1. Consider a tray with 8 lemonades and 3 raspberry juices. Alice and Bob each take 1 drink from the tray, without replacement. Assume that all of their choices are equally likely. Let $X$ be the number of lemonades that Alice and Bob get. (Note: $X$ is either 0, 1, or 2.) Find the variance of $X$. 
2. In question #1, let $X_1$ and $X_2$ indicate (respectively) if Alice and Bob (respectively) get lemonade. In other words, $X_1 = 1$ if Alice gets lemonade, or $X_1 = 0$ otherwise; and $X_2 = 1$ if Bob gets lemonade, or $X_2 = 0$ otherwise.

Find the correlation $\rho(X_1, X_2)$ between $X_1$ and $X_2$. 
3a. For the $X, Y$ in question #1 of Problem Set 35, in which Jim cuts wood, and $Y = 2X + 2$, find Cov$(X,Y)$, i.e., the covariance of $X$ and $Y$.

b. Find the correlation $\rho(X,Y)$ of $X$ and $Y$. 
4a. For the $X, Y$ in question #3 of Problem Set 35, in which $Y = (X - 1)(X + 1) = X^2 - 1$, find $\text{Cov}(X, Y)$, i.e., the covariance of $X$ and $Y$.

b. Find the correlation $\rho(X, Y)$ of $X$ and $Y$. 
5. Roll two 4-sided dice (not 6-sided dice). Let $X$ be the minimum value, and let $Y$ be the maximum value. Find the covariance of $X$ and $Y$. 
6. **Design your own problem and solution.** Create your own problem about the correlation of two discrete or continuous random variables. Design your problem in such a way that you would find it enjoyable and also interesting (i.e., not completely trivial) if you found this problem in a probability book. Please provide the answer for your problem too.