PROB FINAL

Wajahat Ali
K18 0363
Section D.

Q1. i) H_0: μ (Prebody) = μ (Postbody)
H_1: μ (prebody) $\neq$ μ (postbody)
$\alpha = 0.05$

Mean prebody
$= 22.6$
Var Prebody
$= 48.198$

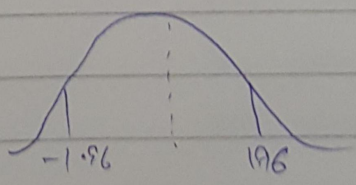
Mean Postbody
$= 26.05$
Var Postbody
$= 31.45993$

$n = 55$

$$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\delta)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma^2}{n_2}}}$$

$= -2.8402$
Z Critical $= \pm 1.96$
$P(Z < Z) = 0.004507$

Accept H_0 at $0.004507 < 1.96$



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ii) Sex & Age

$\mu_1 = 1.509$ $\quad$ $\mu_2 = 51.43$

$\sigma^2 = 0.255$ $\quad$ $\sigma^2 = 28.95$

Z test

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

$Z = \pm 1.96$ (critical value)

$$Z = \frac{(1.509 - 51.43)}{\sqrt{\frac{0.255}{55} + \frac{28.95}{55}}}$$

$$= -68.507$$

H_0 rejected

Not related.

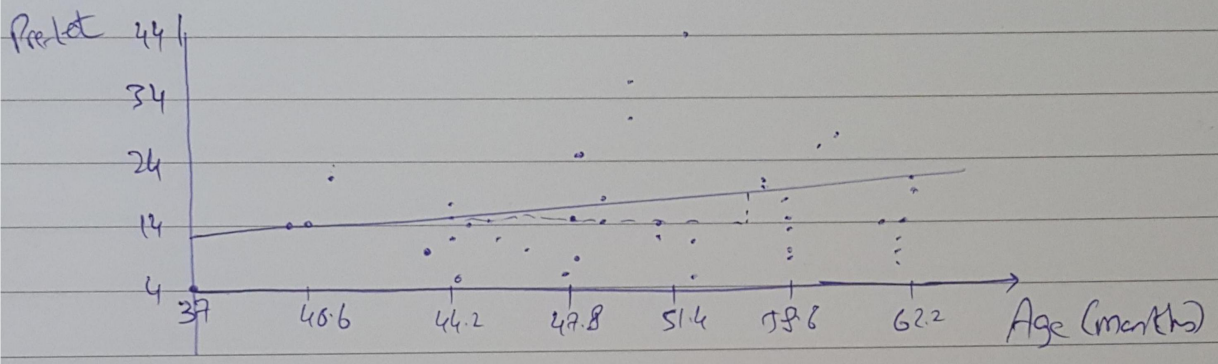
iii)

Independent = Age

Dependent = Pre-Let

Age taken independent as it is not dependent on anything.

Scatter Plot



Regression Line ⇒ $\hat{y} = 0.17775x + 6.30637$

$\hat{y} = bX + a$

Summary:-

$\Sigma x = 2829$

$\Sigma y = 849$

$\bar{x} = 51.4364$

$\bar{y} = 15.4364$

$\Sigma x^2 = 1563.5$

$\Sigma y^2 = 277.53$

Findings:

It can be said that they are moderately related as there are some anomaly point but overall it fits well.

Co-relation Coefficient: 0.43581.

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Q2. i) p = removes stain = 75% = 0.75
q = does not removes stain = 25% = 0.25
n = 16

$$P(X<13) = 1 - \sum_{x=13}^{16} {}^{16}C_x (0.75)^x (0.25)^{16-x}$$

$$P(x<13) = 1 - 0.01022 - 0.053453 - 0.133634 - 0.207876$$
$$= 0.595.$$

~~at $P(X=11) = {}^{16}C_{11} (0.75)^{11} (0.25)^{16-11}$~~
~~$= 0.1801.$~~

at $P(X=11) = \frac{11}{16} \times 100 = 68.75\%$

claim rejected as $68.75\% \neq 75\%$

mean = np = 16 (0.75) = 12
Variance = npq = 16 (0.75)(0.25) = 3.

