

*ALIENS!***Due Thursday, September 18**

ball game. **Aliens invade earth!** Details at 11, after the football game. **Aliens invade earth!** Details at 11, after the football game. **Aliens**

Background assumptions We imagine an alien language which has only three words:

- 40% of the words are 1111111. Abbreviate this word with **A**. It is seven bits long.
- 30% of the words are 00000. Abbreviate this word with **B**. It is five bits long.
- 30% of the words are 10101010. Abbreviate this word with **C**. It is eight bits long.

1. Decipher the following messages. That is, describe the sequence of alien words which produced them. For example, if you believe the message is $\overbrace{00000}^{\text{B}}\overbrace{1111111}^{\text{A}}\overbrace{10101010}^{\text{C}}\overbrace{10101010}^{\text{C}}$ you would report that the aliens were signalling **BACC**.

a) The aliens have xored a message with a pseudorandom bit string with about 5% 1's.

10111 11111 11111 01010 10111 11110 01001 01010 10000 00101 01010 11111 11101
01110 00000 10111 11101 01010 11101 11000 00

b) The aliens have xored a message with a pseudorandom bit string with about 10% 1's.

10101 00001 10011 01111 00000 11111 11000 10110 10111 01010 10111 11111 11011
10000 11000 11010 10100 00001 11111 11111 010

2. The aliens now xor two messages and send the resulting bitstream.

11111 11111 00000 10111 11101 01011 01001 01000 00101 00101 00000 01010 00010
10101 11100 11111 11110 10101 00000 00111 11

Reconstruct both messages as well as you can from this information.

3. The aliens created a pseudorandom bitstream with 50% 1's and 50% 0's, **but** they made a major error. They used the same stream to conceal three different messages. The concealed messages are displayed below. Decipher as much as you can of all three messages.

First message

00100 11011 10110 10110 10101 11110 11101 11111 11110 00000 10010 01110 10110
00011 01111 01011 00000 10110 11000 10010 00101 1

Second message

00100 11001 00011 01001 11010 01110 11100 10101 01110 00011 01111 01110 11100
10110 00000 10100 11111 00110 11011 01111 01111 0

Third message

01110 01110 11100 00110 11010 01110 00011 11111 11011 01010 00111 01110 00011
00110 00101 11110 01010 01100 01110 00101 110

Hint**Xor of first and second messages**

00000 00010 10101 11111 01111 10000 00001 01010 10000 00011 11101 00000 01010 10101 01111 11111
11111 10000 00011 11101 01010 1

Xor of first and third messages

01010 10101 01010 10000 01111 10000 11110 00000 00101 01010 10101 00000 10101 00101 01010 10101
01010 11010 10110 10111 111

Xor of second and third messages

01010 10111 11111 01111 00000 00000 11111 01010 10101 01001 01000 00000 11111 10000 00101 01010
10101 01010 10101 01010 101