

Boğaziçi University
Department of Physics

Phys 497

Spring 2008

Problem Set #1
Due in class Thursday, 20 Mar 2008

Problem 1:

Assume that we are dealing with boolean functions with n input variables and 2 output variables. In other words, we have functions like $f(i_n, \dots, i_3, i_2, i_1) = b_2 b_1$.

- a) How many possible functions are there for $n = 1$ boolean variables?
- b) How many possible functions are there for $n = 2$ boolean variables?
- c) How many possible functions are there of n boolean variables?

Problem 2:

Consider that we wish to transmit a text in English which contains only the letters from a to z (26 different letters) and a symbol for white space, thus we have total of 27 different symbols, and the length of the text is exactly 100 symbols.

- a) Assuming we decide to use a fixed-length code such that we transmit the symbols one at a time. What is the number of bits per symbol? How many bits do we need to use to transmit the whole text?
- b) Invent a variable length coding. The only requirement is that the number of total bits/symbol must be optimum for this 100-symbol specific text, but we do not care for any other similar text. Explain it.
- c) How many bits do we need to use to transmit the whole text using the above variable length coding?
- d) If information is measured in bits, how much information does this sequence contain? Which number of bits is correct, if any?

Problem 3:

Compress the following text using LZW compression.

ali topu at tut veli tut al hapi yut

- a) List the 9-bit transmitted codes.
- b) Write down the built dictionary.
- c) What is the compression ratio?