ECON STAT-1 Lecture NOTES | CHAPTER: 4

PROBABILITY - Basic Definitions

* S: Sample Space: Olabilecek tüm durumların kümesi

A: Event: Sample Space'in herhangi bir alt kümesi

$\boxed{A \subset S}$

P(A): Probability of Event A

Impossible Event. $\leftarrow 0 \leq P(A) \leq 1 \rightarrow$ Certain Event

* What is Probability?
Probability gives us the "likelihood" of an event.
Formally, probability of an event is the long-run fraction of the occurance of that event

In General;

$$\boxed{\text{Olasılık} = \frac{\text{Olayın gerçekleştiği durumlar}}{\text{Tüm durumlar.}}}$$

* If elements of sample space are "equally likely";

$$\boxed{P(A) = \frac{n(A)}{n(S)}}$$

Then, the more elements event A has, the probability of event A gets closer to 1.

What do we mean by "The probability that I'll pass the lecture is 30%."? We mean, 3 out of 10 such lectures, I had succeeded to pass.

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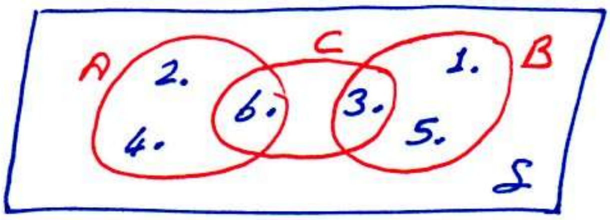
Ex: Let a fair die is tossed. Also let the following events are defined. A: Outcome is even, B: Outcome is odd, C: Outcome is multiple of 3. Then we have;

$$S = \{1, 2, 3, 4, 5, 6\}$$

$$A = \{2, 4, 6\} \qquad B = \{1, 3, 5\} \qquad C = \{3, 6\}$$



$$P(A) = \frac{3}{6}\ ; \quad P(B) = \frac{3}{6}\ ; \quad P(C) = \frac{2}{6}\ ; \quad P(S) = 1$$

Union and intersection of Events;

Union: $\cup$ means "OR": At least one of the events.

Intersection: $\cap$ means "AND": Two events together

Then; P(Even OR Multiple of 3) — Because it is counted twice

$$= \boxed{P(A \cup C) = P(A) + P(C) - P(A \cap C)}$$

$$= \frac{3}{6} + \frac{2}{6} - \frac{1}{6} = \frac{4}{6}.$$

To verify the result, observe that

$$A \cap C = \{6\} \Rightarrow P(A \cap C) = \frac{1}{6}$$ "Even AND Multiple of 3"

$$A \cup C = \{2, 4, 6, 3\} \Rightarrow P(A \cup C) = \frac{4}{6}$$

Complement of an Event;

A complement: $\bar{A}$ means NOT A

For example; P(NOT multiple of 3)

$= P(\bar{C}) = \frac{4}{6}$ Because 4 numbers are NOT multiple of 3.

Observe that $\bar{C} = \{2, 4, 1, 5\}$

Also observe that $\boxed{P(C) + P(\bar{C}) = 1}$

Because; $S = C \cup \bar{C}$

$$P(S) = P(C \cup \bar{C}) = P(C) + P(\bar{C}) - \underbrace{P(C \cap \bar{C})}_{=0} = 1$$

Mutually Exclusive (AYRIK) events;

If two events are mutually exclusive, they cannot happen together. Then, we have;

If A and B are mutually exclusive,

$$\boxed{P(A \cap B) = 0}$$

* Note that for any event A, A and $\bar{A}$ are mutually exclusive events.

* Also note that, if A and B are mutually exclusive, then $P(A \cup B) = P(A) + P(B)$

For our simple example;

A and B are Mutually exclusive
B and C are NOT Mutually exclusive
C and $\bar{C}$ are Mutually exclusive

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Collectively Exhaustive EVENTS;

Birleşimleri "Sample Space"i veren olaylara "Collectively Exhaustive Events" diyoruz.

