Date 20

Uzair Ahmed Mughal.

18K-0179.

Section-C.

Probability

Final Exam.

Letter Grade.

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Q 2 (i)

$P(x<12) = 1 - P(x \geq 12)$

$= 1 - \sum_{12}^{15} \left({}^{15}C_x (0.7)^{x} (0.3)^{15-x} \right).$

$= 1 - 0.29686$

$= 0.70313$

$\mu = np$
$= 15 \times 0.7$
$= 10.5$

$\sigma^2 = npq$
$= 15 \times 0.7 \times 0.3$
$= 3.15$

(ii) $p = 0.2, 0.5, 0.3.$

$P(x=1, x=3, x=4) = \frac{n!}{x_1! \cdot x_2! \cdot x_3!} \cdot P_1^{x_1} \cdot P_2^{x_2} \cdot P_3^{x_3}.$

$= \frac{8!}{1!3!4!} (0.2)^1 (0.5)^3 (0.3)^4.$

$= 0.0567$ Ans

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(iii) $x = 28$
$\lambda = 34$

$$P(x=28) = \frac{e^{-34}(34)^{28}}{28!}$$

$$P(X=28) = 0.0427 \text{ Ans}$$

(iv) $\mu = 65$ $\sigma = 8$

(a) $(x>75)$

$$P(x>75) = \frac{75-65}{8} = 1.25$$

$$P(x>75) = 1 - P(x<75)$$
$$= 1 - P(1.25)$$
$$= 1 - 0.89435$$
$$= 0.10565 \Rightarrow 10.56\%$$

(c) $P(x<50)$

$$= \frac{50-65}{8} = -1.875$$

$P(x < -1.87) =$

$$P(x<50) = 0.0307$$
$$= 3\%$$

(b) $P(50<x<85)$

$$z_1 = \frac{50-65}{8} = -1.875$$

$$z_2 = \frac{85-65}{8} = 2.5$$

$$P(z_1<x<z_2) = P(z_2) - P(z_1)$$
$$= P(2.5) - P(-1.875)$$
$$= 0.99379 - 0.03074$$
$$= 0.96301 \text{ A} = 96.3\%$$

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Date ______ 20

Q3(i) $P(A)=0.8$
$P(B)=0.12$
$P(C)=0.08$

$P(D|A)=0.05$
$P(D|B)=0.02$
$P(D|C)=0.01$

$P(A|D)=?$

$$P(A|D)=\frac{P(A)\times P(D|A)}{P(D)}$$

Defected $\Rightarrow P(D) = P(A)\times P(D|A) + P(B)*P(D|B) + P(C)*P(D|C)$

$= (0.80\times 0.05) + (0.12\times 0.02) + (0.08\times 0.01)$
$= 0.0432$

$$P(A|D)=\frac{(0.80)(0.05)}{(0.0432)}$$

$= 0.925926$ Ans.

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Date 20

Q3 (ii) Box plot.

530 539 542 565 570 575 579 590 593

600 610 610 629 637 651 685 700 710

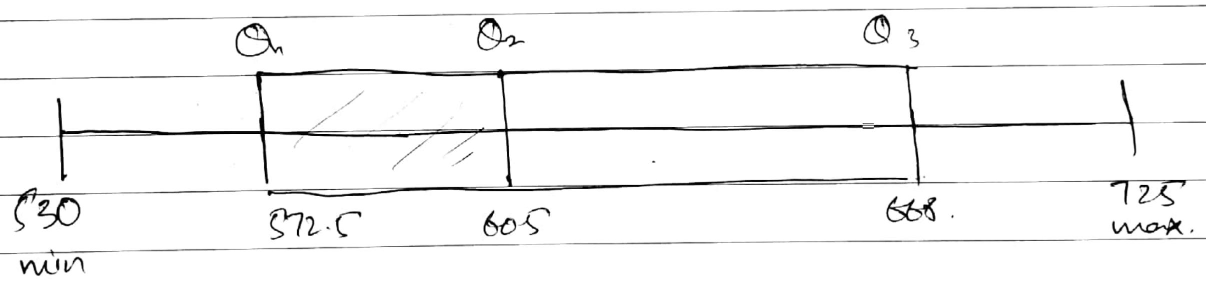
715 725.

