$p_Y(y)$

Ex: 5.1

$p(x,y)$		y = 0	1	2
x	0	0.1	0.04	0.02
	1	0.08	0.2	0.06
	2	0.06	0.14	0.3

a) $P(X=1 \text{ and } Y=1) = p(1,1) = 0.2$

b) $P(X \le 1 \text{ and } Y \le 1)$

$= p(0,0) + p(0,1) + p(1,0) + p(1,1)$

$= 0.1 + 0.04 + 0.08 + 0.2$

$= 0.42$

c) It is not an impossible event

~~d)~~ $P(X \neq 0 \text{ and } Y \neq 0)$

$= p(1,1) + p(1,2) + p(2,1) + p(2,2)$

$= 0.2 + 0.06 + 0.14 + 0.3$

$= 0.7$

d) $P(X \le 1) = p_x(0) + p_x(1)$

$p_x(0) = \sum_{y=0}^{2} p(x,y) = p(0,0) + p(0,1) + p(0,2) = 0.16$

$p_x(1) = \sum_{y=0}^{2} p(x,y) = p(1,0) + p(1,1) + p(1,2) = 0.34$

$p_x(2) = 0.5$

~~$P(X \le 1) = p$~~

$p_y(0) = \sum_{x=0}^{2} p(x,y) = p(0,0) + p(1,0) + p(2,0) = 0.24$

$p_y(1) = 0.38$

$p_y(2) = 0.38$

$P(X \le 1) = p_x(0) + p_x(1)$

$= 0.16 + 0.34$

$= 0.5$

$P(Y \le 2) = p_y(0) + p_y(1) + p_y(2)$

$= 0.24 + 0.38 + 0.38$

$= 1$

$P(Y \ge 1) = 1 - P(Y \le 1)$

$= 1 - p_y(0) - p_y(1)$

$= 1 - 0.24 - 0.38$

$= 0.38$

e) $p(0,0) = 0.1$, $p_x(0) = 0.16$

$p_y(0) = 0.24$

$\therefore p(0,0) \neq p_x(0) \times p_y(0)$

So, they are dependent.

X and Y

plan makes more sense.

Ex: 5.1

2) $p(x,y) = p_x(x) \cdot p_y(y)$ X and Y are independent

$p_x(x) = 0.1, 0.2, 0.3, 0.2, 0.2$ for $x = 0, 1, 2, 3, 4$

$p_Y(y) = 0.1, 0.3, 0.4, 0.2$ for $y = 0, 1, 2, 3$

a) $p(0,0) = 0.1 \times 0.1 = p_x(0) \times p_y(0) = 0.01$

$p(0,1) = p_x(0) \times p_Y(1) = 0.1 \times 0.3 = 0.03$

$p(0,2) = p_x(0) \times p_Y(2) = 0.1 \times 0.4 = 0.04$

$p(0,3) = 0.1 \times 0.2 = 0.02$

$p(1,0) = 0.2 \times 0.1 = 0.02$

$p(1,1) = 0.2 \times 0.3 = 0.06$

$p(1,2) = 0.2 \times 0.4 = 0.08$

$p(1,3) = 0.2 \times 0.2 = 0.04$

$p(2,0) = 0.3 \times 0.1 = 0.03$

$p(2,1) = 0.3 \times 0.3 = 0.09$

$p(2,2) = 0.3 \times 0.4 = 0.12$

$p(2,3) = 0.3 \times 0.2 = 0.06$

$p(3,0) = 0.02$

$p(3,1) = 0.06$

$p(3,2) = 0.08$

$p(3,3) = 0.04$

$p(4,0) = 0.02$

$p(4,1) = 0.06$

$p(4,2) = 0.08$

$p(4,3) = 0.04$

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$p(x,y)$		y: 0	1	2	3
x	0	0.01	0.03	0.04	0.02
	1	0.02	0.06	0.08	0.04
	2	0.03	0.09	0.12	0.06
	3	0.02	0.06	0.08	0.04
	4	0.02	0.06	0.08	0.04

b) $P(X \le 1 \text{ and } Y \le 1) = p(0,0) + p(0,1) + p(1,0) + p(1,1)$

$= 0.01 + 0.03 + 0.02 + 0.06$

$= 0.12$

$P(X \le 1) = p(0,0) + p(0,1) + p(0,2) + p(0,3) + p(1,0) + p(1,1) + p(1,2) + p(1,3)$ $= p_X(0) + p_X(1)$