Formally, if $A_1, A_2, \ldots, A_k$ are collectively exhaustive events, then

$$\boxed{A_1 \cup A_2 \cup \ldots \cup A_k = S}$$

For our simple example;

A and B are Collectively Exhaustive events.

A and C are NOT collectively Exhaustive events.

Also let, $D = \{\text{Multiple of } 5\} = \{5\}$

$E = \{\text{Prime Numbers}\} = \{2, 3, 5\}$

Then; A, C, D and $\bar{E}$ are Collectively Exhaustive events.

Also, E and $\bar{E}$ are Collectively Exhaustive events.

(: Geyik uzadı burada arkadaşlar ama, geleceğim yeri anlamak bir dahaki konu için önemli :)

As a final Remark, judge that (yok artık!)

A and B are mutually exclusive and collectively exhaustive events.

E and $\bar{E}$ are mutually exclusive and collectively exhaustive events.

A, C, D and $\bar{E}$ are NOT mutually exclusive, but collectively exhaustive events.

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Combination;

C_r^n or $\binom{n}{r}$ is number of r element subsets of a set who has n elements. We use combination to determine "in how many ways, can we choose r objects from a set of n objects?"

$$\boxed{\binom{n}{r} = \frac{n!}{r!.(n-r)!} = \frac{n.(n-1).\ ....\ (n-r+1)}{r!}}$$

Ex// From a set of 7 doctors, in how many ways can we select 3 doctors?

$$\binom{7}{3} = \frac{7.6.5}{3!} = 35$$

Ex// From a set of 7 doctors and 8 nurses, in how many ways can we select 3 doctors AND 2 nurses?

$$\binom{7}{3} \cdot \binom{8}{2} = \frac{7.6.5}{3!} \cdot \frac{8.7}{2!} = 35.28 = 980$$

Ex// From a set of 7 doctors and 8 nurses, if we select 5 people randomly, WPT (what is the probability that) 3 of them are doctors? (And the remaining are Nurses)

cases that event has occured.

$$P(3\text{ doctors}, 2\text{ nurses}) = \frac{\binom{7}{3}\binom{8}{2}}{\binom{15}{5}} = \frac{980}{2002} = 0,49$$

overall selection, All possible cases

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4.8 The sample space contains 5 A's and 7 B's. What is the probability that a randomly selected set of 2 will include 1 A and 1 B?

Ex

→ $\frac{\binom{5}{1}\binom{7}{1}}{\binom{12}{2}}$

4.9 The sample space contains 6 A's and 4 B's. What is the probability that a randomly selected set of 3 will include 1 A and 2 B's?

→ $\frac{\binom{6}{1}\binom{4}{2}}{\binom{10}{3}}$

4.10 The sample space contains 10 A's and 6 B's. What is the probability that a randomly selected set of 4 will include 2 A's and 2 B's?

→ $\frac{\binom{10}{2}\binom{6}{2}}{\binom{16}{4}}$

4.11 In a city of 120,000 people there are 20,000 Norwegians. What is the probability that a randomly selected person from the city will be Norwegian?

→ $\frac{20000}{120000}$

4.12 In a city of 180,000 people there are 20,000 Norwegians. What is the probability that a random sample of 2 people from the city will contain 2 Norwegians?

→ $\frac{20000}{180000} \cdot \frac{19999}{\cancel{1}79999} \cong 0,012$

First is Norwegien AND Second is Norwegien

4.14 A fund manager is considering investing in the stock of a health care provider. The manager's assessment of probabilities for rates of return on this stock over the next year is summarized in the accompanying table. Let *A* be the event "Rate of return will be more than 10%" and *B* the event "Rate of return will be negative."