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Total Customers = 8

Q2 ii) $P(0) = 0.2$ — 1 - 0
$P(1) = 0.5$ — 3 - 1
$P(\geq 2) = 0.3$ — 4 - 2

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

$$= 0.0567.$$

iii) $\frac{\lambda^u e^{-u}}{u!}$ $\lambda = 34$, $u = 28$

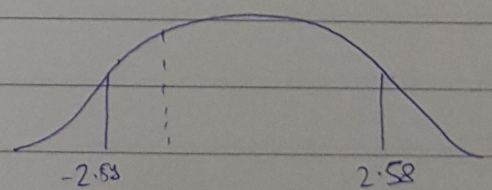
$$= \frac{34^{28} \cdot e^{-34}}{28!} = 0.04278$$

iv) $Z = \frac{\bar{u} - u_0}{s/\sqrt{n}}$ $u_0 = 30$, $n = 30$, $\sigma^2 = 7.344$, $\bar{u} = \frac{883}{30} = 29.45$

$H_0 : u_0 = 30$
$H_1 : u_0 \neq 30$

$Z = \frac{29.45 - 30}{\sqrt{7.344}/\sqrt{30}} = -1.111$, $\alpha = 0.01$

C.V $= \pm 2.58$



Dondt reject H_0.

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Q3. i) $P(A) = 80\% = 0.80$
$P(B) = 12\% = 0.12$
$P(C) = 8\% = 0.08$
$P(F/A) = 5\% = 0.05$
$P(F/B) = 2\% = 0.02$
$P(F/C) = 1\% = 0.01$

$$P(A/F) = \frac{P(F \cap A)}{P(F)} = \frac{P(A).P(F/A)}{P(A).P(F/A) + P(B).P(F/B) + P(C).P(F/C)}$$

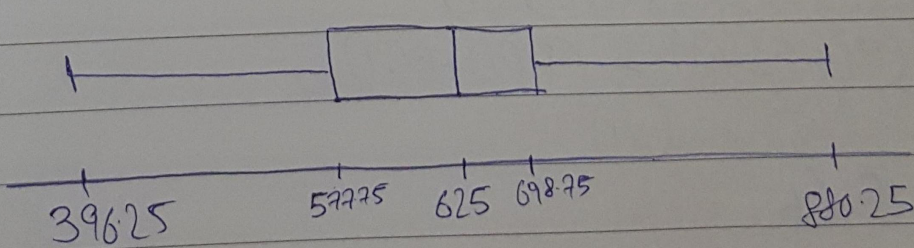
$$= \frac{0.8 \times 0.05}{(0.8 \times 0.05) + (0.12 \times 0.02) + (0.08 \times 0.01)}$$

$$\boxed{P(A/F) = 0.9259}$$

ii) $Q_1 = (n+1/4)^{th} = 5.25^{th} = 577 + 0.25(580-577) = 577.75$
$Q_2 = 2(n+1/4)^{th} = 10.5^{th} = 620 + 0.5(630-620) = 625$
$Q_3 = 3(n+1/4)^{th} = 15.75^{th} = 695 + 0.75(700-695) = 698.75$

$IQR = Q_3 - Q_1 = 121$
$X_{min} = 577.75 - 1.5(121) = 396.25$
$X_{max} = 698.75 + 1.5(121) = 880.25$

Box Plot



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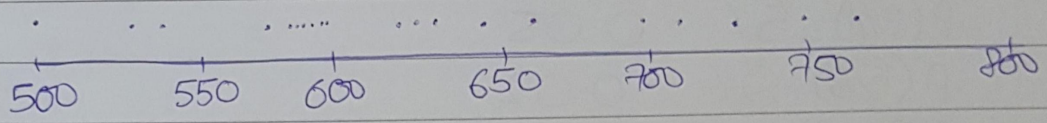
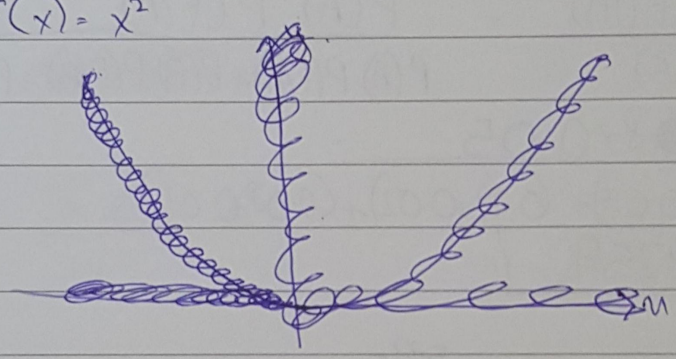
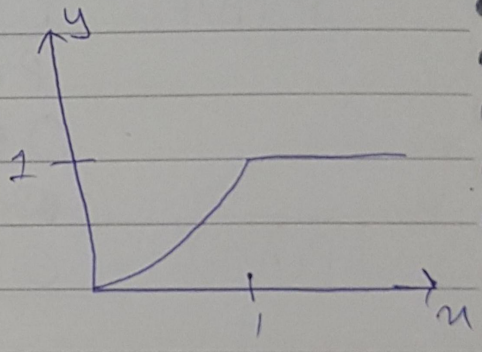
Dot Plot