$= 0.1 + 0.2 = 0.3$

$P(Y \le 1) = p_Y(0) + p_Y(1) = 0.4$

$\therefore P(X \le 1) \cdot P(Y \le 1) = 0.12 = P(X \le 1 \text{ and } Y \le 1)$

c) $E : \{(0,0), (0,1), (1,0)\}$

$P(E) = p(0,0) + p(0,1) + p(1,0) = 0.01 + 0.03 + 0.02 = 0.06$

d) P(atleast one of the two hospitals has 0 beds occupied)

$= p(0,0) + p(0,1) + p(0,2) + p(0,3) + p(1,0) + p(2,0) + p(3,0) + p(4,0)$

$= 0.01 + 0.03 + 0.04 + 0.02 + 0.02 + \cancel{0.06 + 0.08 + 0.04}$ $0.03 + 0.02 + 0.02$

$= 0.19$

Let X and Y be two crv's

Ex:- 5.1

3)

x_1 \ x_2	0	1	2	3
0	0.08	0.07	0.04	0
1	0.06	0.15	0.05	0.04
2	0.05	0.04	0.1	0.06
3	0	0.03	0.04	0.07
4	0	0.01	0.05	0.06

a) $P(X_1=1, X_2=1) = p(1,1) = 0.15$

b) $P(X_1=X_2) = p(0,0)+p(1,1)+p(2,2)+p(3,3)$
$= 0.08+0.15+0.1+0.07$
$= 0.4$

c) A is the event that there are atleast two more customers in one line than in the other line.

$A = \{X_1 \geq 2+X_2\} \cup \{X_2 \geq 2+X_1\}$

$P(A) = p(2,0)+p(3,0)+p(4,0)+p(3,1)+p(4,1)+p(4,2)$
$+p(0,2)+p(0,3)+p(1,3)$
$= 0.05+0+0+0.03+0.01+0.05+0.04+0+0.04$
$= 0.22$

d) P(The total no. of customers in the two lines is exactly 4)
$= P(4,0)+P(3,1)+P(2,2)+P(1,3)$
$= 0+0.03+0.1+0.04$
$= 0.17$

P(The total no. of customers in the two lines is atleast 4)
$= 0.17+P(4,1)+P(4,2)+p(4,3)+p(3,2)+p(3,3)+p(2,3)$
$= 0.17+0.01+0.05+0.06+0.04+0.07+0.06$
$= 0.46$

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6.

