GOVERNMENT COLLEGE OF ENGINEERING & CERAMIC TECHNOLOGY

(AN AUTONOMOUS INSTITUTE AFFILIATED TO MAKAUT)

Online Examination Schedule for MID TERM I of M.Tech 2nd Semester

EXAM. DATE (DAY)	Dept.	Time: 11:00-11:20 Hrs.	Time: 11:45-12:05 Hrs.	Time: 12:30-12:50 Hrs.
11/04/2022 (Monday)	CT	M(CT) 204A :: Bio Ceramics	M(CT) 203:: Nano Ceramics	----
	IT	Advanced Operating System:: ITPC204	Database Design:: ITPC205	Advanced Algorithm:: ITPC206
16/04/2022 (Saturday)	CT	M(CT) 201:: Glass Science and Technology	M(CT) 202:: New generation refractories	M(CT) 205A:: Electronic ceramics
	IT	Machine Learning:: ITPEC203B	IoT and Its Application:: ITPEC204B	Research Methodology and IPR:: ITAUD202

Date: 24.03.2022

Haldar

[PARTHA HALDAR]

Controller of Examinations
Govt. College of Engineering
& Ceramic Technology
Govt. of West Bengal

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11/04/2022 (Monday)	CT	Mathematics-II::BS(CT) 204	CT	Basic Electrical Engineering::ES(CT) 204
	CSE and IT	Mathematics-II::BS(CS/IT) 205	CSE and IT	Chemistry::BS(CS/IT) 204
12/04/2022 (Tuesday)	CT	Physics::BS(CT)205	CT, CSE and IT	English::HS(CT/IT/CS) 201
	CSE and IT	Programming for problem solving::ES(CS/IT) 204		

Date: 24.03.2021

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17-03-2022

Probability

Random Experiment → E

event / outcome →

Event points = {H, T}

Event space = [S = {H, T}]

~~Events that broken down in simpl~~

Events which can be further broken down into simpler events is simple events.

Events that can't be broken down is called simple events.

m.e → mutually exclusive.

(Occurance of one event entails the non occurance of other. for example →

$S = \{H, T\}$

H, T are mutually exclusive.

pairwise m.e →

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

(more than two event points)

For M.E →

$P(A \cap B) = 0$

Difference between M.E. and independent:

$P(A \cap B) = 0$

$P(A \cap B) = P(A)P(B)$

Exhaustive → Event space is finite

$$P(A \cup B) = 1$$

complimentary event.
Impossible event.

conditional Probability:

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

- probability of occurrance that event A has occured.

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

$\therefore P(B/A) \cdot P(A) = P(A/B) \cdot P(B)$

[multiplication rule] — ①

$P(B/A) = P(B)$ — ②

(B does not depend ~~on~~ on A)

If $P(B/A)$ is $P(B)$ we may say that the info that event A has occured ~~...~~ does not affect the probability of event B. then B is said to be independent of A. It follows

$P(A/B) = P(A)$ — ③

putting 2, 3 in eq - 1
we get. $P(A)\,P(B) = P(A \cap B) = P(A)P(B)$

Thus we define two events A & B to be stochastically independent or simply independent.

$$P(A \cap B) = P(AB) = P(A)P(B)$$

21-03-2022

1. $P(\bar{A} \cup \bar{B}) = 1 - P(A \cap B)$
2. $P(\bar{A} \cap \bar{B}) = 1 - P(A \cup B)$

Q.1 Given $P(A) = 1/2$
$P(B) = 1/3$
$P(AB) = 1/4$

Find the values of $P(\bar{A})$, $P(A \cup B)$, $P(A/B)$, $P(\bar{A}B)$, $P(\bar{A}\bar{B})$, $P(\bar{A} \cup B)$, &

state weather the events A & B are —
i) mutually exclusive
ii) exhaustive
iii) equally likely
iv) independent

⇒ i) $P(\bar{A}) = 1 - 1/2 = 1/2$

ii) $P(A \cup B) = P(A) + P(B) - P(AB) = 7/12$

iii) $P(A/B) = P(AB)/P(B) = 3/4$

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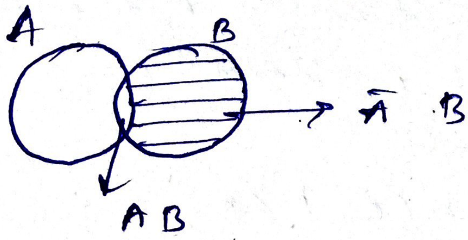
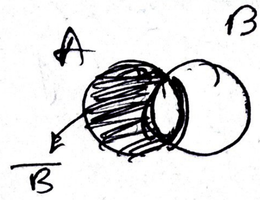




