

Fall Semester 2007
 CSCI 2570 - Introduction to Nanocomputing

Assignment 02

Due: Tuesday, September 25, 2007

- To obtain an appreciation for the problems of designing nanowire (NW) decoders, consider the following problem.

The goal is to choose w codewords (NWs) from a set of C codewords at random and with replacement so that the average number of different codewords chosen is close to $0.75w$. If there are duplicates of a given codeword, they count as one codeword. Give a simple formula for the expected number of distinct codewords present as a function of w and C . Estimate the value of C to achieve the goal when $w = 10$.

- In Lecture 4, *Reconfigurable Computing*, FPGAs are introduced. To heighten your awareness of the problems involved in mapping a function to an FPGA as well as give you an appreciation for the use of area, consider mapping the FFT graph to a uniform rectangular grid of cells. (See Figure 1.) The FFT graph on $n = 2^k$ inputs has $(\log_2 n) + 1 = k + 1$ levels of vertices.

Here are the questions. Don't worry about constant factors; it suffices to provide the answers using big-Oh notation.

1. Under the assumption that wires occupy no area, how many cells are needed to embed the vertices of the FFT graph when vertices are mapped to cells in a rectangular array of cells. How deep are the circuits, that is, how many cells does the longest path pass through between an output and an input.
2. When wires have a width equal to the width (and height) of cells, please answer the same two questions.

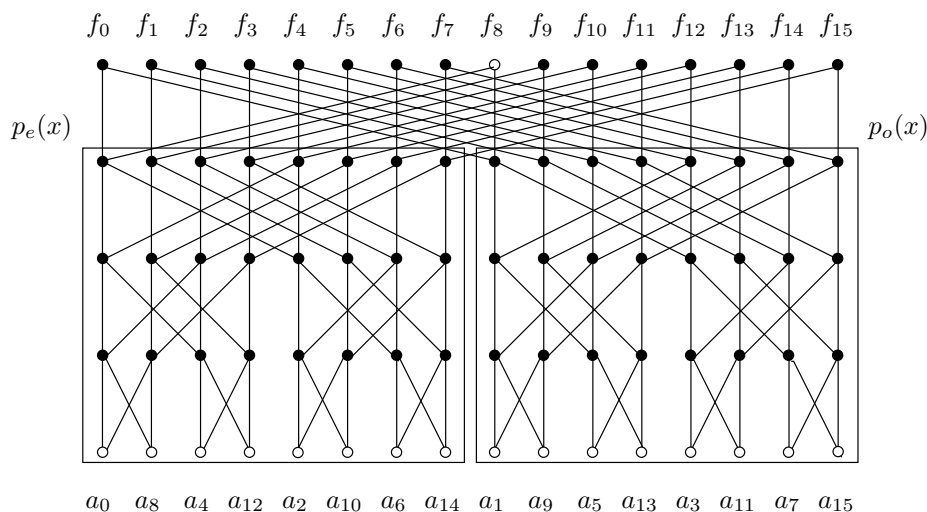


Figure 1: The FFT Graph.