CS440  1/28/10

Gaussians, Mean, Variance

Mean → Random Variable

Sample

$X \sim N(\mu, \sigma^2)$

$X = \text{position of a pen on floor}$

3, -1, 0, -0.5

Mean of Samples $= \frac{1}{4} \cdot (3 + (-1) + 0 + (-0.5))$

$= \frac{3}{8}$

Variance → Random Var

Sample

$\text{Discrete} \rightarrow \frac{1}{n} \cdot \sum_{i=1}^{n} p(x_i)$

$\text{Continuous} \rightarrow \int_{\text{Dom}(x)} p(x) \cdot \text{d}x$
Variance \( (X) \) = \( \frac{1}{n} \sum_{i=1}^{n} (X_i - \mu)^2 \)  
\( \mu = E(X) \) = mean of RV \( X \).

Variance \( (X_i - \bar{X}) \) = \( \frac{1}{m} \sum_{i=1}^{m} (X_i - \bar{X})^2 \)

\( \bar{X} = \frac{1}{m} \sum_{i=1}^{m} X_i \)  
mean of Sample

Estimate Variance of \( X \) from sample set \( X_1 \ldots X_m \)

\[ \Rightarrow \frac{1}{m-1} \sum_{i=1}^{m} (X_i - \bar{X})^2 \]
Mathematical proof that

\[ A \land B = A \]

Every model of \( A \land B \) is a model of \( A \).

**pf:**

Truth table. \( A, B \) prop vars.

\[
\begin{array}{c|c|c}
A & B & A \land B \\
\hline
T & T & T \\
T & F & F \\
F & T & F \\
F & F & F \\
\end{array}
\]

Let \( M \) be a model of \( A \land B \).

Then \( \ldots M \models A \).

\( M \) is a model of \( A \land B \) \( \Rightarrow \) \( (A \land B)[M] = TRUE \)

\( \Rightarrow A[M] = TRUE \)

Follow def. & evaluate at formula in truth assignment.