

2.8

Multiplicative Law of probability[THEOREM]

$$P(AB) = P(A)P(B|A) = P(B)P(A|B) \quad (A, B \text{ 가 독립일 때})$$

$$P(AB) = P(A)P(B) \quad (A, B \text{ 가 독립일 때})$$

Additive Law of probability[THEOREM]

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

PROOF $P(A \cup B) = P(A) + P(\bar{A} \cap B) (\because \text{disjoint}) = P(A) + P(B) - P(AB)$

THEOREM $P(\bar{A}) = 1 - P(A)$ (**PROOF:** $P(S) = P(A \cup \bar{A})$)



EXAMPLE 2-17

$$P(A) = P(AB) + P(A\bar{B}) \quad (A, B \text{ 가 독립일 때})$$

$$P(\bar{A}, \bar{B}) = 1 - P(A \cup B)$$

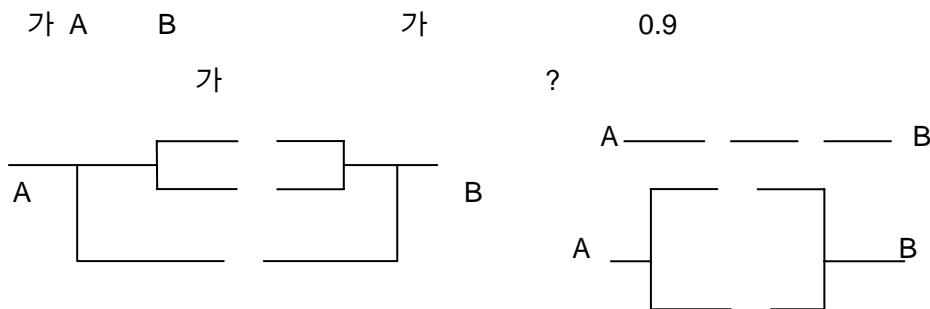


EXAMPLE 2-18

$$P(A, B \text{ 가 독립일 때}) \quad (1)P(A \cup B) \quad (2)P(\bar{A} \cap \bar{B}) \quad (3)P(\bar{A} \cup \bar{B})$$



EXAMPLE 2-19

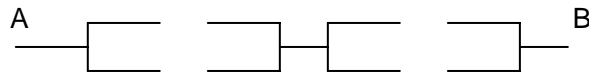
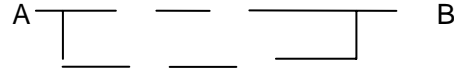
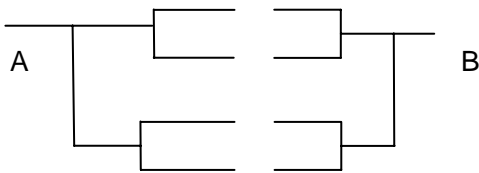




HOMEWORK #3-3

DUE 3 17 ()

가 A B 가 0.9
 가 ?



HOMEWORK #3-4

DUE 3 17 ()

$P(A \cup B | C) = P(A | C) + P(B | C) - P(AB | C)$ when $P(C) > 0$.

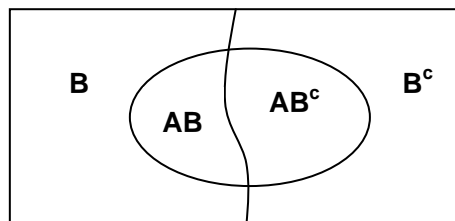
Additive Law in conditional PROB

2.9 (Bayes's Rule)

2.9.1 (Event decomposition)

(union) (intersection)
 A가 B Venn Diagram B
 S 2 . A (AB, AB^C) disjoint

$A = AB + AB^C$





EXAMPLE 2-20

40% , 60% 가 70% A A ?
40% . A ?



EXAMPLE 2-21

(2)

A p 가 r-



EXAMPLE 2-22

(3)

3 가 .
0.02 .
(1) 가 ,
(2) 가 ,



HOMEWORK #3-5

DUE 3 17 ()

7 3



HOMEWORK #3-6

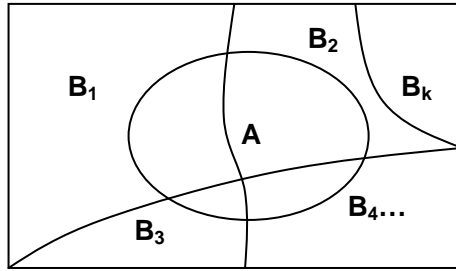
DUE 3 17 ()

가 .
10% 95% .
가 .
가 .

2.9.2 (Law of total probability)

$$S = \bigcup_{n=1}^k B_n, \quad B_i B_j = \emptyset \text{ for } i \neq j \quad P(B_j) > 0 \quad \text{가} \quad . \quad A$$


$$P(A) = \sum_{n=1}^k P(AB_n) = \sum_{n=1}^k P(B_n)P(A|B_n) \quad (\text{PROOF: obvious})$$



2.9.3 (Bayes's rule)


$$S = \bigcup_{n=1}^k B_n, \quad B_i B_j = \emptyset \text{ for } i \neq j \quad P(B_j) > 0 \quad \text{가}$$

$$P(B_j | A) = \frac{P(B_j)P(A|B_j)}{\sum_{n=1}^k P(B_n)P(A|B_n)} \quad (\text{PROOF: obvious})$$

 **EXAMPLE 2-23**

A 35% , 65% . 8%.

5% . 가? (tree diagram)

 **EXAMPLE 2-24**

5 , 6 가 . 2 .



EXAMPLE 2-25

(2)

3가 . , . 60% , 30% ,
 10% . 60% 50%,
 90% .
 (1) 가 .
 (2) .



HOMEWORK #4-1

DUE 3 22 ()

10 1 . 가 가 가
 가?



HOMEWORK #4-2

DUE 3 22 ()

30% . 가
 가 70% 가 가
 10% . 가 . 가

2.10 (Random variable)

DEFINITION

(random variable) X (domain)

. $X : S \rightarrow R$. X $A = \{x : x = X(w), w \in S\}$.

$P(X \in A) = P_X(A) = P(C)$, $C = \{w : w \in S \text{ and } X(w) \in A\}$ () .



EXAMPLE 2-24

X . X ?



EXAMPLE 2-24

(diameter) 4~4.5 . X X
 . 4.41π .