1. Why does circuit switching waste bandwidth if the traffic is bursty? Under what traffic conditions is circuit switching optimal?

2. You may have noticed that at busy events (e.g., concerts, sporting events, etc.) the Internet connection on your mobile device can become unstable or stop working entirely. Provide two hypotheses, each one focusing on a different part of the network stack, for why this degradation in performance might be happening.

3. Give two examples of multiplexing in a real-world system not related to computing: one that behaves more like a circuit-switched network and that behaves more like a packet-switched network. In each example, describe the (a) characteristics that make it more packet/circuit-like, (b) explain what is being multiplexed, and (c) how overloading of the underlying resource manifests itself.

4. An office has an Internet link with a capacity of 120 Mbps full-duplex. Each user requires 15 Mbps when transmitting and each user is active 15% of the time.

   (a) Initially a static allocation of bandwidth is made for each user. How many users can the link support?

   (b) The office actually has 25 people who need to use the Internet. As a result, they decide that the static allocation is not particularly efficient and decides to use a statistical approach instead. What is the probability that *exactly* 8 users are transmitting at any given moment?

   (c) What is the probability that more than 8 users are transmitting at any given moment?

5. Popular mobile phone apps, such as Uber and WhatsApp benefit massively from the layered architecture of the Internet. List three ways of how the layered design of the network stack simplified their creation and enable their day-to-day operation.

6. Which layers of the networking stack must routers on the Internet implement? Why is it that routers on the Internet only need to implement a subset of the layers that make up the networking stack?