Ex

Rate of return	Less than −10%	−10% to 0%	0% to 10%	10% to 20%	More than 20%
Probability	0.04	0.14	0.28	0.33	0.21

a. Find the probability of event *A*.
b. Find the probability of event *B*.
c. Describe the event that is the complement of *A*.
d. Find the probability of the complement of *A*.
e. Describe the event that is the intersection of *A* and *B*.
f. Find the probability of the intersection of *A* and *B*.
g. Describe the event that is the union of *A* and *B*.
h. Find the probability of the union of *A* and *B*.
i. Are *A* and *B* mutually exclusive?
j. Are *A* and *B* collectively exhaustive?

a) $P(A) = 0,33 + 0,21 = 0,54$

b) $P(B) = 0,14 + 0,04 = 0,18$

c) $\bar{A}$: Not A : At most 10%

d) $P(\bar{A}) = 1 - P(A) = 0,46$

e) A and B : More than 10% and Negative

f) $P(A \cap B) = 0$ → impossible event

g) A ~~or~~ or B : More than 10% or Negative

h) $P(A \cup B) = 0,54 + 0,18 = 0,72$

i) Yes, $P(A \cap B) = 0$

j) No, $P(A \cup B) \neq 1$

4.17 A department store manager has monitored the number of complaints received per week about poor service. The probabilities for numbers of complaints in a week, established by this review, are shown in the following table. Let A be the event "There will be at least 1 complaint in a week" and B the event "There will be less than 10 complaints in a week."

Ex

Number of complaints	0	1 to 3	4 to 6	7 to 9	10 to 12	More than 12
Probability	0.14	0.39	0.23	0.15	0.06	0.03

a. Find the probability of A.
b. Find the probability of B.
c. Find the probability of the complement of A.
d. Find the probability of the union of A and B.
e. Find the probability of the intersection of A and B.
f. Are A and B mutually exclusive?
g. Are A and B collectively exhaustive?

Meet "Random Variable"!

X: # of complaints recieved per week

$A: X \geq 1$ → at least: OR more : Equality

$B: X < 10$ → less than : No equality.

a) $P(A) = P(X \geq 1) = 1 - P(X < 1) = 1 - 0,14 = 0,86$

b) $P(B) = P(X < 10) = 1 - P(X \geq 10) = 1 - [0,06 + 0,03] = 0,91$

c) $P(\bar{A}) = 1 - P(A) = 0,14$

e) $P(A \cap B) = P(1 \leq X < 10) = 0,39 + 0,23 + 0,15 = 0,77$

d) $P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0,86 + 0,91 - 0,77 = 1$

f) No, $P(A \cap B) \neq 0$

g) Yes, $P(A \cup B) = 1$

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Conditional Probability & Independence

* Basically, there are 3 types of probability;

(i) Marginal → Single Event

(ii) Joint → Two Events Together

(iii) Conditional → Event given that another event has occured.

Ex4 A study on color choices and gender is shown in the following table

Gender \ Color choice	Pink	Blue	White	TOTAL
Male	6	16	8	40
Female	35	15	10	60
TOTAL	41	31	18	100

what is the Probability that;

a) A randomly choosen person is male?

b) A randomly choosen person selects white?

c) A randomly choosen person is female and selects Blue?

d) If it is known that color choice is Pink, WPT the person is female?

e) WPT a female chooses white?

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Ans// (i) Marginal

a) $P(M) = \frac{40}{100}$ b) $P(W) = \frac{18}{100}$

(ii) Joint

c) $P(F \cap B) = \frac{15}{100}$

(iii) Conditional

d) $P(F|P) = \frac{35}{41}$ e) $P(W|F) = \frac{10}{60}$

* Consider the probability in part (e)

$$P(W|F) = \frac{10}{60} = \frac{10/100}{60/100} = \frac{P(W \cap F)}{P(F)}$$

In general; $\boxed{P(A|B) = \frac{P(A \cap B)}{P(B)}}$

$P(A|\overset{\text{Given}}{B})$: Probability of A given B

B → Known Event

A → Random Event in (the knowledge of) B

* By cross multiplication, we have,

$\boxed{P(A \cap B) = P(B) . P(A|B)}$ → Multiplication Rule for any Event A and B.

