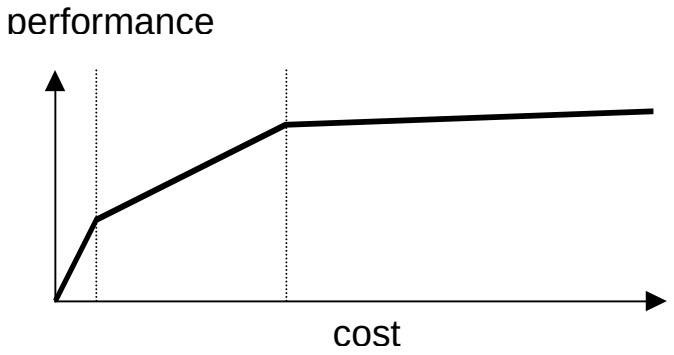
University of California at Berkeley
College of Engineering
Department of Electrical Engineering and Computer Sciences

EECS150 J. Wawrzynek
Spring 2000

Homework #1

This homework is due on **Friday January 28th by noon**. Homework will be accepted in the EECS150 box on the door to room 218 Cory Hall. Late homework will be penalized by 50%. No late homework will be accepted after the solution is handed out.

1. Below is a performance-cost tradeoff curve for a set of implementations for some particular digital system specification. In 50 words or less, discuss the reason for the shape of the curve and the shape of its three regions.



2. Katz, *Contemporary Logic Design,* exercise 1.2.

3. An n-bit gray code is a cyclic sequence of 2^n n-bit numbers where successive numbers differ by exactly one bit. For example, a 2-bit gray code: 00 01 11 10. Note that the sequence is cyclic such that the last number differs from the first by exactly one bit. This code is not unique, and either is any n-bit gray code. For example, another 2-bit gray code: 00 10 11 01. How many unique 3-bit gray codes exist? (consider only sequences starting at 000)

4. Data transmission:

   In this question you are asked to draw signal waveforms for several methods of transmitting multi-bit data as individual bits on wires. A wire's waveform will represent the binary value on the wire at a given position (*e.g.* at the transmititng circuit) as it varies with time (*i.e.* you are graphing a binary value versus time).

Assume that the time slice between signal transitions is 1 second. Assume that each wire is high (value 1) when not in use.

a. Assuming that data is transmitted in byte-sized chunks (1 byte = 8 bits), show the "bit-parallel" waveform(s) for the transmission of the decimal number '125'. Be sure to indicate the MSB and LSB (most significant and least significant bits).

b. Now show the "bit-serial" waveform(s) of the same byte value. Assume that the LSB is sent first.

c. In many cases a "bit-serial" signal is transmitted over long distances. To provide a degree of error control, a parity bit is appended to the end of the transmitted byte. This bit is chosen so as to make the sum of the transmitted data bits (number of 1's in data + parity) to be an even number. In order to be able to transmit a series of bytes over a single wire it is also necessary to prepend a "start" bit and append a "stop" bit (each valued 0) to each data byte. Using the same assumptions as above, show the transmission of the byte '125' immediately followed by '25' with parity, start, and stop bits. (Hint: The order is start, byte, parity, stop, start, byte, parity, stop).

5. Convert the following numbers from base ten to two's complement, one's complement and sign magnitude (use 16 bits for each number). -1011, -32752, 1500