STAT 333

Day 1

Basic Review

Conditional probability:

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$
$$P(A \cap B) = P(A|B)P(B)$$

Law of total probability:

$$P(A) = \sum_{i=1}^{n} P(A|B_i)P(B_i)$$

Baye's Rule:

$$P(B|A) = \frac{P(A|B)P(B)}{P(A)}$$

Example 1.2

> Show that when n is large and p is small, the $BIN(n,p)$ distribution may be approximated by a $POI(\lambda)$ distribution where $\lambda = np$.

$$\lim_{n\to\infty}\lim_{p\to 0} BIN(n,p)$$
$$= \lim_{n\to\infty}\lim_{p\to 0} \binom{n}{x}(p)^x(1-p)^{n-x}$$
$$= \lim_{n\to\infty}\lim_{p\to 0} \frac{n(n-1)\dots(n-x+1)}{x!}(\frac{\lambda}{n})^x(1-\frac{\lambda}{n})^{n-x}$$
$$= \lim_{n\to\infty}\lim_{p\to 0} \frac{n(n-1)\dots(n-x+1)}{n^x}\frac{\lambda^x}{x!}\frac{(1-\frac{\lambda}{n})^n}{(1-\frac{\lambda}{n})^x}$$
$$= \frac{\lambda^x}{x!}e^{-\lambda}$$
$$\lambda = np \implies \lim_{n\to\infty}\lim_{p\to 0} BIN(n,p) = POI(\lambda)$$

Day 2