Course 3

conditional probability条件概率

$P(A|B) = ?$, B is the condition of this total event

$P(A) = \frac{N(A)}{N(S)}$

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

$P(A|B) \neq P(B|A)$

$P(A\cup B\cup C) = P(A) + P(B) + P(C) - P(A\cap B) - P(A\cap C) - P(B\cap C) - P(A\cap B\cap C)$

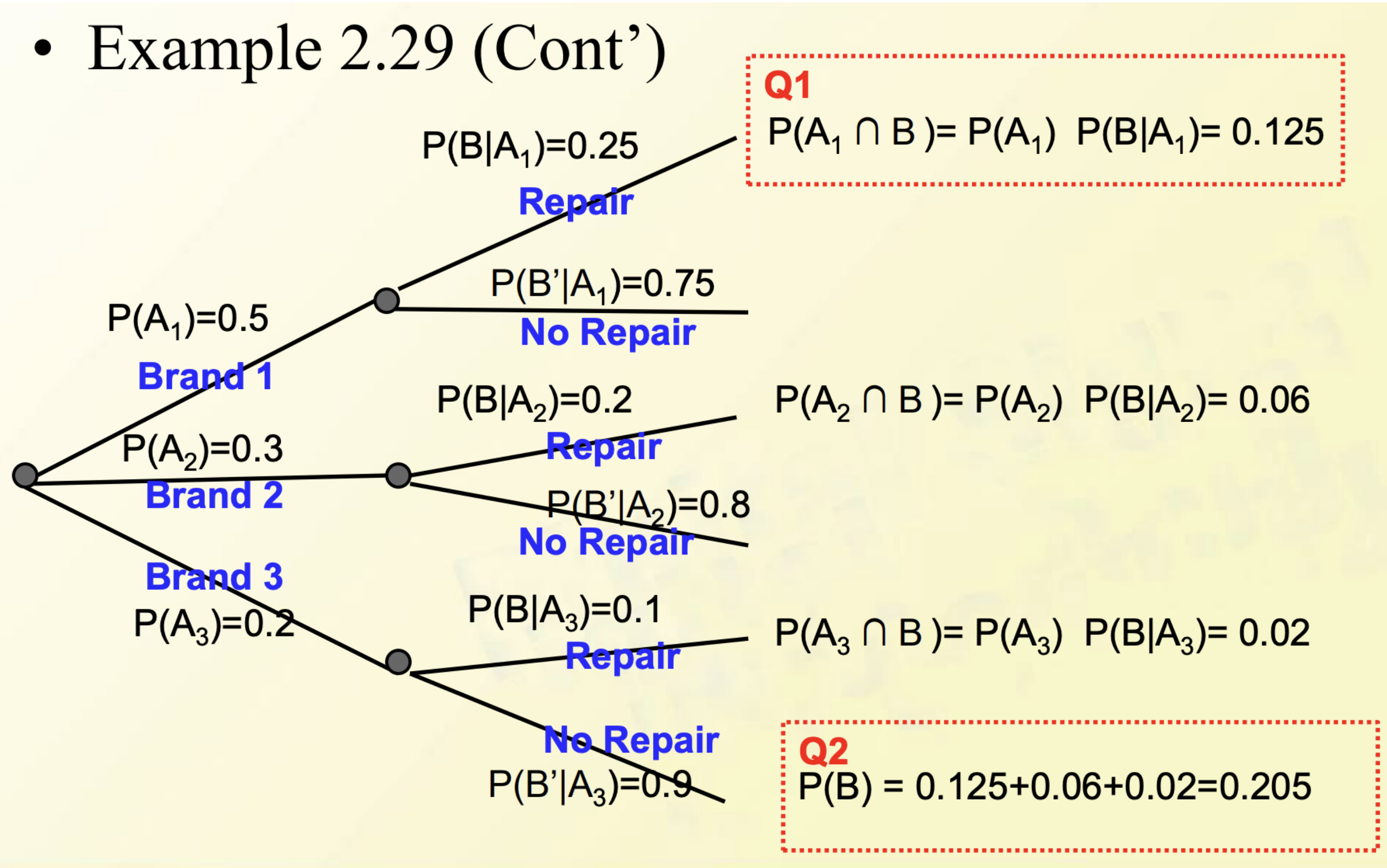
解复杂的条件概率题目时画Venn Graph解决会方便许多 *（光展开能展开到发疯）*

multiplication rule乘法律

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

therefore, $P(A_1\cap A_2\cap A_3) = P(A_3|A_1\cap A_2)\times P(A_1\cap A_2)$

probability tree概率树



解题前要画出来

the law of total probability(2D-case)

- $A\cup A' = S$
- $A\cap A' = \emptyset$
- $P(B) = P(B\cap A) + P(B\cap A') = P(B|A)\times P(A) + P(B|A')\times P(A')$

Bayes'Theorem贝叶斯定理: Let $A_1, A_2, \ldots, A_k$ be a collection of k mutually exclusive and exhaustive events with $P(A) > 0$ for $i = 1, \ldots, k$, then for any other event B for which $P(B) > 0$

令 $A_1, A_2, \ldots, A_k$ 为k个互斥且详尽的事件的集合，对于 $i = 1, \ldots, k$，$P(A) > 0$，然后对于任何其他事件B其中$P(B) > 0$，有：

$$P(A_j|B) = \frac{P(A_j \cap B)}{P(B)} = \frac{P(A_j)P(B|A_j)}{P(B)} = \frac{P(A_j)P(B|A_j)}{\sum_{i=1}^{k} P(A_i)P(B|A_i)} \quad j = 1, 2, \ldots, k$$

Homework

Section 2.4 46, 50, 58, 53