

1. Exercise 12.11 of the CC Book: Let $f : \{0, 1\}^m \rightarrow \{0, 1\}$ be any function. Show that there is a branching program for f of length m and width 2^m and branching program of width 3 and length $O(m2^m)$.
2. Exercise 12.17 of the CC Book: Consider the element disjointness function, ED, of Example 7.14. Prove that any oblivious branching program for ED requires either $\Omega(m \log m)$ length or exponential width.
3. Exercise 8.5 of the CC Book: Consider a parallel machine where the k processors communicate via a shared memory whose total size is b bits. Each time unit a processor can read an arbitrary number of bits from the shared memory and write an arbitrary number of bits into the shared memory (the values written in time unit t will be read only in time unit $t + 1$). If more than one processor tries to write into the same unit, then conflicts are resolved by assuming that the value written by the lower numbered processor is the value that is actually written into this bit. Denote by $T_b(f)$ the time needed to compute the function f in this model and recall the definition of the measure D^{worst} (Definition 7.1). Prove that $T_b(f) \geq D^{\text{worst}}(f)/b$.