Worksheet:
Information: Quantifying

1. A text message is to be sent using ASCII binary coding, consisting of 8 bits per character. What is the self information for each character? Assume all ASCII characters have equal probability.

2. A single frame of a high definition digital television stream consists of three 1920 by 1080 arrays of pixels (one for each colour: R,G,B). Each pixel can take on of 256 levels. If the frame rate is 30Hz:

   (a) Calculate the theoretical maximum information rate presented by a TV set to a viewer.
   Assume that: all 256 values of each colour channel are equally likely; that the 3 colour channels are independent of each other; all pixels are independent of each other; and all frames are independent of each other.

   (b) How can this information rate be reduced? Are the assumptions correct if we can reduce the information rate without corrupting the quality of the pictures?

3. A five symbol source has the following probabilities for each of the symbols:

symbol	a	e	i	o	u
probability	0.3	0.5	0.1	0.05	0.05

   Calculate the following:

   (a) self information for each symbol

(b) Entropy for the source

(c) maximum Entropy of the source

4. Why is the Entropy of a binary symbol system equal to zero if the probability of either of the symbols is 1. *Please explain in terms of what Entropy actually represents, not by just using any equations.*

5. What is the value of the Entropy H for systems consisting of more than 2 symbols when all symbols are equally likely?