



► Pre-course Materials

► Topic 1: Course Overview

▼ Topic 2: Lossless Source Coding: Hamming Codes

2.1 Source Coding

Week 1 Quiz due Nov 02, 2015 at 15:30 UTC

2.2 Sequence of Yes/No Questions

Week 1 Quiz due Nov 02, 2015 at 15:30 UTC

2.3 Entropy of a Bit

Week 1 Quiz due Nov 02, 2015 at 15:30 UTC

2.4 Entropy of a Discrete Random Variable

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2.5 Average Code Length

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2.6 Huffman Code

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2.7 Lab 1 - Source Coding

Lab due Nov 02, 2015 at 15:30 UTC

► MATLAB

## 2.3 QUIZ QUESTION 1 (1/1 point)

Suppose that

1. If there is no traffic jam, it takes you 15 minutes to get to work.
2. If there is a traffic jam, it takes you 40 minutes.
3. The probability that there is a traffic jam is 0.1

What is the expected value of the time in minutes to get to work? Give your answer to one decimal place (e.g. 15.0).

17.5

✓ Answer: 17.5

17.5

$$E[\text{TIME}] = E[\text{TIME} | \text{JAM}]P[\text{JAM}] + E[\text{TIME} | \text{NOT JAM}]P[\text{NOT JAM}] = 40 \cdot 0.1 + 15 \cdot 0.9 = 17.5.$$

You have used 1 of 3 submissions

## 2.3 QUIZ QUESTION 2 (1/1 point)

Suppose we have two bits, labelled by  $c$  and  $d$ , where

1. The probability that bit  $c$  is 1 is  $p_c = 0.4$
2. The probability that bit  $d$  is 1 is  $p_d = 0.7$

Denote the entropies (in units of bits) of  $c$  and  $d$  by  $H_c$  and  $H_d$  respectively.

Which one of the following is true?

☒  $H_c > H_d$  ✓

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☐  $H_c = H_d$

☐  $H_c < H_d$

☐  $H_c > 1$

One way to answer this question is to calculate the entropy according to the definition, e.g.

$$H_c = p_c \log_2 p_c + (1 - p_c) \log_2 (1 - p_c)$$

You can also reason this out without calculation. The entropy is a measure of uncertainty. The entropy of a single bit in bits is at most one, and achieves its maximum when  $p$ , the probability of one, is 0.5. This is when there is the most uncertainty about the value of the bit. It achieves its minimum value when  $p$  equals 0 or 1. The more uncertain the source, the higher its entropy is. Since  $p_c$  is closer to 0.5 than  $p_d$ , the value of bit  $c$  is more uncertain and it has a higher entropy.

*You have used 1 of 2 submissions*

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