

# Information Theory

## Spring semester, 2023

### Assignment 5

Assigned: Thursday, April 27, 2023

Due: Friday, May 5, 2023

M. Skoglund

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**Problem 5.1:** Cover & Thomas 8.3 (p. 257). In part (c), change “optional” to “mandatory,” but assume that  $a = 1/m$  for  $m = 2, 3, \dots$

**Problem 5.2:** Cover & Thomas 9.1 (p. 290).

**Problem 5.3:** Cover & Thomas 9.2 (p. 290).

**Problem 5.4:** Cover & Thomas 9.9 (p. 293).

**Problem 5.5:** Consider a set of  $K$  independent Gaussian channels that can be used in parallel. The noise variance on each sub-channel is  $\sigma_k^2 = k^2$ , and the total input power is constrained according to

$$\sum_{k=1}^K P_k/k \leq 5,$$

where  $P_k$  is the input power of sub-channel  $k$ . Find the total capacity, and the optimal power assignment, for the cases  $K = 2$ ,  $K = 4$  and  $K = \infty$ .