

# CS 5800 Distributed OS - Spring 2017

## Homework 5

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**Problem 1** Suppose there are  $k$  traitors among  $n$  generals, calculate the number of messages sent by a lieutenant under the Lamports algorithm.

If there are  $k$  traitors and  $n$  generals, then the message complexity will be bounded by  $O(n^{k+1})$  with an exact count of messages sent being:

$$\sum_{i=1}^{k+1} \frac{(n-1)!}{(n-1-i)!}$$

This is because, for the first row, or stage,  $(n-1)$  messages are sent, as seen in question 2. In the second row,  $(n-1) * (n-2)$  messages are sent. This pattern continues until the  $k^{th} + 1$  row, which is:  $(n-1) * (n-2) \dots (n-(k+1))$ . To get total message complexity, we must sum all of these stages, which results in the aforementioned equation.