x	0	1	2	3	4
$p_X(x)$	0.1	0.2	0.3	0.25	0.15

a) $p = 0.6$

$P(Y=k) = {}^nC_k \times p^k \times (1-p)^{n-k}$

$P(Y=2 \mid X=4)$

$n = 4$

$= {}^4C_2 \times (0.6)^2 \times (0.4)^2$

$= 0.3456$

$P(4,2) = P(X=4) \times P(Y=2 \mid X=4)$

$= 0.15 \times 0.3456$

$= 0.05184$

b) $P(Y=0 \mid X=0) = {}^0C_0 \times (0.6)^0 \times (0.4)^0 = 1$

$P(Y=1 \mid X=1) = {}^1C_1 \times (0.6)^1 \times (0.4)^0 = 0.6$

$P(Y=2 \mid X=2) = {}^2C_2 \times (0.6)^2 \times (0.4)^0 = 0.36$

$P(Y=3 \mid X=3) = {}^3C_3 \times (0.6)^3 \times (0.4)^0 = 0.216$

$P(Y=4 \mid X=4) = {}^4C_4 \times (0.6)^4 \times (0.4)^0 = 0.1296$

$p(0,0) = P(X=0) \times P(Y=0 \mid X=0) = 0.1 \times 1 = 0.1$

$p(1,1) = P(X=1) \times P(Y=1 \mid X=1) = 0.2 \times 0.6 = 0.12$

$p(2,2) = P(X=2) \times P(Y=2 \mid X=2) = 0.3 \times 0.36 = 0.108$

$p(3,3) = P(X=3) \times P(Y=3 \mid X=3) = 0.216 \times 0.25 = 0.054$

$p(4,4) = P(X=4) \times P(Y=4 \mid X=4) = 0.15 \times 0.1296 = 0.01944$

$P(X=Y) = p(0,0) + p(1,1) + p(2,2) + p(3,3) + p(4,4)$

$= 0.1 + 0.12 + 0.108 + 0.054 + 0.01944$

$= 0.40144$

c) $P(Y=0 \mid X=1) = {}^1C_0 \times (0.6)^0 \times (0.4)^1 = 0.4$

$P(Y=0 \mid X=2) = {}^2C_0 \times (0.6)^0 \times (0.4)^2 = 0.16$

$P(Y=0 \mid X=3) = {}^3C_0 \times (0.6)^0 \times (0.4)^3 = 0.064$

$P(Y=0|X=4) = 4_{C_0} \times (0.6)^0 \times (0.4)^4 = 0.0256$

$P(Y=1|X=2) = 2_{C_1} \times (0.6)^1 \times (0.4)^1 = 0.48$

$P(Y=1|X=3) = 3_{C_1} \times (0.6)^1 \times (0.4)^2 = 0.288$

$P(Y=1|X=4) = 4_{C_1} \times (0.6)^1 \times 0.4)^3 = 0.1536$

$P(Y=2|X=3) = 3_{C_2} \times (0.6)^2 \times (0.4)^1 = 0.432$

$P(Y=2|X=4) = 4_{C_2} \times (0.6)^2 \times (0.4)^2 = 0.3456$

$P(Y=3|X=4) = 4_{C_3} \times (0.6)^3 \times 0.4 = 0.3456$

$p(1,0) = 0.2 \times 0.4 = 0.08$

$p(2,0) = 0.3 \times 0.16 = 0.048$

$p(3,0) = 0.25 \times 0.064 = 0.016$

$p(4,0) = 0.15 \times 0.0256 = 0.00384$

$p(2,1) = 0.3 \times 0.48 = 0.144$

$p(3,1) = 0.25 \times 0.288 = 0.072$

$p(4,1) = 0.15 \times 0.1536 = 0.02304$

$p(3,2) = 0.25 \times 0.432 = 0.108$

$p(4,2) = 0.15 \times 0.3456 = 0.05184$

$p(4,3) = 0.15 \times 0.3456 = 0.05184$

		X				
		0	1	2	3	4
	0	0.1	0.08	0.048	0.016	0.0038
y	1	0	0.12	0.144	0.072	0.023
	2	0	0	0.108	0.108	0.0518
	3	0	0	0	0.054	0.0518
	4	0	0	0	0	0.0194

$p_y(0) = 0.1 + 0.08 + 0.048 + 0.016 + 0.0038 = 0.2478$

$p_y(1) = 0.12 + 0.144 + 0.072 + 0.023 = 0.359$

$p_y(2) = 0.108 + 0.108 + 0.0518 = 0.2678$

$p_y(3) = 0.054 + 0.0518 = 0.1058$

$p_y(4) = 0.0194$

9) $f(x,y) = \begin{cases} k(x^2+y^2), & 20 \le x \le 30,\ 20 \le y \le 30 \\ 0, & \text{otherwise} \end{cases}$

a) we know that,

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

$$\Rightarrow \int_{20}^{30}\left\{\int_{20}^{30} k(x^2+y^2)\,dy\right\}dx = 1$$

$$\Rightarrow k\left[\int_{20}^{30}\left[x^2y + \frac{y^3}{3}\right]_{20}^{30} dx\right] = 1$$

