업데이터 통계학 스터디: ASSIGNMENT 1 Key

1. The probability that 'MIT' will conduct a joint research about Computer science with 'Korea University' is 0.7. The probability that it will conduct a joint research about CS with 'Yonsei University' is 0.4. and the probability that it will conduct a joint research with either KU or YU or Both is 0.8.

What is the probability that 'MIT' will conduct a joint research with both universities? 0.3

A: KU - MIT Joint research.

B: YU - MIT Joint research

$\rightarrow$ $P(A) = 0.7$, $P(B) = 0.4$, $P(A \cup B) = 0.8$

$$\therefore P(A \cap B) = P(A) + P(B) - P(A \cup B) = \underline{0.3}$$

2. It is common in many industrial areas to use a filling machine to fill boxes full of product. This occurs in the food industry as well as other areas in which the product is used in the home, for example, detergent. These machines are not perfect, and indeed they may A, fill to specification, B, underfill, and C, overfill. Generally, the practice of underfilling is that which one hopes to avoid. Let P(B) = 0.001 while P(A) = 0.990.

(a) Give P(C). 0.009

(b) What is the probability that the machine does not underfill? 0.999

(c) What is the probability that the machine either overfills or underfills? 0.01

(a) $P(C) = 1 - \{P(A) + P(B)\} = 1 - (0.991) = \underline{0.009}$

(b) $P(B^c) = 1 - P(B) = \underline{0.999}$

(c) $P(B) + P(C) = 0.001 + 0.009 = \underline{0.01}$

3. The probability that a married man watches a certain television show is 0.4, and the probability that a married woman watches the show is 0.5. The probability that a man watches the show, given that his wife does, is 0.7. Find the probability that

(a) a married couple watches the show; 0.35

(b) a wife watches the show, given that her husband does; 0.875

(c) at least one member of a married couple will watch the show. 0.55

H : Husband watches a certain television show.

W : Wife watches a certain television show.

$\rightarrow P(H|W) = 0.7, \quad P(H) = 0.4, \quad P(W) = 0.5$

(a) $P(H \cap W) = P(H)P(W|H) = P(W)P(H|W) = 0.5 \times 0.7 = \underline{0.35}$

(b) $P(W|H) = \dfrac{P(H \cap W)}{P(H)} = \dfrac{0.35}{0.4} = \underline{0.875}$

(c) $P(H \cup W) = P(H) + P(W) - P(H \cap W) = 0.4 + 0.5 - 0.35 = \underline{0.55}$

4. The probability that a doctor correctly diagnoses a particular illness is 0.7. Given that the doctor makes an incorrect diagnosis, the probability that the patient files a lawsuit is 0.9. What is the probability that the doctor makes an incorrect diagnosis and the patient sues? 0.27

A : Doctor correctly diagnoses a particular illness

B : Patient files a lawsuit

$P(A) = 0.7, \quad P(B|A^c) = 0.9$

$P(A^c \cap B) = P(A^c)P(B|A^c) = 0.3 \times 0.9 = \underline{0.27}$

5. A town has two fire engines operating independently. The probability that a specific engine is available when needed is 0.96.

(a) What is the probability that neither is available when needed? 0.0016

(b) What is the probability that a fire engine is available when needed? 0.9984

A and B : Each fire engine's operation (mutually independent)

(a) $P(A^c \cap B^c) = P(A^c)P(B^c) = (0.04)^2 = \underline{0.0016}$

(b) $P(A \cup B) = 1 - P(A^c \cap B^c) = \underline{0.9984}$

6. In a certain region of the country it is known from past experience that the probability of selecting an adult over 40 years of age with cancer is 0.05. If the probability of a doctor correctly diagnosing a person with cancer as having the disease is 0.78 and the probability of incorrectly diagnosing a person without cancer as having the disease is 0.06, what is the probability that an adult over 40 years of age is diagnosed as having cancer? 0.096

C: Adult has a cancer.

D: Adult diagnosed a cancer correctly.

$P(C) = 0.05$, $P(D|C) = 0.78$, $P(C^c) = 0.95$, $P(D|C^c) = 0.06$

$$\therefore P(D) = P(C \cap D) + P(C^c \cap D)$$

$$= P(C)P(D|C) + P(C^c)P(D|C^c)$$

$$= \underline{0.096}$$

7. A paint-store chain produces and sells latex and semigloss paint. Based on long-range sales, the probability that a customer will purchase latex paint is 0.75. Of those that purchase latex paint, 60% also purchase rollers. But only 30% of semigloss paint buyers purchase rollers. A randomly selected buyer purchases a roller and a can of paint. What is the probability that the paint is latex? $\underline{0.857}$

A: Customer purchase a latex paint. $P(A) = 0.75$

B: Customer Purchase a roller. $P(B|A) = 0.6$, $P(B|A^c) = 0.3$

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

$$= \frac{P(A\cap B)}{P(A\cap B) + P(A^c\cap B)}$$

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

$$= \frac{0.75\times 0.6}{0.75\times 0.6 + 0.25\times 0.3}$$

$$= \frac{0.45}{0.525} \approx \underline{0.857}$$