CPS 470/570: Homework 3 — Due Tuesday December 3

Note: This is a double homework. It will count the same as the two previous homeworks combined.

Question 1: Fast MAC Protocols

1. Describe the 4B/5B encoding scheme and why it is used. How does it improve bandwidth efficiency?
2. Describe the function of a 10BaseT or 100BaseT hub. How does it allow us to use CSMA/CD with point-to-point wiring?

Question 2: Flow/Error Control

The following diagram (see back) depicts a Go-Back-N frame exchange between two nodes connected by a full-duplex link. The diagram only depicts the data and control messages associated with sending data frames from the left side to the right. The nodes are using a window size of 4.

1. Show the sliding windows for the sender and receiver as the data exchange occurs. Indicate the initial windows and then show the window after each frame transmission or arrival.
2. Assume that the two hosts are communicating over a 15,000 kilometer link with a bandwidth of 155 Megabits/second. Assume a frame size of 53 bytes and signal propagation of 2×10^8 meters/second.

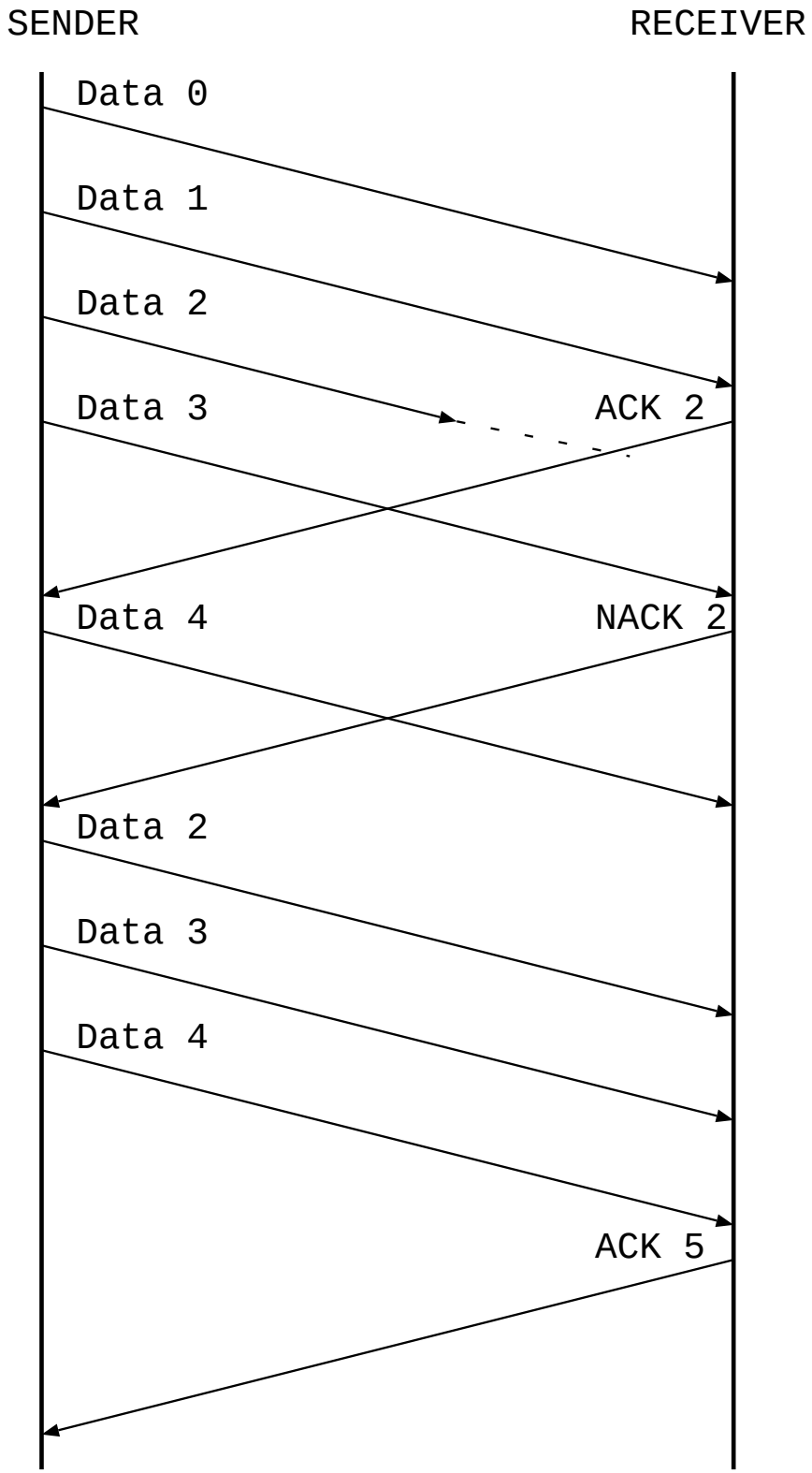
   Assuming an error-free transmission, what is the utilization for the following

   (a) Stop and Wait
   (b) Sliding Windows with Window size of 7
   (c) Sliding Windows with Window size of 127
3. What window size is needed to achieve 90% utilization?

Question 3: Protocol Specification

You are to develop a protocol specification for the telephone. You should create a finite-state machine that represents the operation of the telephone and present it using a state transition diagram.

Focus on the basic services provided by a POTS telephone. Don't try to support call-waiting, etc. Remember, you have two interfaces to worry about. The first is the interface with the user. List the things the user might do and make sure you have a transition to handle each action *anywhere* that it might occur. The second interface is to the phone network. For the purposes of your protocol, assume that you are communicating with the telephone on the other end.


SENDER
RECEIVER
Data 0
Data 1
Data 2
Data 3
ACK 2
Data 4
NACK 2
Data 2
Data 3
Data 4
ACK 5