Handout 1 Introduction to Communication Systems
Homework 1 October 17, 2009

PROBLEM 1. Consider the three probabilitiy distributions $R = \{0.25, 0.25, 0.25, 0.25\}$, $P = \{0.4, 0.35, 0.15, 0.1\}$ and $Q = \{0.25, 0.35, 0.15, 0.25\}$.

1. Compute the three entropies $H(R)$, $H(P)$ and $H(Q)$. Which one is larger?
2. Can you answer the above question without computing explicitly $H(R)$, $H(P)$ and $H(Q)$?

PROBLEM 2. Consider a random variable s which takes an infinite number of values whith corresponding probabilities $p_i = \frac{\alpha}{2^{i+1}}$, $i \in \mathbb{N} = \{1, 2, 3, \dots\}$.

1. For what value of α this is a probability distribution?
2. What is the entropy of s?

Hint: If $|r| < 1$, $\sum_{i=0}^{\infty}(a + id)r^i = \frac{a}{1-r} + \frac{rd}{(1-r)^2}$.

PROBLEM 3. For each of the following three codes, say if it is uniquely decodable. If so, is it instantaneous?

	Code 1	Code 2	Code 3
s_1	0	0	0
s_2	1	10	01
s_3	00	110	011
s_4	11	111	111