

## Rough course outline

1. Tuesday, January 5  
Course preview and summary. Chapter 1.
2. Thursday, January 7. Chapter 2.  
 $H(X), H(X|Y), H(X, Y), I(X; Y)$ . Chain rule.
3. Tuesday, January 12. Chapter 2.  
Information doesn't hurt.  $H(p)$  is concave in  $p$ .  $D(p||r) \geq 0$ . Data processing inequality. Convexity. Jensen's Inequality. Generating randomness.
4. Thursday, January 14.  
Markovity; Data processing inequality. AEP. Data Compression.
5. Tuesday, January 19.  
Geometric Mean. Entropy Rates. AEP.
6. Thursday, January 21.  
Random walk on graph.  $k^{\text{th}}$  order Markov processes.  $D(\mu_n || \mu'_n) \searrow$ .
7. Tuesday, January 26.  
Second law of thermodynamics. Concavity of entropy increase.
8. Thursday, January 28.  
Optimal gambling. Kelly gambling. Entropy and growth rate. Side information and mutual information.
9. Tuesday, February 3.  
Entropy of English.  $(S_n^*)^{1/n} \rightarrow e^{H(X)}$ .
10. Thursday, February 5.  
Data compression. Kraft inequality.  $L_n \rightarrow H(\mathcal{X})$ .
11. Tuesday, February 10.  
Huffman coding. Optimal data compression. McMillan Inequality.
12. Thursday, February 12.  
Kolmogorov complexity.

13. Tuesday, February 17.  
Midterm.
14. Thursday, February 19.  
Channel capacity.
15. Tuesday, February 24.  
Joint AEP.
16. Thursday, February 26.  
Proof of achievability of capacity.
17. Tuesday, March 3.  
Converse.
18. Thursday, March 5.  
Source channel separation.
19. Tuesday, March 10.  
Gaussian channel capacity.