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

a) *Show the flow of energy through a cable when the binary sequence 1011001010 is transmitted using on-off keying.*

b) *Show the flow of energy though a cable when the binary sequence 1011001010 is transmitted using Manchester encoding.*

Question 2. *Which, if any, of the wave forms shown below could be an example of binary data being transmitted using Manchester encoding? Explain your answer. What sequence of 0s and 1s would be represented by each sequence you identify as an example of Manchester encoding.*

a)

b)

c)
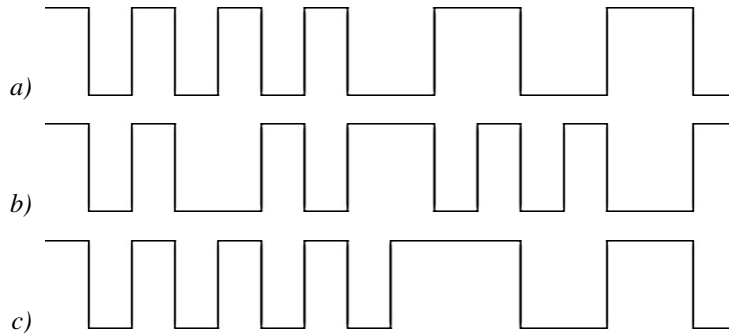
Question 3. *A transition is a change in signal amplitude from zero to full amplitude or vice versa. A transition is represented in the graphs of signals as a vertical line. For example, in the signal shown in question 2 part a, there are 11 transitions. In particular, the number of transitions in a signal is not necessarily the same as the number of bits being sent by the signal.*

For this problem, we would like you to consider the frequency with which transitions occur. The number of transitions in a signal depends on the bits being sent and whether we are using on-off keying or Manchester encoding.

For each of the following questions, assume that data is being transmitted at a rate of 1000 bits per second.

a) *If we use on-off keying, what is the maximum rate at which transitions may occur? What sequence of bits would produce this transition rate?*

b) *If we use on-off keying, what is the minimum rate at which transitions may occur? What sequence of bits would produce this transition rate?*

c) *If we use Manchester encoding, what is the maximum rate at which transitions may occur? What sequence of bits would produce this transition rate?*

d) *If we use Manchester encoding, what is the minimum rate at which transitions may occur? What sequence of bits would produce this transition rate?*

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 which 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.

a) *After clicking Sunny?*

b) *And then clicking Healthy?*

c) *And finally clicking Saturday?*

d) *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 Mysterious_if extends GUIManager {
    private final int WINDOW_WIDTH = 400, WINDOW_HEIGHT = 75;

    private JButton sunny = new JButton("Sunny");
    private JButton saturday = new JButton("Saturday");
    private JButton healthy = new JButton("Healthy");

    public Mysterious_if() {
        this.createWindow( WINDOW_WIDTH, WINDOW_HEIGHT );
        sunny.setEnabled(true);
        saturday.setEnabled(true);
        healthy.setEnabled(true);
        contentPane.add(sunny);
        contentPane.add(saturday);
        contentPane.add(healthy);
    }

    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(14, 16)*

  b) *words.indexOf("ice")*

  c) *words.substring(words.length() - 9)*

  d) *words.substring(words.indexOf("in"), words.indexOf("s"))*

  e) *words.substring(words.indexOf("is")) + words.substring(0 , words.indexOf("is") - 1)*