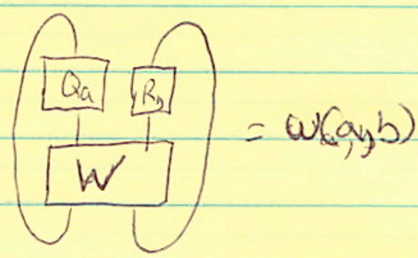
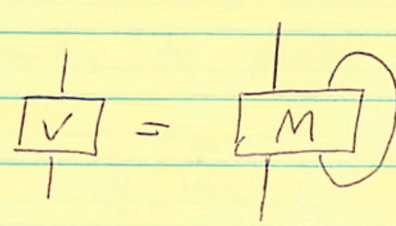
Let's begin with the statement that there is a linear functional W on $H \otimes H$ such that $\mathrm{tr}((Q_a \otimes R_b) W) = \omega(a,b)$, the joint probability of measuring outcome a on Alice's side and b on Bob's side.

As a tensor network picture we have:

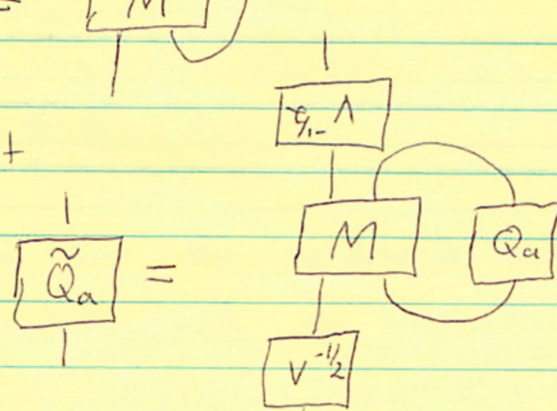


Our goal is to be able to show that by possibly changing the measurements, we can have a similar equation with the added condition that W is a density matrix and hence the system can be modeled as quantum.

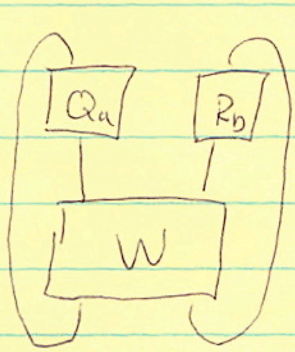
To do this we define V:

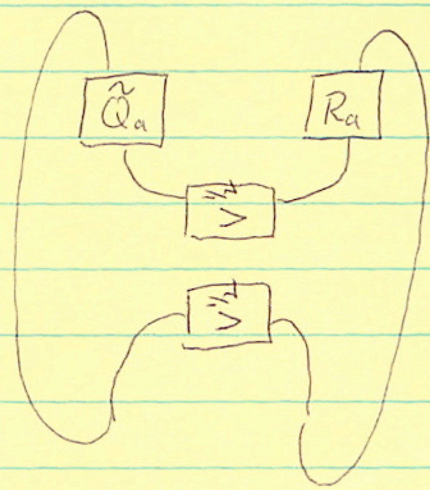


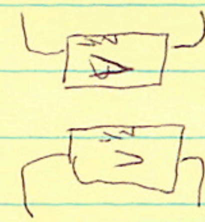
and set



It follows by plugging in these pictures that

$w(a,b) =$ 

$=$ 

which is what we want since  is

the density matrix associated to the projection onto the pure state 

It remains to verify that $\tilde{Q}_a$ is a measurement: i.e.

① $\tilde{Q}_a$ is positive.

② $\sum_a \tilde{Q}_a = 1$.

The former (1) is just the condition that W is positive on tensor products and the latter (2) is ensured by the definition of V.