$P(A\bar{B})$
$\Rightarrow P(A\cap\bar{B})$

$P(A)$

$$P(\bar{A}B) = P(B) - P(AB)$$
$$= 1/12$$

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

i) No, A & B are not M.E, As $P(A\cap B) = 0$

ii) No, A & B are not Exhaustive as
$P(A\cup B) \neq 1$

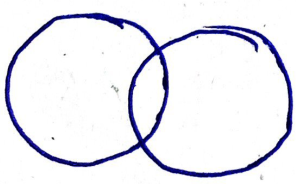
iii) No, Not equally likely as
$P(A) \neq P(B)$

iv) No, Not independent.
$P(AB) \neq P(A)\,P(B)$

Q.2) A & B are two event such that

$$P(A\cup B) = 7/8$$
$$P(A\cap B) = 1/4$$
$$P(\bar{A}) = 5/8$$

Find $P(A/\bar{B}) = ??$



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

$P(A) = 1 - 5/8$

$= 3/8$

$7/8 = 3/8 + P(\bar{B}) - 1/4$

$\Rightarrow 1/2 + 1/4 = P(\bar{B})$

$\Rightarrow \frac{3}{4} = P(\bar{B})$

$1 - P(\bar{B}) = 1 - 3/4 = 1/4$

$P(A/\bar{B}) = \frac{P(A\bar{B})}{P(\bar{B})}$

$\boxed{\begin{aligned} P(A\bar{B}) &= P(A) - P(AB) \\ &= 3/8 - 1/4 \\ &= \frac{3-2}{8} = 1/8 \end{aligned}}$

$= \frac{1/8}{1/4} = 1/8 \times 4 = 1/2$

$\therefore P(A/\bar{B}) = 1/2$

Q.3) If A & B are two events such that

$P(\bar{A} \cup \bar{B}) = 5/6$

$P(\bar{A}) = 1/2$

$P(\bar{B}) = 2/3$

Show that A & B are independent

$P(\bar{A} \cup \bar{B}) = 1 - P(A \cap B)$ $\qquad P(\bar{B}) = 1/3$

$\Rightarrow 5/6 = 1 - P(A \cap B)$

$\Rightarrow P(A \cap B) = 1 - 5/6 = 1/6$

$\therefore P(AB) = 1/2 \times 1/3 = 1/6 = R.H.S$

$\therefore$ L.H.S = R.H.S (proved)

$P(A) = \frac{\quad}{a+b}$

~~odds in favour of A~~:

odds against A are A:B signifies:

$$P(A) = \frac{b}{a+b}$$

4) odds in favour of an event A are 3:4, the odds against another independent event B, are 7:4. what is the probability that atleast one of the event still happen.

⇒ Here,

$$P(A) = 3/7$$

odds against another event B:

$$P(B) = 4/11$$

$$\therefore P(AB) = P(A)\,P(B)$$
$$= 3/7 \cdot 4/11 = \frac{12}{77}$$

∴ therefore the probability of occurance of atleast one of the event is given by →

$$P(A \cup B) = P(A) + P(B) - P(AB)$$
$$= 3/7 + 4/11 - \frac{12}{77}$$
$$= \frac{33+28-12}{77} = \frac{49}{77}$$
$$= 7/11$$

basic, ... and basic ...

(5) the manufactoring process of an article consists of two parts x & y. the probabilities of defects x and y are 10% & 15% respectively. What is the probability that the assemble part will not have any defect.

⇒ let, A denote the event defect in x part and B denote y part

then, $P(A) = 10/100 = 0.1$

$P(B) = 15/100 = 0.15$

$\therefore P(\bar{A}) = P(\text{no defect in x part})$

$= 0.9$

$P(\bar{B}) = P(\text{no defect in y part})$

$= 0.85$

$\therefore$ P(assembled part is free from defect) $= P(\bar{A}\bar{B}) = P(\bar{A}).P(\bar{B})$

$= 0.9 \times 0.85$

$= 0.675$

If $A_1, A_2, A_3 \ldots A_n$ be a even set of 'n' pairwise mutually exclusive and exhaustive events one of which certainly occurs then for any arbitrary event x

$$P(x) = P(A_1) \cdot P(x/A_1) + P(A_2) \cdot P(x/A_2) + \cdots P(A_n) \cdot P(x/A_n)$$

and if $P(x) \neq 0$ then,

$$P(A_i/x) = \frac{P(A_i)\,P(x/A_i)}{P(x)}$$

Where, $i = 1, 2, 3, 4 \ldots$

① There are two identical urns containing respectively 4 white, 3R and 3 white, 7 red balls. An urn is selected at random and a ball is drawn from it. Find the probability that it is white in colour. If the ball drawn is white what is the prabibility it came from first urn.