Q1 = 570 | Q2 = 600 | Q3 = 685

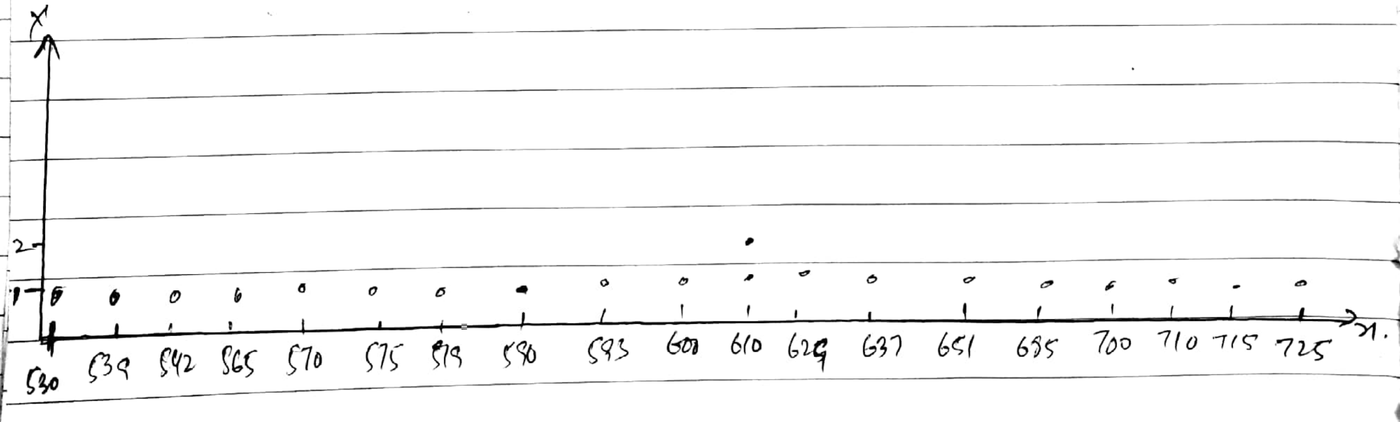
$Q1 = \frac{20}{4} = \frac{570 + 575}{2} = 572.5$

$Q_2 = \frac{20}{2} = \frac{600 + 610}{2} = 605$

$Q_3 = \frac{3 \times 20}{4} = \frac{651 + 685}{2} = 668.$



Dot.