For example; $P(F \cap B) = P(F) . P(B|F) = \frac{60}{100} . \frac{15}{60} = \frac{15}{100}$

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* Two events A and B are independent if knowledge of occurance of one event does not change the probability of the other event.

Then; A and B are independent if;

$$\boxed{P(A|B) = P(A)} \quad (\text{or } P(B|A) = P(B))$$

* "Independence" ile "Mutually exclusive" kavramlarını karıştırmayın. İki olay AYRIK ise kesinlikle BAĞIMLI'dır çünkü;

$P(A|B) = 0$ olur.

Bağımsız olaylar ayrık değillerdir.

* $P(A|B) = P(A)$

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

$$\boxed{P(A\cap B) = P(A) \cdot P(B)}$$ → Multiplication Rule for independent Events.

Ex: Is Gender and Color Choice independent?
(Cont)

ANS: Check if $P(\text{Color Choice} \cap \text{Gender}) = P(\text{Color Choice}) \cdot P(\text{Gender})$ for every choice of Color Choice & Gender.

$$P(M\cap P) \stackrel{?}{=} P(M) \cdot P(P)$$

$$\frac{6}{100} \qquad \frac{40}{100} \cdot \frac{41}{100}$$

$$0{,}060 \neq 0{,}164$$ → NOT independent.

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4.21 The probability of A is 0.60 and the probability of B is 0.40 and the probability of either is 0.76. What is the probability of both A and B?

Ex

$P(A) = 0{,}60$; $P(B) = 0{,}40$; $P(A \cup B) = 0{,}76$

$P(A \cap B) = P(A) + P(B) - P(A \cup B) = 0{,}24$

4.22 The probability of A is 0.60 and the probability of B is 0.45 and the probability of both is 0.30. What is the probability of either A and B?

$P(A) = 0{,}60$; $P(B) = 0{,}45$; $P(A \cap B) = 0{,}30$

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0{,}75$

4.23 The probability of A is 0.60 and the probability of B is 0.45 and the probability of both is 0.30. What is the conditional probability of A, given B? Are A and B independent in a probability sense?

$P(A) = 0{,}60$; $P(B) = 0{,}45$; $P(A \cap B) = 0{,}30$

$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0{,}30}{0{,}45} = \frac{2}{3} \neq P(A)$

Not independent

4.24 The probability of A is 0.80 and the probability of B is 0.10 and the probability of both is 0.08. What is the conditional probability of A, given B? Are A and B independent in a probability sense?

$P(A) = 0{,}80$; $P(B) = 0{,}10$; $P(A \cap B) = 0{,}08$

$P(A \cap B) = P(A) \cdot P(B) = 0{,}80 \cdot 0{,}10 = 0{,}08$

independent.

$P(A|B) = P(A) = 0{,}80$

4.27 A company knows that a rival is about to bring out a competing product. It believes that this rival has three possible packaging plans (superior, normal, cheap) in mind and that all are equally likely. Also, there are three equally likely possible marketing strategies (intense media advertising, price discounts, and use of a coupon to reduce the price of future purchases). What is the probability that the rival will employ superior packaging in conjunction with an intense media advertising campaign? Assume that packaging plans and marketing strategies are determined independently.

4.27) Packaging : Superior, Normal, Cheap
All are equally likely

Marketing : Advertising, Discount, Coupon
All are equally likely

$P(\text{Pack} = \text{Superior} \cap \text{Mark} = \text{Advertising})$

$= P(\text{Pack} = \text{Superior}) \cdot P(\text{Mark} = \text{Advertising})$

$= \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$ → Due to independence

4.28 A financial analyst was asked to evaluate earnings prospects for seven corporations over the next year and to rank them in order of predicted earnings growth rates.

a. How many different rankings are possible?
b. If, in fact, a specific ordering is the result of a guess, what is the probability that this guess will turn out to be correct?

