CSE 6117

## Homework Assignment #5Due: March 2, 2016 at 4:30 p.m.

1. Let  $k \ge 1$ . In the *k*-set consensus problem, each process starts with an integer input value and eventually terminates and outputs an integer value. The following two conditions must be satisfied:

Validity: Every output value is the input value of some process.

k-Agreement: The number of different output values is at most k.

Note that 1-set agreement is just ordinary consensus.

The following synchronous algorithm for a complete network is a generalization of the one given in class for consensus (notice that the two are very similar when k = 1).

```
Set-AGREE(input : \mathbb{N})
1
         pref \leftarrow input
2
         for i \leftarrow 1 \dots \left| \frac{f}{k} \right| + 1
3
              send a message containing pref to all processes including self
4
              pref \leftarrow minimum value received in this round
5
         end for
6
         return pref
7
    end SET-AGREE
8
```

Show that this algorithm solves k-set consensus in a synchronous message-passing system where up to f halting failures can occur (f < n).

Hint: Let  $P_i$  be the set of values in the *pref* variables of all the live processes at the end of round *i*. How is  $P_i$  related to  $P_{i-1}$ ? How big can  $P_i$  be if  $f_i$  processes fail during round *i*?