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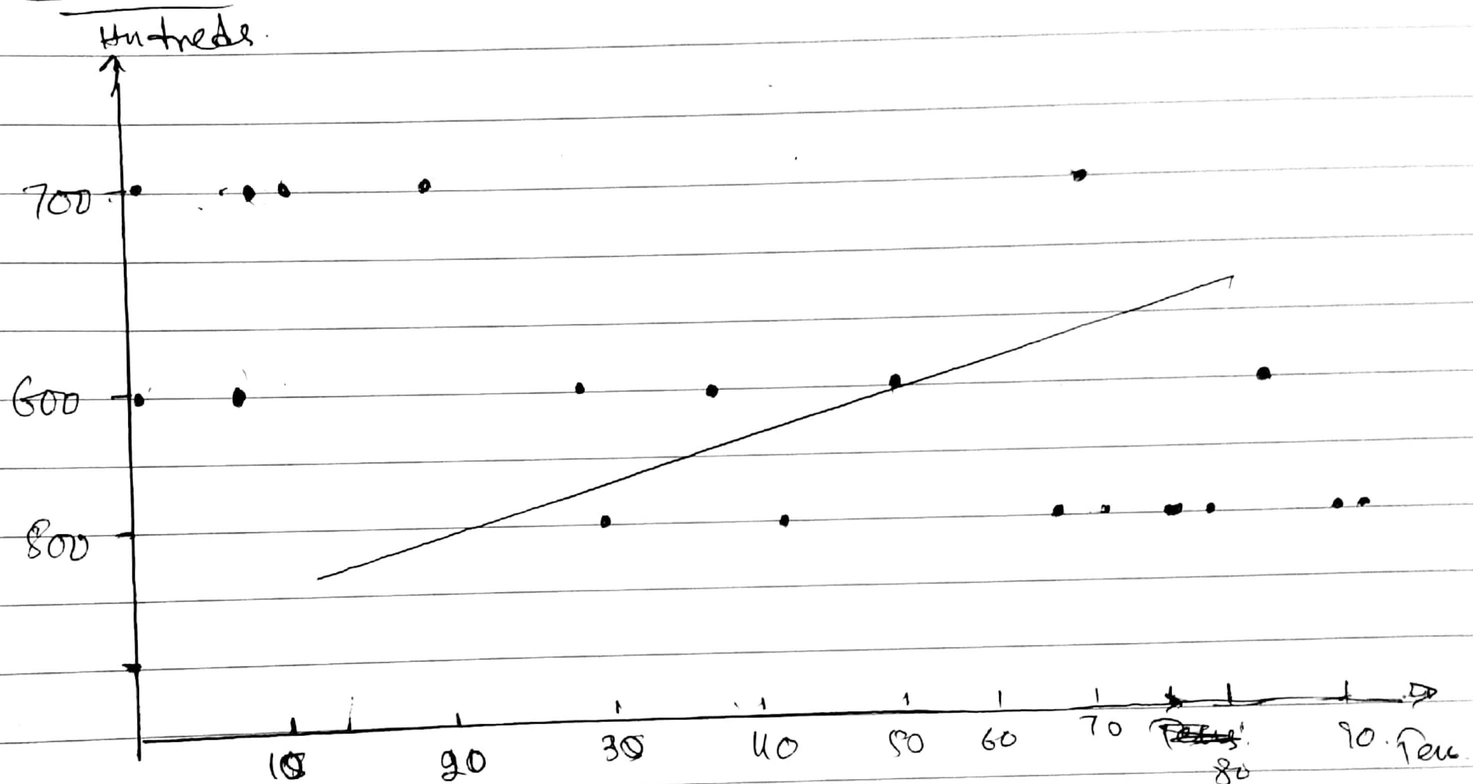
Letter Grade

Date 20

Scatter plot:



⇒ The data in box plot is right skewed because mode > median and mean > mode.

From scatter plot we see we have value mor close to 500–600.

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18K-0278 Section C
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Q4(a) let $\alpha = x$, $\beta = y$

$$f(x,y) = \begin{cases} kxy & , 0<x<4, 1<y<5 \\ 0 & , \text{else where.} \end{cases}$$

① Value of k

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

$$\int_{1}^{5}\int_{0}^{4} kxy\, dx\, dy = 1$$

$$k\int_{1}^{5} \frac{x^2}{2} y \Big|_{0}^{4} = 1$$

$$k\int_{1}^{5} \left[\frac{(4)^2}{2} y - \frac{(0)^2}{2} y \right] = 1$$

$$k\int_{1}^{5} 8y\, dy = 1$$

$$k \frac{\cancel{8}^{4} y^2}{\cancel{2}} \Big|_{1}^{5} = 1$$

$$k\, 4y^2 \Big|_{1}^{5} = 1$$

$$k\left(4(5)^2 - 4(1)^2\right) = 1$$

$$k(100-4) = 1$$

$$\boxed{k = \frac{1}{96}}$$

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Date 20

(b) $\Rightarrow g(x) = \int_1^5 \frac{1}{96} xy \, dy$

$= \frac{1}{96} x \frac{y^2}{2} \Big|_1^5$

$= \frac{1}{96} \left(\frac{x(5)^2}{2} - \frac{x(1)^2}{2} \right)$

$= \frac{1}{96} \left(\frac{25x}{2} - \frac{x}{2} \right)$

$= \frac{1}{96} \left(\frac{24x}{2} \right)$

$= \frac{1}{96} \cdot 12x$

$\boxed{g(x) = \frac{1}{8} x}$ A.