$$\Rightarrow k\int_{20}^{30}\left(10x^2 + \frac{30^3-20^3}{3}\right)dx = 1$$

$$\Rightarrow k\left\{\frac{10x^3}{3} + \frac{30^3-20^3}{3}x\right\}_{20}^{30} = 1$$

$$\Rightarrow k\left\{\frac{10\times30^3}{3} + \frac{30^3-20^3}{3}\times30 - \frac{10\times20^3}{3} - \frac{30^3-20^3\times20}{3}\right\} = 1$$

$$= k\left\{126666.6667\right\} = 1 \quad \Rightarrow k = 7.8\times10^{-6}$$

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b. P(Both tires are underfilled)

$$= \int_{20}^{26}\int_{20}^{26} f(x,y)\,dy\,dx$$

$$= \int_{20}^{26}\left\{\int_{20}^{26} k(x^2+y^2)\,dy\right\} dx$$

$$= \frac{3}{380000}\int_{20}^{26}\left(x^2y+\frac{y^3}{3}\right)_{20}^{26} dx$$

$$= \frac{3}{380000}\times\int_{20}^{26}\left\{6x^2+\frac{26^3-20^3}{3}\right\}dx$$

$$= \frac{3}{380000}\left\{\frac{6x^3}{3}+\frac{26^3-20^3}{3}x\right\}_{20}^{26}$$

$$= \frac{3}{380000}\times\left\{4\times\frac{(26^3-20^3)}{}\right\} \qquad \frac{(26^3-20^3)\times 6^2}{3}+$$

$$= \frac{4\times(26^3-20^3)\times 3}{380000}$$

$$= 0.3024$$

c. $P(|X-Y| \leq 2)$

$= P(-2 \leq X-Y \leq 2)$

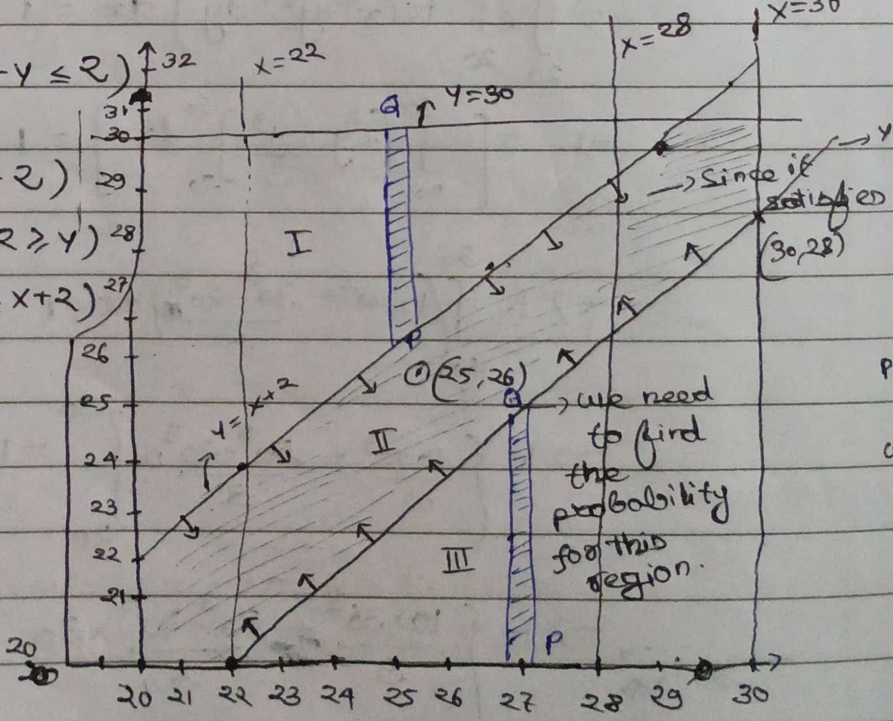
$P(X-Y \geq -2)$

$= P(X+2 \geq Y)$

$= P(Y \leq X+2)$

$X-Y \leq 2$

$\Rightarrow X-2 \leq Y$



Region I and region III are symmetric

Probability of whole I, II, III region = 1

≤ 27 ✓

$X - Y \le 2$

~~x~~ $X - 2 \le Y$

$Y = X - 2$

~~x~~ $(27, 24)$

$3 \le 2\ X$

So, the region will be away from

$P(|X-Y| \le 2)$

$= \iint_{II} f(x,y)\,dy\,dx$

$= 1 - \iint_{I} f(x,y)\,dy\,dx - \iint_{III} f(x,y)\,dx$

Region I and III ka integration same ayega.

