Homework Exercise #7
Due: November 19, 2008

7. In this question, we consider shared-memory asynchronous systems where halting failures can occur. If the system has n processes, assume the processes have ids $1, 2, 3, \ldots, n$.

(a) Xin's question: Show that, for all n, consensus can be solved among n processes using only stacks if at most one process may have a halting failure.

(b) Suppose the shared memory consists of a collection $\mathcal{C}$ of shared objects that can solve wait-free consensus among k processes. (Recall that wait-free consensus means that it tolerates any number of halting failures.) Show that $\mathcal{C}$, together with one additional read/write register, can solve consensus among n processes if the number of failures is at most $k - 1$.

(c) Hamoun's question: Consider a "resettable register" object that can store a natural number and is equipped with two operations:

- WRITE(v): changes the state of the object to v and returns *ack*, for any $v \in \mathbb{N}$, and
- READ&RESET: changes the state of the object to 0 and returns the value previously stored in the object.

Assume the resettable register can be initialized with any natural number. What is the consensus number of this object type? Prove your answer is correct.