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 1101001010 is transmitted using on-off keying.

b. Show the flow of energy through a cable when the binary sequence 1101001010 is transmitted using Manchester encoding.

Question 2. Which, if any, of the following wave forms 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 graphs of signals like the ones in Question 2 as a vertical line. For example, in 2a, there are eleven transitions. Note that the number of transitions is not necessarily the same as the number of bits being sent by a signal. In this problem, you will 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 will cause buttons to be enabled or disabled in various ways. The method somebutton.isEnabled() is a JButton method which returns true if someButton is enabled, and false otherwise.

Suppose 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 we have the following declarations and assignment:

```java
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 )`

**Question 6.** Consider the mystery code below:

```java
int N = 6;
int result = 1;
while ( N > 1 ) {
    result = result * N;
    N = N - 1;
}
textbox.append( “” + result + “\n” );
```

a. What is appended to the textbox?

b. How many times is the `(N > 1)` condition evaluated?

c. If the first line was `N = 0`, then what would be written to the text box?

d. If the first line was `N = 0`, then how many times would the `(N > 1)` condition be evaluated?

e. What is the mathematical name for the function of `N` that is computed?

**Question 7.** Using a loop, write code that sends the following sequence of strings to a server: “0”, “01”, “0123”, “01234”, “012345”, “0123456”, “01234567”. Assume that `toServer` is already declared and is assigned to a valid `NetConnection`. 