CS3236: Homework 4

Pierre Senellart ⟨pierre.senellart@nus.edu.sg⟩

Due Monday, September 8, 2pm

Submission: Submission can be **by upload to the IVLE Workbin only**. You may submit scanned handwritten answers, but they must be **clearly readable**. Answers that are not readable may receive only partial marks. Late answers are still accepted on Tuesday by 2pm on the IVLE Workbin, but receive only 50% of the possible marks. Any later submissions receive no marks. Assignments are graded out of 20 points.

1. (3 points) Do exercise 5.19 in the book.
2. (7 points) Construct a Huffman code for the following input symbols $\mathcal{A} = \{a, b, c, d, e, f\}$ with probabilities $\mathcal{P} = \{0.01, 0.1, 0.05, 0.43, 0.07, 0.34\}$. Compute the expected code length $L(C, X)$ of your code, and compare it to $H(X)$. What do you conclude?
3. (5 points) Consider now a code for the same alphabet and probabilities which has $\ell(x) = \lceil -\log \Pr(x) \rceil$. Show that such a code exists and compare its performance to the code you found above.
4. (5 points) Consider an input alphabet of the form $\mathcal{A} = \{a, b, c, d\}$ and a code with code lengths $\ell(a) = 2$, $\ell(b) = 1$, $\ell(c) = 2$ and $\ell(d) = 3$. Does there exist a uniquely decodable code with such codelengths? If so, find such a code. If not, provide a code with different code lengths that does.
5. (Bonus) Do exercise 5.30 in the book.