4.28) a) $7! = 5040$

b) $\frac{1}{7!} = \frac{1}{5040} = 0{,}000198$

4.30 A securities analyst claims that, given a specific list of six common stocks, it is possible to predict, in the correct order, the three that will perform best during the coming year. What is the probability of making the correct selection by chance?

4.30) $n(S) = 6 \cdot 5 \cdot 4 = 120$

$P(\text{Best tree}) = \frac{1}{120} = 0{,}00833$

4.31 A student committee has six members—four undergraduate and two graduate students. A subcommittee of three members is to be chosen randomly so that each possible combination of three of the six students is equally likely to be selected. What is the probability that there will be no graduate students on the subcommittee?

4.31) $\boxed{\begin{array}{l} 4 \text{ Under G.} \\ 2 \text{ G.} \end{array}}$ → select $n = 3$ members.

$P(\text{No G.}) = \frac{\binom{4}{3}\binom{2}{0}}{\binom{6}{3}} = \frac{4}{20} = 0{,}2$

4.45 An inspector examines items coming from an assembly line. A review of her record reveals that she accepts only 8% of all defective items. It was also found that 1% of all items from the assembly line are both defective and accepted by the inspector. What is the probability that a randomly chosen item from this assembly line is defective?

4.45) $P(\text{Accept}) = 0{,}08$

$P(\text{Defective} \cap \text{Accept}) = 0{,}01$

$P(\text{Defective} \mid \text{Accept}) = \frac{0{,}01}{0{,}08} = \frac{1}{8}$

4.50 A quality control manager found that 30% of work-related problems occurred on Mondays and that 20% occurred in the last hour of a day's shift. It was also found that 4% of worker-related problems occurred in the last hour of Monday's shift.

a. What is the probability that a worker-related problem that occurs on a Monday does not occur in the last hour of the day's shift?
b. Are the events "Problem occurs on Monday" and "Problem occurs in the last hour of the day's shift" statistically independent?

4.50) $P(\text{Monday}) = 0{,}30 = P(M)$

$P(\text{Last Hour}) = 0{,}20 = P(L)$

$P(\text{Monday} \cap \text{Last Hour}) = 0{,}04$

a) $P(\bar{L} \mid M) = 1 - P(L \mid M)$

$= 1 - \frac{P(L \cap M)}{P(M)} = 1 - \frac{0{,}04}{0{,}30} = \frac{26}{30}$

b) $P(M) \cdot P(L) = 0{,}30 \cdot 0{,}20 = 0{,}06 \neq 0{,}04$
NOT independent

Odds;

The odds in favor of a particular event A is;

$$\text{Odds} = \frac{P(A)}{1 - P(A)} = \frac{P(A)}{P(\bar{A})}$$

* At yarışındaki gibi ⇒ At 1'e 3 veriyorsa Atın kazanma olasılığının kazanmama olasılığına oranı 1/3 olur. Böylece; $P(\text{Horse wins}) = 0{,}25$ olur. $(3P(W) = 1 - P(W))$

Overinvolvement Ratios;

$\frac{P(A_1 \mid B_1)}{P(A_1 \mid B_2)}$ is over-involvement Ratio.

If overinvolvement ratio is greater than 1, it means that occurance of A_1 increases the conditional odds ratio in favor of B_1. Namely; $\frac{P(B_1 \mid A_1)}{P(B_2 \mid A_1)} > \frac{P(B_1)}{P(B_2)}$

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4.63 Consider two groups of students: B_1, students who received high scores on tests; and B_2, students who received low scores on tests. In group B_1, 80% study more than 25 hours per week, and in group B_2, 40% study more than 25 hours per week. What is the overinvolvement ratio for high study levels in high test scores over low test scores?

4.63)
A_1: Studying more than 25 hours
B_1: High score on test
B_2: Low score on test

$P(A_1 | B_1) = 0{,}80$
$P(A_1 | B_2) = 0{,}40$

$\frac{P(A_1|B_1)}{P(A_1|B_2)} = 2$ → Studying more than 25 hours increases the prob. of getting high score on test twice.

