

Boğaziçi University
Department of Physics

Phys 497

Spring 2008

Midterm #1

1 Apr 2008 – 75 minutes

Question 1: (6 pts)

Consider the following variable length coding for the symbols from A through F, and their assigned probabilities:

Symbol	Code	Probability
A	0	0.4
B	10	0.2
C	1100	0.1
D	1101	0.1
E	1110	0.1
F	1111	0.1

- a) What is the average information per symbol? (1 pts)
- b) What is the average code length per symbol? (1 pts)
- c) Code “AABAEFFDC”. What is the code length per symbol for this message? (2 pts)
- d) Decode “110001011111110101101”. What is the code length per symbol for this message? (2 pts)

Question 2: (4 pts)

Consider the following six symbols with the given probabilities:

Symbol	A	B	C	D	E	F
Probability	1/2	1/4	1/16	1/16	1/16	1/16

- a) Find the minimum code length for a fixed length code. (1 pts)
- b) What is the average information per symbol? (1 pts)
- c) Construct a Huffman coding for this set of symbols. (1 pts)
- d) Find the average code length per symbol for the Huffman coding. (1 pts)

Question 3: (6 pts)

Consider a set of eight cards of the same size. Four of them were marked with a marker from “1” to “4”. And, four of them were marked with the same “A” letter, so they are identical in every respect. Then, you are asked to choose one of these cards randomly, but you are not allowed to see it.

- a) How many possible different outcomes can we have? List them. (1 pts)
- b) What are the probabilities of each of these outcomes? (1 pts)
- c) What is the uncertainty of the outcome? (2 pts)
- d) If you are told that “the chosen card does not contain a number”, what is the new uncertainty? How much information did we gain by this statement? (2 pts)

Question 4: (4 pts)

Consider the Hamming code defined as:

b_7	b_6	b_5	b_4	b_3	b_2	b_1
d_3	d_2	d_1	p_2	d_0	p_1	p_0

- a) Construct a block which contains the following data: $d_3d_2d_1d_0 = 1011$ (2 pts)
- b) Does the “1011101” block contain any error. If it does, find its location and correct it. (2 pts)