→ Let A_1 & A_2 be the events that the ball is drawn from the second urn respectively

We see that A_1, A_2 are M.E and exhaustive. Also, $P(A_1) = P(A_2) = 1/2$

Let A be the event that the ball drawn is white.

then, $P(A/A_1) = 4/7$

and $P(A/A_2) = 3/10$

$\therefore P(A) = P(A_1).P(A/A_1) + P(A_2).P(A/A_2)$

$= \frac{61}{140}$

If it is white in colour →

Now from Bayes theorem →

$$P(A_1/A) = \frac{P(A_1).P(A/A_1)}{P(A)} = \frac{40}{61}$$

(2) Two urns contain respectively 5 white, 7 black and 2 white, 2 black urns.

one of the urns is selected by the toss of a coin, two balls are drawn from ~~the~~ it whithout replacement.

If both balls drawn are white, what is the probability that first urn is selected.

→ Let A_1, A_2 be the event that the ball is drawn.

Let 'A' be the event both the balls drawn is white.

then, $P(A/A_1) = \frac{{}^5C_2}{{}^{12}C_2}$ $\frac{5}{12} \times \frac{4}{11}$ $= \frac{\cancel{5!}}{\cancel{3!} \times \cancel{2!}}$ 20

$P(A/A_2) = \frac{{}^4C_2}{{}^6C_2} = \frac{4}{6} \times \frac{3}{5} = \frac{12}{30}$

$\therefore P(A) = P(A_1) \cdot P(A/A_1) + P(A_2) \cdot P(A/A_2)$

$= \frac{1}{2} \times \frac{20}{132} + \frac{1}{2} \times \frac{12}{30}$

$= \frac{10}{132} + \frac{1}{5}$

$= \frac{50+132}{660}$

$= \frac{182}{660}$

probability that the first urn is selected

$P(A_1/A) = \frac{\frac{1}{2} \times \frac{5}{66}}{\frac{91}{330}} = \frac{5}{132} \times \frac{330}{91}$

$= \frac{25}{91}$

③ The

(3) The probability that a doctor diagonis a patient correctly is 80%, the probability that patient dies after correct operation is 40%, and dies after wrong diagonis is 70%. The patient died, what is the probability that the diseased have correcty diagonsed.

→ Let A_1 denote the event that dieased was correcty diagonesd by doctor and A_2 denote the event that patient who have the dieases dies.

$$P(A_1) = \frac{80}{100} = 0.8$$

$$P(\bar{A_1}) = 0.2$$

Also,

$$P(A_2/A_1) = \frac{40}{100} = 0.4$$

$$P(A_2/\bar{A_1}) = \frac{70}{100} = 0.7$$

$$P(A_2) = P(A_1)\, P(A_2/A_1) + P(\bar{A_1}) + P(A_2/\bar{A_1})$$

$$P(A_1/A_2) = P -$$

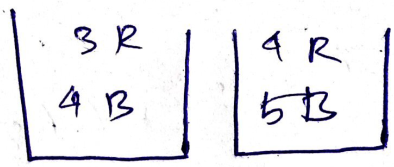
① Bag 1 contains 3 Red, 4 black balls, bag 2 contains 4 R, 5 Black. 1 ball is transferred from bag 1 to bag 2 and then a ball is drawn at random from bag 2. If the ball drawn is red in colour. Find the prabibility that the transferred ball is black. 2

⇒ Let E_1, E_2 and A be the events defined as follows.

E_1 = black ball is transferred from bag 1 to bag 2

E_2 = Red ball is transferred from bag 1 too bag 2

A = Red ball has been drawn from bag 2.



