Review session today 4:30 Sieg 134

Joint distribution:

\[ X, Y, Z \]

Joint prob mass fn

\[ P_{XY}(x, y) = \Pr(X = x, Y = y) \]

\[ \sum_{x \in X} \sum_{y \in Y} P_{XY}(x, y) = 1 \]

Joint Cumulative Distn. Fn

\[ F_{XY}(x, y) = \Pr(X \leq x, Y \leq y) = \sum_{a \leq x} \sum_{b \leq y} P_{XY}(a, b) \]

100 random voters

\[ \begin{array}{ccc}
R & D & L \\
\text{prob} & P_R & P_D & P_L & P_R + P_D + P_L = 1 \\
XD & \# \text{ voters for democrats} & \\
XR & \# \text{ republicans} & \\
\end{array} \]

\[ P_{XD \times XR}(d, r) = \Pr(X_D = d, X_R = r) = \frac{n!}{d! \cdot (n-d)!} \cdot \frac{d}{100} \cdot \frac{r}{100} \cdot \frac{100 - d - r}{100} \cdot \frac{P_D}{P_D + P_R + P_L} \]

\[ \frac{d}{P_D} \cdot \frac{r}{P_R} \cdot \frac{100 - d - r}{P_L} \]
Random vars $X$ and $Y$ are independent

$$P_{XY}(x,y) = P_X(x)P_Y(y) \quad \forall x, y$$

$$Pr(X=x, Y=y) = Pr(X=x)Pr(Y=y)$$

For any function $g$ of 2 vars,

$$E(g(X,Y)) = \sum_{(x,y) \in \mathcal{X} \times \mathcal{Y}} g(x,y)P_{XY}(x,y)$$

$$g(x,y) = x^2 - 3y$$
Bag with $N$ candies (r types)

\[ \sum_{i=1}^{r} k_i = N \]

Reach into bag and draw $n$ candies without replacement.

$X_i$: # of candies of type $i$ drawn

\[ P(X_1 = x_1, X_2 = x_2, \ldots, X_r = x_r) \]

\[ = \frac{(k_1^x_1)(k_2^x_2)\cdots(k_r^x_r)}{N^n} \]