

## Slides Week 38

### Hierarchical Models and Mixture Distributions

$$X|Y \sim B(Y, p)$$

$$Y|\Lambda \sim \text{Po}(\Lambda)$$

$$\Lambda \sim \exp(\beta)$$

$$E[X] = E[E[X|Y]]$$

$$\text{Var}[X] = E[\text{Var}[X|Y]] + \text{Var}[E[X|Y]]$$

### Holders Inequality

$$|E[XY]| \leq E|XY| \leq \left(E|X|^p\right)^{\frac{1}{p}} \left(E|X|^q\right)^{\frac{1}{q}}, \quad \frac{1}{p} + \frac{1}{q} = 1$$

### Jensen's Inequality

$$E[g(X)] \geq g(E[X]), \quad g(x) \text{ convex}$$

### Chapter 5 Random Sample

Random sample:  $X_1, \dots, X_n$  are iid.

Statistic:  $T(X_1, \dots, X_n)$