For region I, constant limits for x are $x = 20$ to $x = 28$

Variable limits for 'Y'

At 'P', $y = x + 2$

At 'Q', $y = 30$

limits are $y = x+2$ to $y = 30$

$\therefore \iint_{I} f(x,y)\,dy\,dx = \int_{20}^{28} \int_{x+2}^{30} \{k(x^2+y^2)\,dy\}\,dx$

$= k\int_{20}^{28} \left[x^2 y + \frac{y^3}{3}\right]_{x+2}^{30} dx$

$= k\int_{20}^{28} \left(x^2(30 - x - 2) + \frac{30^3 - (x+2)^3}{3}\right) dx$

$= k\int_{20}^{28} \left(28x^2 - x^3 + \frac{27000 - x^3 - 8 - 6x^2 - 12x}{3}\right) dx$

$= k\int_{20}^{28} \left(\frac{84x^2 - 3x^3 + 27000 - x^3 - 8 - 6x^2 - 12x}{3}\right) dx$

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$$= k\int_{20}^{28} \left(\frac{-4x^3+28x^2-12x+26992}{3}\right) dx$$

$$= 0.3203$$

<u>Region-3</u>

$$\iint_{III} f(x,y)\,dy\,dx = k\int_{22}^{30}\int_{20}^{x-2} (x^2+y^2)\,dy\,dx = 0.3203$$

$$P(|X-Y| \le 2) = 1 - 2\times 0.3203 = 0.3594$$

d) $$f_X(x) = \int_{-\infty}^{\infty} f(x,y)\,dy$$

$$= k\int_{20}^{30} (x^2+y^2)\,dy \quad , \quad 20 \le x \le 30$$

$$= \int_{20}^{30} \frac{3(x^2+y^2)}{380000}\,dy$$

$$= k \times \left[x^2y + \frac{y^3}{3}\right]_{20}^{30}$$

$$= k\left(10x^2 + \frac{30^3-20^3}{3}\right)$$

$$= \frac{3}{380000} \times \left(10x^2 + 6333.33\right)$$

$$= 10kx^2 + 0.05$$

$$= 7.9 \times 10^{-5} x^2 + 0.05, \quad 20 \le x \le 30$$

$$f_Y(y) = \int_{-\infty}^{\infty} f(x,y)\,dx$$

$$= k\int_{20}^{30} (x^2+y^2)\,dx$$

$$= k \times \left[\frac{x^3}{3} + y^2x\right]_{20}^{30}$$

$$= 10ky^2 + 0.05 \;, \quad 20 \le y \le 30$$

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$$f_X(x) \cdot f_Y(y) = (10kx^2 + 0.05) \cdot (10ky^2 + 0.05)$$
$$= 100k^2x^2y^2 + 0.5kx^2 + 0.5ky^2 + 0.0025$$

$$f_X(x) = \begin{cases} 10kx^2 + 0.05, & 20 \le x \le 30 \\ 0, & \text{otherwise} \end{cases}$$

$$f_Y(y) = \begin{cases} 10ky^2 + 0.05, & 20 \le y \le 30 \\ 0, & \text{otherwise} \end{cases}$$

$$f_X(x) \cdot f_Y(y) = \begin{cases} (10kx^2 + 0.05) \cdot (10ky^2 + 0.05) & 20 \le x \le 30,\ 20 \le y \le 30 \\ 0, & \text{otherwise} \end{cases}$$

$$\ne k(x^2+y^2) = f(x,y)$$

So, X and Y are dependent.

