We discuss the following two problems:

1. We generalize the traditional ballot box problem of finding the probability that in a two-candidate election that the winner was never behind during the counting of the votes. We assume that voters cast their votes following a finite birth-death chain with constant transition probabilities $a$, $b$ and $c$.

2. When certain types of finite birth-death chains are redefined to include generalized catastrophe probabilities, the eigenvalues and transition probability functions of the newly created (non birth-death) Markov chains may be determined.

For each problem, we make use of the Cayley-Hamilton formulation of the $k$th power of an $n \times n$ real matrix, $M$, that has $n$ distinct eigenvalues. This is also called Sylvester’s matrix theorem. We also reference two articles of S. Kouachi concerning eigenvalues of certain tridiagonal matrices. (Received September 01, 2019)