

Fall 2012 QIC 890 / CO 781 Assignment 3

Due Oct 04, 2012 (in class)

Question 1. Quantum mutual information and quantum relative entropy [8 marks]

Show that $S(A : B)_\rho = S(\rho \parallel \rho_A \otimes \rho_B)$. A proof sketch is given in class and you should work out the details.

Question 2. Accessible information [12 marks]

Consider the ensemble $\mathcal{E}_2 = \{p(x), \rho_x\}_{x=0}^2$,

where $p(x) = 1/3$ for $x = 0, 1, 2$, $\rho_x = |\psi_x\rangle\langle\psi_x|^{\otimes 2}$,

$$|\psi_0\rangle = |0\rangle, |\psi_1\rangle = \cos(\pi/3)|0\rangle + \sin(\pi/3)|1\rangle, |\psi_2\rangle = \cos(2\pi/3)|0\rangle + \sin(2\pi/3)|1\rangle,$$

(Note: \mathcal{E}_2 is as defined in class.)

Calculate the mutual information between X and the measurement outcome Y for the two measurements \mathcal{M}_2 and \mathcal{M}_3 as defined in class.