This Homework is a Practice for Buffer Insertion Problem Discussed in Class

1) Explain Why: In Lukas Van Gineken Algorithm for Buffer Insertion, at each node when we combine m and n solution, only O(m+n) are retained (Co-Optimal).

2) Given a wire of length l. Let us suppose that buffers can be added at equidistant positions on this wire. Assuming that wire resistance/unit length = r and capacitance/unit length = c, buffer capacitance = c_buf and resistance = r_buf, derive an analytical expression for the fastest this wire could be made using buffer insertion (you need to derive an expression for the number of buffers that need to be added. Note all buffers are added equidistantly). You must assume that this wire of length l has another buffer (with input pin capacitance c_buf) as the sink.

3) The Buffer Sizing Problem: Given a wiring tree on which buffer insertion has been done so we know exactly where the buffers have been added. The buffer sizing problem chooses a size for each buffer from the library such that the speed of this wiring tree is as fast as possible. Assuming the library has exactly two sizes for the buffer. The parameters for each of these buffers are R_buf1, C_buf1 and R_buf2, C_buf2. Device an algorithm to select the best size for each of the buffers such that the required time at the root of the wiring tree is as high as possible. You can assume that required time at the sinks and other wire parameters are known. Is your algorithm Optimal, Is it polynomial?

4) Can your algorithm in Question 3 be generalized if you have more than two choices for buffer sizes in the library? What can be said about the Optimality and Polynomial Nature of your algorithm?