$P(E_1) = \frac{4}{7}$

$P(E_2) = 3/7$

Now, $P(A/E_1) = 4/10 = \frac{2}{5}$ = Probability of drawing a red ball from bag 2 when E_1 has occured

$P(A/E_2) = \frac{5}{10} = \frac{1}{2}$

$\therefore P(A) = P(E_1) \cdot P(A/E_1) + P(E_2) \cdot P(A/E_2)$

$= \frac{31}{70}$

∴ By Bayes' theorem →

$$P(E_1/A) = \frac{P(E_1) \cdot P(A/E_1)}{P(A)}$$

$$= \frac{16}{31}$$

② A box contains 5 defective and 10 non-defective lamps. 8 lamps are ~~thrown~~ drawn at random in succession without replacement. What is the probability that the 8th lamp is the 5th defective.

⇒ Let A denote the event getting exactly 4 defectives in the first 7 drawn. Let, B be the event. The 8th drawn is the defective one.

Since, the lamps are not replaced after been taken out,

$$P(A) = \frac{5c_4 \times 10c_3}{15c_7}$$

$\cancel{\frac{5!}{4! \times 1!}}$

$\frac{15!}{7! \times 8!} \rightarrow$

Now,

We see that $P(B/A)$ = probability that the 8th drawn is defective, given that there were 4 defectives in the first 7th draw.

$$P(B/A) = 1/8$$

$$P(AB) = P(B/A) \cdot P(A)$$

$$= 5/429$$

(5) A and B in order ~~blow~~ throw alternatively a pair of dice. A wins if B throws 8 before he throws 5 and B wins if ~~A~~ he throws 5 before A throws 8. Find the probability that A wins. Assume that game can continue indefinetly.

$$(1-x)^{-1} = 1+x+x^2+x^3+\ldots$$

$$(1+x)^{-1} = 1-x+x^2-x^3\ldots$$

$\Rightarrow$ when two dice are thrown, the total no of outcomes is 36.

Let X and Y denote respectively the events that A throws 8, B throws 5.

$\therefore X = \{(2,6),(3,5),(4,4)(5,3),(6,2)\} = \frac{5}{36}$

$\therefore Y = \{(1,4),(2,3),(3,2),(4,1)\} = \frac{4}{36} = \frac{1}{9}$

$\therefore P(X) = \frac{5}{36}$, $P(\bar{X}) = \frac{31}{36}$

$P(Y) = \frac{1}{9}$, $P(\bar{Y}) = \frac{8}{9}$

Now, A will win if he throws 8, either in the first or fifth . . .

B doesn't throw 5 in 2, 3, 6 . . .

$\therefore P(A \text{ wins}) = P(X) + P(\bar{X}\bar{Y}X) + P(\bar{X}\bar{Y}\bar{X}\bar{Y}X) + \ldots$

$= P(X) + P(\bar{X})\,P(\bar{Y})\,P(X) +$

$$= \frac{5}{36} + \left(\frac{31}{36} \cdot \frac{8}{9}\right) \cdot \frac{5}{36} + \left(\frac{31}{36} \cdot \frac{8}{9}\right)^2 \cdot \frac{5}{36} + \dots$$

$$= \frac{45}{76}$$

25-03-21

1) If corresponding to every point U of an event space S we have by a given rule a unique real value of $X = X(U)$ then X is called a random variable or a variate. The range of the function X is called the spectrum of 'X'. This spectrum may be discrete all continuous accordingly as the random variable is discrete or continuous.

$S = \{HH, HT, TH, TT\}$

Let the random variable X is such that

X (an outcome) = no of heads

$X(HH) = 2$

$X(HT) = 1 = X(TH)$

$X(TT) = 0$

$\{0, 1, 2\}$

	x_1	x_2	x_3
X :	0	1	2
$P(X = x_i) =$	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{1}{4}$

$= f_i$ $\quad \Sigma f_i = 1$

Probability distribution of random variable x.

