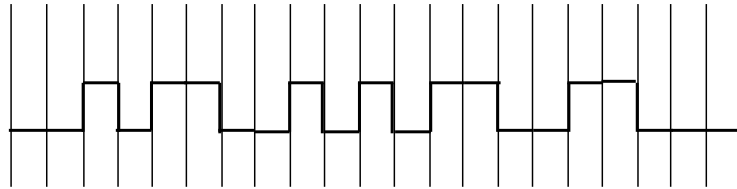


Question 1. Draw diagrams for the following binary bit sequences and transmission techniques.

- Show the energy flow of energy through a cable when transmitting 1011101001 using on-off keying.
- Show the flow of energy though a cable when transmitting 1011101001 using Manchester encoding.

Question 2. Consider the signal represented by the following diagram:



- Assuming that signal is intended to transmit data encoded using on-off keying and that each of the intervals between the thin vertical lines represents the transmission of one bit, what sequence of binary digits does this signal represent? (Hint: Yes, the answer should be 21 bits long.)
- Now, continue to assume that on-off keying is being used and that the vertical lines represent bit times, suppose that the data has been grouped into 8-bit frames with one start bit preceding each frame. Under these assumptions, what data does the signal represent?
- Finally, suppose we drop the assumption about on-off keying and the assumption that the vertical lines represent bit times. Instead, assume that the Manchester encoding scheme is being used. In addition, continue to assume that the data is grouped into 8-bit frames and that each frame is preceded by a start bit (i.e., a one transmitted using Manchester encoding precedes the data). Under these assumptions, what data does the signal represent?

Question 3. Consider two computers, A and B that are connected by a wire that transmits at a rate of 1 Mbps (1 million bits/second). Suppose that A sends 2000 bits to B and the distance between A and B is 50Km.

- How long is it from when A transmits the first bit until B receives it, assuming that data travels at the speed of light (3×10^8 meters/second)?
- How long does it take A to put all 2000 bits onto the wire?
- How long is it from when A starts sending the bits until B has completely received it?

Question 4. The program on the next page draws three buttons in a window. Initially, all three buttons are enabled, but pressing the buttons variably enables or disables the buttons. The method `someButton.isEnabled()` is a `JButton` method that returns true if `someButton` is enabled, and false otherwise.

Suppose that the buttons labeled Sunny, Healthy, and Saturday are clicked in sequence. Indicate which buttons will be enabled after the `buttonClicked` method is invoked in response to each of the three clicks in this sequence.

- After clicking Sunny?
- And then clicking Healthy?
- And finally clicking Saturday?
- Starting from scratch (i.e. when the program first begins execution), is there a sequence of button clicks, clicking at least one button, that will leave Sunny and Saturday both enabled? Explain your answer.

```
public class MysteriousIf extends GUIManager {
    private final int WINDOW_WIDTH = 400;
    private final int WINDOW_HEIGHT = 75;

    private JButton sunny;
    private JButton saturday;
    private JButton healthy;

    public MysteriousIf() {
        this.createWindow( WINDOW_WIDTH, WINDOW_HEIGHT );
        sunny = new JButton("Sunny");
        saturday = new JButton("Saturday");
        healthy = new JButton("Healthy");

        contentPane.add(sunny);
        contentPane.add(saturday);
        contentPane.add(healthy);

        sunny.setEnabled(true);
        saturday.setEnabled(true);
        healthy.setEnabled(true);
    }

    public void buttonClicked( JButton which ) {
        healthy.setEnabled(false);
        if (which == sunny){
            if (saturday.isEnabled()){
                healthy.setEnabled(true);
            } else {
                saturday.setEnabled(true);
            }
            sunny.setEnabled(false);
        } else if ( !(which == saturday) ){
            saturday.setEnabled(true);
        } else if (which == healthy){
            if (saturday.isEnabled()){
                sunny.setEnabled(false);
            }
        } else {
            sunny.setEnabled(true);
            saturday.setEnabled(false);
            healthy.setEnabled(true);
        }
    }
}
```

Question 5. Suppose that we have the following declaration and assignment:

```
String words;
words = "Efficiency is intelligent laziness";
```

What would be the result of each of the following expressions?

- a) words.substring(16, 20)
- b) words.indexOf("ice")
- c) words.substring(words.length() - 9)
- d) words.substring(words.indexOf("in"), words.indexOf("li"))
- e) words.substring(words.indexOf("is")) + words.substring(0 , words.indexOf("is") - 1)