Problem 1. Toss a fair coin twice and let $X$ be the number of Heads, and let $Y = 1$ if the first toss is Tails, $Y = 0$ otherwise. Find: (i) the distribution of $X$; (ii) the distribution of $Y$; (iii) $E_X$; (iv) $E_Y$; (v) $\text{Var} X$; (vi) $\text{Var} Y$; (vii) $\text{Cov}(X, Y)$; (viii) $P(X = 2 \mid Y = 0)$. 