

M460 Information and Coding Theory

exercise sheet # 4

Exercise # 1 (1 points)
 Let \mathcal{S} be a source with three symbols with probabilities $p_1 \geq p_2 \geq p_3$. Show that the expected length of the binary Huffman code for \mathcal{S} is $2 - p_1$.

Exercise # 2 (1 points)
 Compute the binary Entropy of a source with probabilities $\frac{1}{3}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \frac{1}{12}, \frac{1}{24}$.

Exercise # 3 (1 points)
 Compute the binary Entropy of a source with probabilities $\frac{2}{3}, \frac{2}{9}, \frac{2}{27}, \frac{2}{81}, \frac{2}{243}, \frac{1}{243}$.

Exercise # 4 (1 points)
 Determine the entropy of the random variable which counts the sum of three dice.

Exercise # 5 (1 points)
 What is the maximum number of words in a binary prefix code with maximum word length 6?

Exercise # 6 (5 points)
 Use a *ternary Shannon-Fano code* to encode the following text. What is the expected word length of your code, how efficient is it? Compare with the code from last time.

giraffe zebra rhino dog cat rhino zebra rhino giraffe
 rhino snake lion rhino dog lion elephant
 rhino elephant cat giraffe elephant giraffe dog elephant
 dog rhino giraffe dog snake lion elephant
 zebra rhino dog cat dog rhino elephant dog cat
 elephant lion giraffe zebra rhino giraffe dog rhino
 cat dog zebra cat giraffe