Q4. a) i. $F(x) = x^2$





ii.

i) $P(1/2 < x \leq 3/4)$

$= F(3/4) - F(1/2)$

$= (3/4)^2 - (1/2)^2$

$= 9/16 - 1/4$

$= 5/16$

ii) $P(1/4 \leq x \leq 2)$

$P(1/4 \leq x \leq 1) + P(1 \leq x \leq 2)$

$= (F(1) - F(1/4)) + (F(2) - F(1))$

$= (1 - (1/4)^2) + (1 - 1)$

$= 15/16$

b) $K = \alpha\beta$

$\therefore K\int_0^4\int_1^5 \alpha\beta \, d\beta \, d\alpha = 1$

$K\int_0^4 \alpha \left|\beta^2/2\right|_1^5 d\alpha = 1$

$K\int_0^4 \alpha(12)\, d\alpha = 1$

$12K\int_0^4 \alpha \, d\alpha = 1$

$12K\left|\alpha^2/2\right|_0^4 = 1$

$96K = 1$

$\boxed{K = 1/96}$

ii $P(\alpha+\beta < 3)$

$P(\alpha < 3-\beta)$

$= \frac{1}{96}\int_0^{3-\beta}\int_1^5 \alpha\beta \, d\beta \, d\alpha$

$= \frac{1}{96}\int_0^{3-\beta} \alpha \left|\beta^2/2\right|_1^5 d\alpha$

$= \frac{1}{96}(12)\int_0^{3-\beta} \alpha \, d\alpha$

$1/8 \left|\alpha^2/2\right|_0^{3-\beta}$

$1/16 (3-\beta)^2$ When $\beta = 1$

$= 1/16 (2)^2$

$= 1/4.$

$\beta \in \mathbb{R} \ni 2.$

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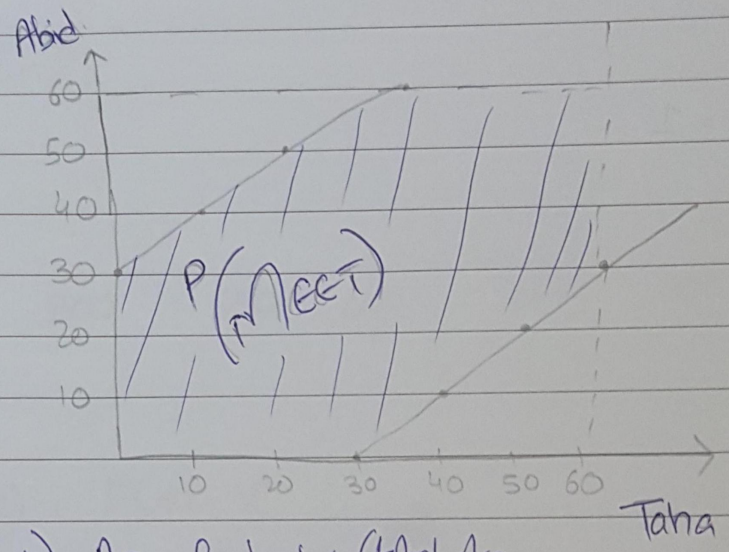
c)



P(meet) = Area of shaded / total Area.

$$P = \frac{(60\times60)-(\frac{1}{2}\times30\times30)-(\frac{1}{2}\times30\times30)}{60\times60}$$

$$= 3/4.$$

There is a probability of 0.75 that they will meet

d)

Prize ($)	Probability	E(x)
6	20/15000 = 0.0133	0.08
25	20/15000 = 0.00133	0.0333
100	5/15000 = 0.00033	0.0333
	Total.	0.14667

reasonable amount would be $0.15 - $0.30.