Note

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10) a) X = Annie's arrival time

Y = Alvie's arrival time

$$f(x,y) = \begin{cases} \frac{1}{6-5}, & 5 \le x \le 6,\ 5 \le y \le 6 \\ 0, & \text{otherwise} \end{cases}$$

$$= \begin{cases} 1, & 5 \le x \le 6,\ 5 \le y \le 6 \\ 0, & \text{otherwise} \end{cases}$$

$$f_X(x) = \begin{cases} 1, & 5 \le x \le 6 \\ 0, & \text{otherwise} \end{cases}$$

$$f_Y(y) = \begin{cases} 1, & 5 \le y \le 6 \\ 0, & \text{otherwise} \end{cases}$$

$\because$ X and Y are independent

$= f(x,y) = f_X(x) \cdot f_Y(y)$.

b) $P(5.25 \le X \le 5.75,\ 5.25 \le Y \le 5.75)$

5:15 → 5 hrs 15 mins

→ 5 hrs $\left(\frac{1}{4}\right)$ hrs $\quad \frac{15}{60}$

= 5.25 hrs

5:45 → 5 hrs 45 mins

→ 5 hrs $\left(\frac{3}{4}\right)$ hrs $\quad \frac{45}{60}$

= 5.75 hrs

$= P(5.25 \le X \le 5.75) \cdot P(5.25 \le Y \le 5.75)$

$$= \int_{5.25}^{5.75} 1 \cdot dx \times \int_{5.25}^{5.75} 1 \cdot dy$$

$= (5.75 - 5.25) \times (5.75 - 5.25)$

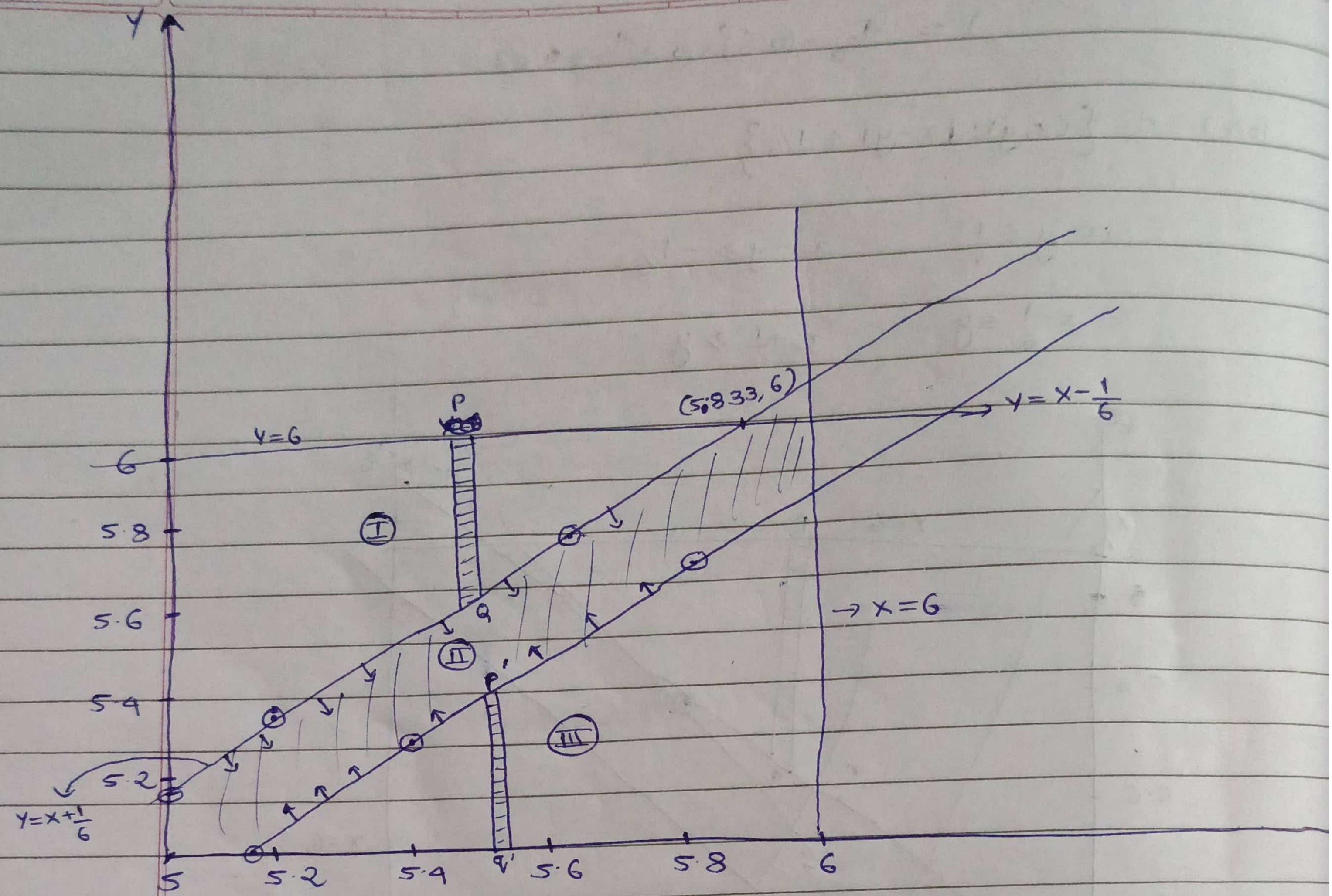
$= 0.5 \times 0.5$

$= 0.25$

10) c) $A = \{(x, y) : |x - y| \leq 1/6\}$

$x - y \leq \frac{1}{6}$ $\quad\quad$ $x - y \geq -1/6$

$\Rightarrow x - \frac{1}{6} \leq y$ $\quad\quad$ $x + \frac{1}{6} \geq y$



For region 1, constant limits of x are $x=5$ to $x=5.833$

~~For region~~ variable limits of y

