Homework Problem 4.3

(a) Suppose you make a von Neumann measurement of the spin component of a spin-1/2 particle along one of the three Cartesian axes, tossing a fair three-sided die to determine which of the three measurements to make. *Determine* the Kraus operators, quantum operations, and POVM elements for this six-outcome measurement.

(b) Suppose now that all you know after the measurement of part (a) is whether the the result is $+1$ or -1 , but not which axis was used. *Determine* the Kraus operators, quantum operations, and POVM elements for this two-outcome measurement. This is a model of a very noisy measurement, the noise a consequence of not knowing how the measuring apparatus is oriented.

(c) *Find* at least one other pair of quantum operations that corresponds to the POVM of part (b).