Solutions to HW3

#1 (Problem reloads with different numbers)

BAG A	BAG B	BAG C
n_A apples	n_B apples	n_C apples
m_A oranges	m_B oranges	m_C oranges
(n_A+m_A fruits)	(n_B+m_B fruits)	(n_C+m_C fruits)

$$P(\underbrace{\text{Pick an apple from } A}_{\text{"Apple A"}}) = \frac{n_A}{n_A+m_A}$$

$$P(\underbrace{\text{Pick an orange from } A}_{\text{"Orange A"}}) = \frac{m_A}{n_A+m_A}$$

similarly for bags B and C

a) In order to pick <u>exactly</u> 2 apples total, either one of the following must happen:

$$\left.\begin{aligned} P(2 \text{ Apples}) = {} & P(\text{Apple } A \cap \text{Apple } B \cap \text{Orange } C) \\ & + P(\text{Apple } A \cap \text{Orange } B \cap \text{Apple } C) \\ & + P(\text{Orange } A \cap \text{Apple } B \cap \text{Apple } C) \end{aligned}\right\} \text{mutually disjoint events!}$$

$$= \frac{n_A}{n_A+m_A}\cdot\frac{n_B}{n_B+m_B}\cdot\frac{m_C}{n_C+m_C} + \frac{n_A}{n_A+m_A}\cdot\frac{m_B}{n_B+m_B}\cdot\frac{n_C}{n_C+m_C} + \frac{m_A}{n_A+m_A}\cdot\frac{n_B}{n_B+m_B}\cdot\frac{n_C}{n_C+m_C}.$$

b) ← The quantities $n_A, n_B, n_C, m_A, m_B, m_C$ have the same meaning from a), but the numeric values might be different on Blackboard!

$$P(\text{Apple } A \mid 2 \text{ Apples}) = \frac{P(\text{Apple } A \cap 2 \text{ Apples})}{P(2 \text{ Apples})}$$

$$= \frac{P(\text{Apple } A \cap \text{Apple } B \cap \text{Orange } C) + P(\text{Apple } A \cap \text{Orange } B \cap \text{Apple } C)}{P(2 \text{ Apples})}$$

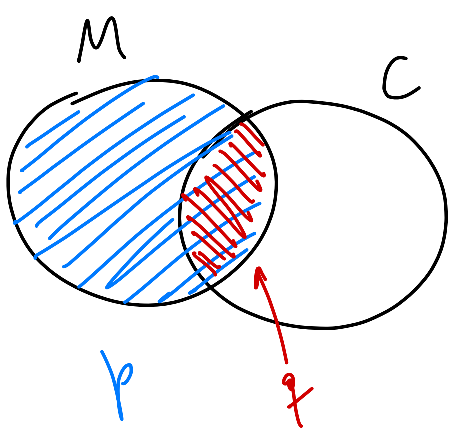
from a)

$$= \frac{\frac{n_A}{n_A+m_A}\cdot\frac{n_B}{n_B+m_B}\cdot\frac{m_C}{n_C+m_C} + \frac{n_A}{n_A+m_A}\cdot\frac{m_B}{n_B+m_B}\cdot\frac{n_C}{n_C+m_C}}{\frac{n_A}{n_A+m_A}\cdot\frac{n_B}{n_B+m_B}\cdot\frac{m_C}{n_C+m_C} + \frac{n_A}{n_A+m_A}\cdot\frac{m_B}{n_B+m_B}\cdot\frac{n_C}{n_C+m_C} + \frac{m_A}{n_A+m_A}\cdot\frac{n_B}{n_B+m_B}\cdot\frac{n_C}{n_C+m_C}}$$

#2 M = migrate south

C = need to consume at least 800 cal/day to survive.

$P(M) = p$, $P(CM) = q$ $P(C^c \mid M) = ?$



$$P(C^c \mid M) = 1 - P(C \mid M)$$

$$= 1 - \frac{P(CM)}{P(M)}$$

$$= \boxed{1 - \frac{q}{p}}$$