$$P_{e}(X \mid Y) \ge 1 - \frac{n(n-1) - (n-2) \exp(H_{1/2}(X \mid Y)) + 2\sqrt{\exp(H_{1/2}(X \mid Y))(n-1)(n-\exp(H_{1/2}(X \mid Y)))}}{n^{2}}$$

$$P_{e}(X \mid Y) \ge 1 - \frac{1 + \sqrt{\exp(-H_{2}(X \mid Y))(n-1)(n-\exp(H_{2}(X \mid Y)))}}{n^{2}}$$