Q1/ From the table, find the linear regression equation $y = mx + a$.

x	2	4	6	8	10
y	20	40	55	70	85

Solution:

						Sum
Radiation Dose (Gy) x	2	4	6	8	10	30
Growth Inhibiting (%) y	20	40	55	70	85	270
xy	40	160	330	560	850	1940
x^2	4	16	36	64	100	220

$$m = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{5 \times 1940 - 30 \times 270}{5 \times 220 - (30)^2}$$

$$m = \frac{1600}{200} = 8$$

$$a = \bar{y} - m\bar{x} = \frac{270}{5} - 8 \times \frac{30}{5} = 54 - 48 = 6$$

$$y = mx + a = 8x + 6$$

Q2/ A Zionist enemy camp was targeted by an Iranian rocket, resulting in 75 casualties, including:

Injury Type	Mild	Moderate	Severe	Critical	Dead
Number of Casualties	9	12	18	21	15

Calculate the standard deviation.

Solution:

x_i	1	2	3	4	5	Sum
f_i	9	12	18	21	15	75
$P(x_i)$	$\frac{9}{75} = 0.12$	$\frac{12}{75} = 0.16$	$\frac{18}{75} = 0.24$	$\frac{21}{75} = 0.28$	$\frac{15}{75} = 0.2$	1
$x_i P(x_i)$	0.12	0.32	0.72	1.12	1	$\mu = 3.28$
$x_i - \mu$	-2.28	-1.28	-0.28	0.72	1.72	
$(x_i - \mu)^2$	5.1984	1.6384	0.0784	0.5184	2.9584	
$(x_i - \mu)^2 P(x_i)$	0.6238	0.2621	0.0188	0.1452	0.5917	$\sigma^2 = 1.6416$

$$\sigma = \sqrt{1.6416} = 1.2812$$

Q3/ In a population where 10% are colorblind, find the probabilities for a random sample of 25 people: (A) At most 2 are colorblind.

(B) At least 2 are colorblind.

Solution:

$$P(x) = \binom{n}{x} p^x q^{n-x}$$

(A) $x \leq 2 \Rightarrow$ $x = 0$ or 1 or 2 $\Rightarrow$ $P(x \leq 2) = P(0) + P(1) + P(2)$

$$P(x \leq 2) = \binom{25}{0}(0.1)^0(0.9)^{25} + \binom{25}{1}(0.1)^1(0.9)^{24} + \binom{25}{2}(0.1)^2(0.9)^{23}$$

$$= 0.0718 + 0.1995 + 0.2658 = 0.5371$$

$(B) P(x \geq 2) = 1 - P(x \leq 1) = 1 - \big(P(0) + P(1)\big)$

$$= 1 - (0.0718 + 0.1995) = 0.7287$$

Q4/ Let $x \sim N(75, 625)$. Then find:

(A) $P(50 \leq x \leq 100)$.

(B) $P(x > 60)$

Solution:

(A) $z_1 = \dfrac{50 - 75}{25} = -1$, $z_2 = \dfrac{100 - 75}{25} = 1$

$P(50 \leq x \leq 100) = P(z < 1) - P(z < -1) = 0.8413 - 0.1587 = 0.6826$

(B) $P(x > 60) = 1 - P(x \leq 60)$

$$z_1 = \frac{60 - 75}{25} = -0.6$$

$$P(x > 60) = 1 - P(z \leq -0.6) = 1 - 0.2743 = 0.7257$$