Exercise 4: Fault Frustration

Task 1: I'm Getting Tired of these Delays!

a) Show that the Srikanth-Toueg algorithm has skew at most $d + u$.

b) Show that this skew bound is tight. It suffices to do so for the maximal number of faults $\lceil n/3 \rceil - 1$.

Task 2: Stop Failing and Start Synchronizing!

In this exercise, $3f \geq n$, i.e., there may be "too many" Byzantine nodes.

a) Show that clock synchronization is impossible with this many faults if the constant amortized progress condition is satisfied. (Hint: First "spend" some of the uncertainty and clock drifts to show that logical clocks cannot increase too rapidly. Then argue that any solution would imply a pulse synchronization algorithm.)

b) Show that even with this many faults, there is an algorithm that achieves constant skew and has unbounded logical clocks. You may assume that $\max_{v \in V_g}\{H_v(0)\} \leq H \in \mathbb{R}^+$. (Hint: Solve the problem *without* communication!)

c) Is the solution from b) useful? (Remark: This is an open-ended discussion. There is not necessarily a single right answer.)