(2) A random variable x has the following pmf →

x :	0	1	2	3	4	5	6	7
$P(x = x_i) = f_i$:	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Find A =

$P(x < 6)$

$P(x \geq 6)$

$P(3 < x \leq 6)$

Find the min value of x. so that

~~$P(3 < x \leq 6$~~ $P(x \leq x) > 1/2$

$P(x < 6) + P(x \geq 6) = 1$

$\Rightarrow P(x < 6) = 1 - \frac{19}{100}$

$P(x < 6 = \frac{81}{100}$

$P(3 < x \leq 6) = \frac{33}{100}$

$P(3 < x) \cap (x \leq 6) = \frac{33}{81}$

$P(x \leq x) > 1/2$

If x is a continuous random variable. The no. of possible values which we can assume is uncountably infinite; Hence, probability function can't be defined from same manner

i) $f(x) \geq 0$

ii) $\int_{-\infty}^{\infty} f(x)\,dx = 1$

iii)

$$p(c \leq x \leq d) = \int_{c}^{d} f(x)\,dx$$

Now, putting c we get

$$p(x = c)$$

$$p(c \leq x \leq d) = \int_{c}^{d} f(x)\,dx = p(c < x < d)$$

Find the value of a constant 'k' such that

$f(x) =$

If a possible density function

$$\int_{-\infty}^{0} kx(1-x)\,dx + \int_{0}^{1} kx(1-x)\,dx + \int_{1}^{\infty} kx(1-x)\,dx$$

else,

$$p(x > 1/2) = 1 - p(x \leq 1/2) = 1 - \int_{0}^{1/2} f(x)\,dx$$

$$\Rightarrow 0 + \int_{0}^{1} kx(1-x)\,dx + 0 = 1$$

$$\therefore k = 6$$

$$\Rightarrow 1 - p(x \leq 1/2) = p(x > 1/2)$$

$$= 1 - \int_{0}^{1/2} kx(1-x)\,dx$$

$$= 1 - 6\left[\frac{(x/2)^2}{2} + 6\left|\frac{x^3}{3}\right)_{0}^{1/2}\right.$$

$$= 1 - 6\left[\frac{1}{4} \cdot \frac{1}{2}\right] + 6\left[\frac{1}{8} \cdot \frac{2}{3}\right]$$

$$= 1 - \frac{36}{8} + \frac{6}{24}$$

$$= 1 - 3/4 + 1/4 = 1/2$$

Length of life of a tyre manufacture of a comp. follows ~~by~~ a continuous distribution given

$f(x) = k/x^3$

find k & the probability selected

$k = 36 \times 10^5$

$p(x \geq 1200) = \frac{29}{20}$

29.03.2022

① 5 → obj
② 15 → short type
③ 2×15 → 8+7
5+5+5
(long answer)

CDF

consider the discrete distribution:

Before the spectrum '0'	x:	0	1	2	After the spectrum '0'
	$p(x = x_i) = f_i$	1/4	1/2	1/4	

$F(x) = 0, (-\infty < x < 0)$

$= \frac{1}{4}, (0 \leq x < 1)$

$= 0 + \frac{1}{4} + \frac{1}{2}, (1 \leq x < 2)$

$= \frac{1}{4} + \frac{1}{2} + \frac{1}{4}, (2 \leq x < \infty)$

$=$

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explain the
pounds is favou
ion, 3. High cha

$= \frac{81}{100} \quad (5 \leq x < 6)$

$= \frac{83}{100} \quad (6 \leq x < 7)$

$= 1 \quad (7 \leq x < \infty)$

CDF is monotonic non-decreasing function (values get repeated)

Q. Let X be the random variable denoting the faces appearing in the throw of a dice. then the probability distribution of →

X :	1	2	3	4	5	6
$P(X = x_i)$:	1/6.	1/6	1/6	1/6	1/6	1/6

$= f_i$

The distribution function is →

$F(x) = 0, \quad -\infty < x < 1$

$= \frac{1}{6}, \quad 1 \leq x < 2$

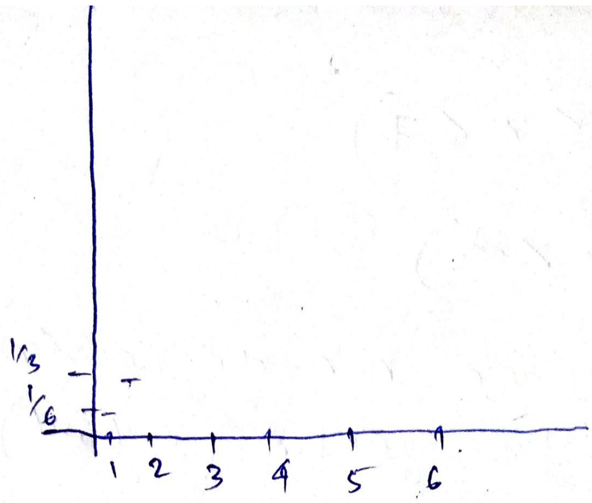
$= \frac{1}{3}, \quad 2 \leq x < 3$

$= \frac{1}{2}, \quad 3 \leq x < 4$

$= \frac{2}{3}, \quad 4 \leq x < 5$

$= \frac{5}{6}, \quad 5 \leq x < 6$

$= 1, \quad 6 \leq x < \infty$



From the graph, it is clear that $F(x)$ is a step function and is continuous from the right 1, 2, 3 . . . , 6 and has a jump discontinuity on the left 1, 2, 3 . . . , 6. The height of the jump 1/6. We write as