$\Rightarrow h(y) = \int_0^4 \frac{1}{96} xy \, dx$

$= \frac{1}{96} \frac{x^2}{2} y \Big|_0^4$

$= \frac{1}{96} \left(\frac{(4)^2}{2} y - \frac{(0)^2 y}{2} \right)$

$= \frac{1}{96} (8y)$

$\boxed{h(y) = \frac{1}{12} y}$ A.

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Date 20

③ find $(x+y<3)$.

$x+y=3$

$y=3-x$

$$\Rightarrow \int_0^2 \int_1^{3-x} \frac{1}{96} xy \, dy\, dx$$

$$\Rightarrow \int_0^2 \frac{1}{96} x \frac{y^2}{2} \Big|_1^{3-x} dx$$

$$= \frac{1}{96} \int_0^2 x \left\{ \frac{(3-x)^2}{2} - \frac{1}{2} \right\} dx$$

$$= \frac{1}{96} \int_0^2 x \left\{ \frac{9-6x+x^2-1}{2} \right\} dx$$

$$= \frac{1}{96} \int_0^2 \frac{(x^2-6x+8)x}{2} dx$$

$$= \frac{1}{192} \int_0^2 (x^3-6x^2+8x) dx$$

$$= \frac{1}{192} \left[\frac{x^4}{4} - \frac{6x^3}{3} + \frac{8x^2}{2} \right]_0^2$$

$$= \frac{1}{192} \left[\frac{(2)^4}{4} - \frac{6(2)^3}{3} + \frac{8(2)^2}{2} \right]$$

$$= \frac{1}{48}$$

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19k-0179 Section-E
letter Grade.

Uzmughal

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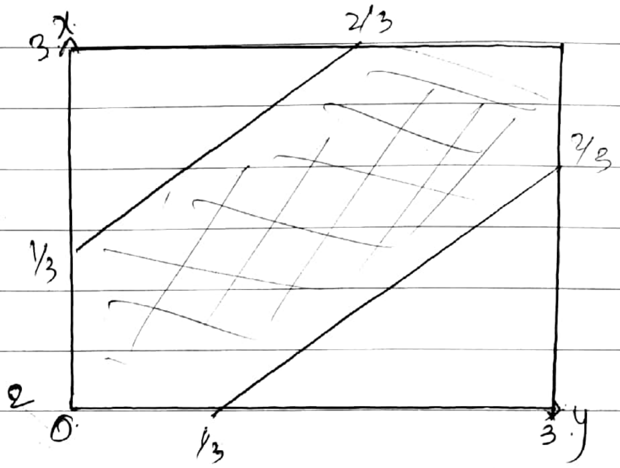
(b)

$|X-Y| \leq 1/3$ ∴ $\frac{2}{60} = 1/3$.



$1-2\left[\frac{1}{2} \times \frac{2}{3} \times \frac{2}{3}\right]$

$= \frac{5}{9}$ Ans

(c) 200 prizes of \$5. $p(\$5) = \frac{200}{8000} = 0.04$.

20 prizes of \$25 $(p\,\$25) = \frac{20}{5000} = 0.004$

~~100~~ 5 prizes for \$100 $p(\$100) = \frac{5}{8000} = 0.001$.

5000 tickets sold. $p(\$0) = 1 - \Sigma P(x)$.

$= 1 - 0.045 = 0.955$

x(dollars)	5	25	100	0.
$p(X=x)$	0.04	0.004	0.001	0.955

$E(x) = (5)(0.04) + (25)(0.004) + (100)(0.001) + (0)(0.955)$

$= 0.4$ Ans