DIS 10A

MULTIPLE RANDOM VARIABLES

the joint distribution of RVs X and Y is

$$P(X=a, Y=b)$$

$X=a$ and $Y=b$

the marginal distribution of a RV can be obtained from the joint by summing the other RVs

marginal of X: $$P(X=a) = \sum_b P(X=a, Y=b)$$

marginal of Y: $$P(Y=b) = \sum_a P(X=a, Y=b)$$

revisiting independence: X and Y independent iff

$$P(X=a, Y=b) = P(X=a)P(Y=b) \quad \forall a, b$$

EXPECTATION

$$E[X] = \sum_{a \in A} a \times P(X=a)$$

weighting possible values of X by their probability

LINEARITY OF EXPECTATION

$$E[X+Y] = E[X] + E[Y]$$

$$E[cX] = c\,E[X]$$ ← constant c

very powerful! no assumptions about variables X and Y needed a useful identity...

LAW OF THE UNCONSCIOUS STATISTICIAN (LOTUS)

$$E[f(X)] = \sum_{x} f(x) P(X=x)$$

we often use

$$E[X^2] = \sum_{x} x^2 P(X=x)$$