Maximum Likelihood Decoding Activity

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Letter	Codeword	With parity bit
e	110	
a	100	
r	011	
i	010	
o	001	
t	000	

Figure 1: A binary encoding of the 6 most common English letters

1. Add a parity bit to the code for the 6 most common English letters on the right. Fill in the chart. What was the rate of the code before adding the parity bit? After?

2. Come up with a short message using only these letters. Write it below.

3. Encode your message using the code with parity bits and write the encoded message below.

4. Roll a die once for each bit in your message. If you roll a 1, corrupt that bit. If you roll a $2 - 6$, keep the bit unchanged. What is the model of this channel? Write the new (potentially corrupted) message on a notecard, and swap notecards with a neighbor. Copy the message they sent you below.

5. Compute the maximum likelihood that y was received given that x_i was sent for each codeword y that you received. (The table on the right might help you organize your work.)

6. What was the message you think your neighbor sent? Check with your neighbor - are you right?

y	x	$d(x,y)$	$P(y|x)$

Figure 2: Binary codewords of the 6 most common English letters