$p = 6$

$q = x+\frac{1}{6}$

$y \leq x+\frac{1}{6}$

$y \geq x-\frac{1}{6}$

5.2, 5.3

For region 3, constant limits of x are $x = 5.167$ to $x=6$

variable limits of y

$p' = x-\frac{1}{6}$

$q' = 5$

$$\int_{5}^{5.833}\int_{x+\frac{1}{6}}^{6} (dy)\,dx$$

$$= \int_{5}^{5.833} \left(6 - x - \frac{1}{6}\right) dx = 0.3472$$

$\therefore P(|x-y| \leq \frac{1}{6}) = 1 - 2 \times 0.3472$
$= 0.3056$

12) a) $f(x,y) = \begin{cases} xe^{-x(1+y)}, & x \geq 0 \text{ and } y \geq 0 \\ 0, & \text{otherwise} \end{cases}$

$P(X \geq 3) = \int_3^{\infty}\int_0^{\infty} \{xe^{-x(1+y)} dy\} dx$

$= \int_3^{\infty} \cancel{x}e^{-x} \cdot \frac{[e^{-xy}]_0^{\infty}}{-\cancel{x}} dx$

$= -\int_3^{\infty} e^{-x} \times (0-1) dx$

$= \int_3^{\infty} e^{-x} dx$

$= \frac{[e^{-x}]_3^{\infty}}{-1}$

$= \frac{0 - e^{-3}}{-1}$

$= e^{-3} = 0.0498$

b) $f_X(x) = \int_{-\infty}^{\infty} f(x,y) dy$

$= \int_0^{\infty} xe^{-x(1+y)} dy$

$= \cancel{x}e^{-x} \times \frac{[e^{-xy}]_0^{\infty}}{-\cancel{x}}$

$= -e^{-x}[0-1]$

$= e^{-x}$

$f_X(x) = \begin{cases} e^{-x}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$

$$f_Y(y) = \int_{-\infty}^{\infty} f(x,y)\, dx$$

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

$$= x\int_{0}^{\infty} e^{-x(1+y)}\, dx - \int_{0}^{\infty}\left(\int e^{-x(1+y)}\, dx\right) dx$$