$$P(X=a) = F(a) - \lim_{x \to a^-} F(x)$$

$$P(X=4) = F(4) - \lim_{x \to 4^-}$$

Q ~~The distr~~

$$F(-\infty) = 0$$

$$F(\infty) = 1$$

$$0 \leq F(x) = 1$$

Suppose A & B are any real numbers such that $A < B$

$$P(A < x \leq B) = F(B) - F(A)$$

$$P(A < X \leq B) = F(B) - F(A)$$

The pdf of a random variable x is $f(x) = k(x-1)(2-x);\ 1 \le x \le 2$

i) find K
ii) Find $F(x)$
iii) Find $P\left(\frac{5}{4} \le x \le \frac{3}{2}\right)$

since $F(x)$ is pdf $\rightarrow$

$$\int_{-\infty}^{\infty} F(x)\,dx = 1$$

$$= \int_{-\infty}^{1}$$

$K = 6$

② The distribution function of $f(x)$ is defined as $F(x) = \int_{-\infty}^{\infty} f(x)\,dx$

$F(x) = 0,\ x < 1$

$$F(x) = \int_{-\infty}^{1} f(x)\,dx + \int_{1}^{x} f(x)\,dx$$

$1 \le x < 2$

$$F(x) = \int_{1}^{x} 6(x-1)(2-x)\,dx$$

$$= 5 - 12x + 9x^2 - 2x^3$$

$$F(x) = \int_{-\infty}^{1} \cancel{f(x)}\,dx + \int_{1}^{2} f(x)\,dx + \int_{2}^{\infty} \cancel{f(x)}\,dx$$

$= 1$

x :
f_i

① If

$X : x_0 \quad x_1 \quad x_2$

$f_i : f_0 \quad f_1 \quad f_2$

$E(x) = \bar{X} = m(x) = m = \sum x_i f_i$

<u>Maths(T)</u> <u>1.04.2022</u>

① If A and B are independent events show that –

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

② $\bar{A}$ & $\bar{B}$ are also independent

$P(A \cap B) = P(A) \cdot P(B)$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $\quad P(A) = 1 - P(\bar{A})$

$= P(A) + P(B) - P(A) \cdot P(B)$

$= P(A) - P(A) \cdot P(B) + P(B)$

$= P(A) \cdot \{1 - P(B)\} + P(B)$

$= P(A) \cdot P(\bar{B}) + P(B)$ as it is independent

$= P(A) + P(B)$ $\quad (P(AB) = 0)$

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

$\{1 - P(\bar{A})\} \cdot P(\bar{B}) + P(B)$

$= P(\bar{B}) - P(\bar{A}) \cdot P(\bar{B}) + 1 - P(\bar{B})$

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

② In a bolt factory A, B and C manufacture respectively 25%, 35% and 40% of total output. 5%, 4% and 2% are defective bolts. A bolt is chosen at random and is found to be defective. What are the prabability that it was manufactured by machine A, B and C.

⇒ X, Y, Z are the event.

$$P(X) = \frac{25}{100} = \frac{1}{4}$$

$$P(Y) = \frac{35}{100} = \frac{7}{20}$$

$$P(Z) = \frac{40}{100} = \frac{2}{5}$$

$$P(D/X) = \frac{1}{20}, \quad P(D/Y) = \frac{1}{25}, \quad P(D/Z) = \frac{1}{50}$$

$$P(X/D) = \frac{P(X) \cdot P(D/X)}{\frac{7}{20} \times \frac{1}{25} + \frac{1}{4} \times \frac{1}{20} + \frac{2}{5} \times \frac{1}{50}}$$

$$= \frac{\frac{1}{4} \times \frac{1}{20}}{\frac{7}{20} \times \frac{1}{25} + \frac{1}{80} + \frac{2}{250}}$$

$$= \cancel{\frac{1}{80}}$$