4.69 A corporation regularly takes deliveries of a particular sensitive part from three subcontractors. It found that the proportion of parts that are good or defective from the total received were as shown in the following table:

	Subcontractor		
Part	A	B	C
Good	0.27	0.30	0.33
Defective	0.02	0.05	0.03

a. If a part is chosen randomly from all those received, what is the probability that it is defective?
b. If a part is chosen randomly from all those received, what is the probability it is from subcontractor B?
c. What is the probability that a part from subcontractor B is defective?
d. What is the probability that a randomly chosen defective part is from subcontractor B?
e. Is the quality of a part independent of the source of supply?
f. In terms of quality, which of the three subcontractors is most reliable?

4.69)

	Subcontractor			
Part	A	B	C	TOTAL
Good	0,27	0,30	0,33	0,90
Def.	0,02	0,05	0,03	0,10
TOTAL	0,29	0,35	0,36	1,00

a) $P(D) = 0{,}10$

b) $P(B) = 0{,}35$

c) $P(D|B) = \frac{0{,}05}{0{,}35} = \frac{1}{7}$

d) $P(B|D) = \frac{0{,}05}{0{,}10} = \frac{1}{2}$

e) $P(A \cap D) \stackrel{?}{=} P(A) . P(D)$

$P(A).P(D) = 0{,}29 . 0{,}10 = 0{,}029 \neq 0{,}02$ → NOT independent

f) $\boxed{P(\bar{D}|A) = \frac{0{,}27}{0{,}29} = 0{,}931}$ $P(\bar{D}|B) = \frac{0{,}30}{0{,}35} = 0{,}857$ $P(\bar{D}|C) = \frac{0{,}33}{0{,}36} = 0{,}916$

→ Most Reliable because highest prob. of nondefective items.

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4.73 A campus student club distributed material about membership to new students attending an orientation meeting. Of those receiving this material 40% were men and 60% were women. Subsequently, it was found that 7% of the men and 9% of the women who received this material joined the club.

a. Find the probability that a randomly chosen new student who receives the membership material will join the club.
b. Find the probability that a randomly chosen new student who joins the club after receiving the membership material is a woman.

4.73) $P(M)=0{,}40$; $P(W)=0{,}60$

$P(C|M)=0{,}07$; $P(C|W)=0{,}09$

Then;

$P(M\cap C)=0{,}40 \cdot 0{,}07=0{,}028$

$P(W\cap C)=0{,}60\cdot 0{,}09=0{,}054$

Joined Club \ Gender	Man	Woman	TOTAL
Club	0,028	0,054	0,082
Not Club	0,40 − 0,028 = 0,372	0,60 − 0,054 = 0,546	0,918
TOTAL	0,40	0,60	1,00

a) $P(Club)=0{,}082$

b) $P(W|C)=\dfrac{P(W\cap C)}{P(C)}=\dfrac{0{,}054}{0{,}082}=0{,}66$

4.77 Before books aimed at preschool children are marketed, reactions are obtained from a panel of preschool children. These reactions are categorized as "favorable," "neutral," or "unfavorable." Subsequently, book sales are categorized as "high," "moderate," or "low," according to the norms of this market. Similar panels have evaluated 1,000 books in the past. The accompanying table shows their reactions and the resulting market performance of the books.

	Panel Reaction			
Sales	Favorable	Neutral	Unfavorable	
High	173	101	61	335
Moderate	88	211	70	369
Low	42	113	141	296
	303	425	272	1000

a. If the panel reaction is favorable, what is the probability that sales will be high?
b. If the panel reaction is unfavorable, what is the probability that sales will be low?
c. If the panel reaction is neutral or better, what is the probability that sales will be low?
d. If sales are low, what is the probability that the panel reaction was neutral or better?

