We encode information so that it can be efficiently transferred from one place to another — whether it be between the hard drive and main memory of a computer or between people chatting on IM. This homework explores the tradeoffs among several basic encoding schemes.

**Question 1.** Show the sequence of binary digits used to encode the four characters in the text 2ft. in ASCII. (A link to the ASCII encoding scheme is available in the links section on the course Web page, but note that this is the 7-bit version of the code - prepend an additional 0 to the binary encodings to get the 8-bit ASCII representation.)

**Question 2.** ASCII is a fixed length code. Each character is represented by a block of eight binary digits (i.e., eight bits, or eight “places” where each place can hold 0 or 1). With 8-bit blocks, one can encode a maximum of 256 different characters, as discussed in class. But what if we allow three values (0, 1, 2) instead of just two (0, 1)? This question explores the nature of ternary codes.

(a) Suppose that we are interested in encoding only the 26 lower case letters of the American English alphabet. Using this new encoding, what is the minimum number of ternary digits (i.e., minimum number of places where each place can hold 0, 1, or 2) required so that any of the 26 letters can be represented?

(b) It is often convenient to write expletives using the characters $#:+. For example, one might write “holy $#:+, i can’t believe prof. barnett has a question with the word ‘$#:+’ in it!” How many more ternary digits do we need to add so that these additional four characters can be included?

(c) In addition to the four characters $#:+, suppose we also want to add the three characters ,’! to our alphabet. How many more ternary digits do we need now?

(d) In general, if we can encode a maximum of \( n \) characters with \( k \) ternary digits, how many characters can we encode with \( k + 1 \) ternary digits? With \( k + 2 \), \( k + 3 \), \( k + m \) where \( m \) is a non-negative integer?
Question 3. This question departs from the encoding theme above in order to help firm up your Java programming vernacular. Below is a sample Java program. It is similar to the ones we have seen in class and in lab. Identify which lines are described by each of the following programming terms (just provide the line number(s)).

(a) Class declaration.  
(b) Instance variable declaration  
(c) Constructor definition  
(d) Method header  
(e) Method body  
(f) Local variable declaration  
(g) Assignment statement  
(h) Method invocation

```java
1. import squint.*;
2. import javax.swing. *
3
4. public class TouchyButton extends GUIManager { 
5. 6. private final int WINDOW_WIDTH = 150;
7. private final int WINDOW_HEIGHT = 300;
8.
9. public TouchyButton() { 
10.   this.createWindow( WINDOW_WIDTH, WINDOW_HEIGHT );
11.   contentPane.add( new JButton( "Click Here" ) );
12. }
13.
14. public void buttonClicked() {
15.   JLabel j;
16.   j = new JLabel("I'm Touched");
17.   contentPane.add( new JLabel( "I'm Touched" ) );
18. }
19.
20. }
```