Solutions for quiz 3

1. The random variable $X$ can take values $0,1,2$. The probability masses at these points are

$$P(X = 0) = \frac{\binom{9}{2}}{12} = \frac{36}{66}$$

$$P(X = 1) = \frac{\binom{3}{1} \binom{9}{1}}{12} = \frac{27}{66}$$

$$P(X = 2) = \frac{\binom{3}{2}}{12} = \frac{3}{66}$$

2. (a) Define these events:
   A: Company A makes a profit
   B: Company B makes a profit
   \[ P(A) = .9, \quad P(B) = .8, \quad P(A \cup B) = P(\overline{B}) = .05 \]
   \[ P(A \cap B) = P(A) + P(B) - P(A \cup B) = .9 + .8 - .95 = .75 \]

   (b) Compare the two conditional probabilities $P(B|A)$ and $P(B|\overline{A})$:
   \[ P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{.75}{.9} \approx .83 \]
   \[ P(B|\overline{A}) = \frac{P(\overline{A} \cap B)}{P(\overline{A})} = \frac{P(B) - P(A \cap B)}{1 - P(\overline{A})} = \frac{.8 - .75}{.1} = .5 \]

   Company B is more likely to make a profit if company A makes a profit.