4.77) a) $\dfrac{173}{303}$

b) $\dfrac{141}{272}$

c) $\dfrac{113+42}{425+303}$

d) $\dfrac{113+42}{296}$

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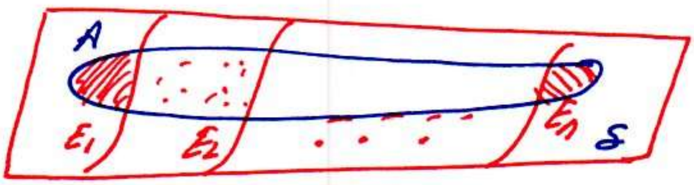
Total Probability Rule & BAYES' THEOREM

Remember; $E_1, E_2, \ldots, E_n$ are mutually exclusive & collectively exhaustive events if;

(i) $E_i \cap E_j = \emptyset$ for $i \neq j$

(ii) $E_1 \cup E_2 \cup \ldots \cup E_n = S$



$$P(A) = P(A \cap E_1) + P(A \cap E_2) + \ldots + P(A \cap E_n)$$

$$P(A) = P(E_1) \cdot P(A|E_1) + P(E_2) \cdot P(A|E_2) + \ldots + P(E_n) P(A|E_n)$$

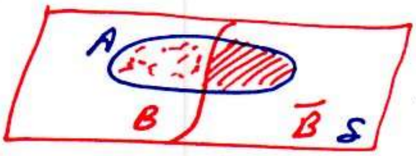
↳ TOTAL Probability Rule

Then;

$$\boxed{P(E_j|A) = \frac{P(E_j) \cdot P(A|E_j)}{\sum_{i=1}^{n} P(E_i) \cdot P(A|E_i)}}$$

↳ Bayes' Theorem.

* Also Remember; B and $\bar{B}$ are mutually exclusive and collectively exhaustive events. Then;



$$P(A) = P(B) \cdot P(A|B) + P(\bar{B}) \cdot P(A|\bar{B})$$

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

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4.85 A publisher sends advertising materials for an accounting text to 80% of all professors teaching the appropriate accounting course. Thirty percent of the professors who received this material adopted the book, as did 10% of the professors who did not receive the material. What is the probability that a professor who adopts the book has received the advertising material?

4.85) A: Proffesor addopts the book

B: Proffessor recieved the advertising material

$$D \rightarrow P(B) = 0{,}80 \;;\; P(A|B) = 0{,}30$$

$$D \rightarrow P(\bar{B}) = 1 - 0{,}80 = 0{,}40 \;;\; P(A|\bar{B}) = 0{,}10$$

$$P(B|A) = \frac{0{,}80 \cdot 0{,}30}{0{,}80 \cdot 0{,}30 + 0{,}40 \cdot 0{,}10} = \underline{0{,}857}$$

4.86 A stock market analyst examined the prospects of the shares of a large number of corporations. When the performance of these stocks was investigated one year later, it turned out that 25% performed much better than the market average, 25% much worse, and the remaining 50% about the same as the average. Forty percent of the stocks that turned out to do much better than the market were rated "good buys" by the analyst, as were 20% of those that did about as well as the market and 10% of those that did much worse. What is the probability that a stock rated a "good buy" by the analyst performed much better than the average?

B: Better ; W: Worse ; A: Same

G: Good Buys

$$D \rightarrow P(B) = 0{,}25 \;;\; P(G|B) = 0{,}40$$

$$D \rightarrow P(A) = 0{,}50 \;;\; P(G|A) = 0{,}20$$

$$D \rightarrow P(W) = 0{,}25 \;;\; P(G|W) = 0{,}10$$

$$P(B|G) = \frac{P(B)\,P(G|B)}{P(B)\,P(G|B) + P(A) \cdot P(G|A) + P(W)\,P(G|W)}$$

$$= \frac{0{,}25 \cdot 0{,}40}{0{,}25 \cdot 0{,}40 + 0{,}50 \cdot 0{,}20 + 0{,}25 \cdot 0{,}10} = \underline{0{,}444}$$

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