]