

Lab 6
CS114 Spring 2018
Information Theory

1. If the entropy of a random variable X is high, then
 is the uncertainty of X low or high?
 is the amount of information low or high?
 is the number of bits required to encode low or high?
2. Simplified Polynesian appears to be just a random sequence of six letters: p, t, k, a, i, u. If we assume that the six letters are equally distributed, what is the entropy of Simplified Polynesian?
 i.e. how many bits do we need to encode these letters?
3. Suppose that the letter frequencies are as shown in the probability distribution function below:

letter	p	t	k	a	i	u
P(letter)	1/8	1/4	1/8	1/4	1/8	1/8

What's the entropy of Simplified Polynesian?

4. You should find that the entropy from 3) is lower than 2). Why is this the case?
5. Suppose that we model the consonants (C) and the vowels (V) jointly. The joint distribution is shown below. What's the conditional entropy $H(C|V)$?

Consonant (C)	Vowel (V)	P(C,V)
p	a	5/14
p	i	1/14
p	u	0
t	a	1/14
t	i	1/14
t	u	1/14
k	a	2/14
k	i	0
k	u	3/14

6. The PDF above suggests that we can predict the following consonant based on the preceding vowel. Compute $I(C,V)$ i.e. the mutual information between consonants and vowels. Does it confirm our intuition?