1.4 Consider two binary random variables, X and Y, and the probability distribution that is symmetric under interchange of the variables and interchange of the binary values,

$$p_{X,Y}(0,0) = p_{X,Y}(1,1) = p/2 \qquad \text{and} \qquad p_{X,Y}(0,1) = p_{X,Y}(1,0) = q/2 \,,$$

where $p + q = 1$.

(a) *Find* the marginal and conditional probabilities for X and Y.

(b) *Find* all the Shannon information quantities for the two variables, *draw* a Venn diagram for these quantities, and *interpret* your results.