$$= \left[\frac{x e^{-x(1+y)}}{-(1+y)}\right]_0^{\infty} + \frac{1}{1+y}\int_{0}^{\infty} e^{-x(1+y)}\, dx$$

$$= 0 + \frac{1}{(1+y)} \left[\frac{e^{-x(1+y)}}{-(1+y)}\right]_0^{\infty}$$

$$= \frac{-1}{(1+y)^2} \times (0-1)$$

$$= \frac{1}{(1+y)^2}$$

$$\therefore f_Y(y) = \begin{cases} \frac{1}{(1+y)^2}, & y \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

$$f_X(x) \cdot f_Y(y) = \begin{cases} \frac{e^{-x}}{(1+y)^2}, & x \geq 0, y \geq 0 \\ 0, & \text{otherwise} \end{cases} \neq f(x,y)$$

So, they are dependent.

c) $$P(\{X > 3\} \cup (Y > 3)) = 1 - P(\{X \leq 3\} \cup \{Y \leq 3\})$$

$$= 1 - \int_0^3 \int_0^3 \{x e^{-x(1+y)}\, dy\}\, dx$$

$$= 1 + \int_0^3 e^{-x} \cdot \left(e^{-xy}\right)_0^3\, dx$$

$$= 1 + \int_0^3 e^{-x} \left(e^{-3x} - 1\right) dx$$

$$= 0.2998$$

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11) a) $p_X(x) = \dfrac{e^{-\mu_1} \mu_1^{x}}{\lfloor x}$ $\quad$ [$\because$ we know $p(x;\mu) = \dfrac{e^{-\mu}\mu^{x}}{\lfloor x}$ for a poisson's distribution]

$p_Y(y) = \dfrac{e^{-\mu_2} \mu_2^{y}}{\lfloor y}$

$\because$ Both of them are independent

$\therefore p(x,y) = p_X(x) \cdot p_Y(y)$

$$p(x,y) = \begin{cases} e^{-\mu_1\mu_2} \dfrac{\mu_1^{x} \cdot \mu_2^{y}}{\lfloor x \lfloor y}, & x, y \in N \\ 0, & \text{otherwise} \end{cases}$$

b) $P(X+Y \leq 1) = p(0,0) + p(0,1) + p(1,0)$

$$= e^{-\mu_1\mu_2} \times \left[\frac{\mu_1^{0} \cdot \mu_2^{0}}{\lfloor 0 \cdot \lfloor 0} + \frac{\mu_1^{0} \cdot \mu_2^{1}}{\lfloor 0 \cdot \lfloor 1} + \frac{\mu_1^{1} \cdot \mu_2^{0}}{\lfloor 1 \lfloor 0} \right]$$

$$= e^{-\mu_1\mu_2} [1 + \mu_2 + \mu_1]$$

c) $P(X+Y=m) = P(X=k, Y=m-k)$ $\quad$ $\dfrac{\lfloor m}{\lfloor k \lfloor m-k}$

$$= \sum_{k=0}^{k=m} e^{-\mu_1\mu_2} \frac{\mu_1^{k} \cdot \mu_2^{m-k}}{\lfloor k \lfloor m-k}$$

$$\cancel{= e^{-\mu_1\mu_2} \sum_{k=0}^{k=m}}$$

$$= e^{-\mu_1\mu_2} \frac{\lfloor m}{\lfloor m} \sum_{k=0}^{k=m} \frac{\mu_1^{k} \cdot \mu_2^{m-k}}{\lfloor k \lfloor m-k}$$

$$= \frac{e^{-\mu_1\mu_2}}{\lfloor m} \sum_{k=0}^{k=m} \binom{m}{k} \mu_1^{k} \cdot \mu_2^{m-k}$$

$$= \frac{e^{-\mu_1\mu_2}}{\lfloor m} \times (\mu_1 + \mu_2)^{m} \quad \left[\because \sum_{k=0}^{m} \binom{m}{k} a^{k} b^{m-k} = (a+b)^{m} \right]$$