

Question 1

Simple random Sampling: When selecting this sample, the items should be randomly selected with no selection criteria applied so that there is an equal chance of selecting a good and a defective item. 10% of 200 will be 20 and therefore, only 20 items will be selected at random from the produced items.

Question 4

$$~~P(x=2) = 0.15~~$$

$$P(x=2) = 0.15$$

$$\begin{aligned} P(x > 3) &= 1 - P(x \leq 3) \\ &= 1 - (0.70 + 0.15 + 0.10) \\ &= 1 - 0.95 \\ &= \underline{\underline{0.05}} \end{aligned}$$

$$P(\text{only one occupant}) = P(x=1) = \underline{\underline{0.70}}$$

$$\begin{aligned} P(\text{fewer than 4 occupants}) &= P(x < 4) \\ &= 1 - P(x \geq 4) \\ &= 1 - (0.03 + 0.02) \\ &= 1 - 0.05 \\ &= \underline{\underline{0.95}} \end{aligned}$$

$$\begin{aligned} \text{Mean of } x &= E(x) = \sum x p(x) \\ &= (1 \times 0.7) + (2 \times 0.15) + (3 \times 0.10) + (4 \times 0.03) + (5 \times 0.02) \\ &= 0.7 + 0.3 + 0.3 + 0.12 + 0.1 \\ &= \underline{\underline{1.52}} \end{aligned}$$

Question 5

$$\begin{aligned}P(x=3) &= (10C3) \times \left(\frac{1}{4}\right)^3 \times \left(\frac{3}{4}\right)^7 \\&= 120 \times 0.002086 \\&= \underline{\underline{0.2503}}\end{aligned}$$

$$P(x \geq 3) = 1 - P(x < 3)$$

$$\begin{aligned}P(x < 3) &= P(x=0) + P(x=1) + P(x=2) \\&= (10C0) \left(\frac{1}{4}\right)^0 \left(\frac{3}{4}\right)^{10} + (10C1) \left(\frac{1}{4}\right) \left(\frac{3}{4}\right)^9 + (10C2) \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right)^8 \\&= (1 \times 1 \times 0.05631) + (10 \times 0.25 \times 0.07508) + (45 \times 0.0625 \times 0.1001) \\&= 0.05631 + 0.1877 + 0.2815 \\&= \underline{\underline{0.5255}}\end{aligned}$$

$$\begin{aligned}P(x \geq 3) &= 1 - 0.5255 \\&= \underline{\underline{0.4745}}\end{aligned}$$

$$\begin{aligned}P(x \geq 7) &= P(x=7) + P(x=8) + P(x=9) + P(x=10) \\&= 0.0030899 + 0.00038623 + 0.0000286 + 0.00 \\&= \underline{\underline{0.003505}}\end{aligned}$$

It will be unusual for the student to pass since the probability that he passes is very low (0.0035)

Question 7

Age (x)	Weight (y)	xy	x ²	y ²
3	50	150	9	2500
4	60	240	16	3600
5	68	340	25	4624
7	70	490	49	4900
8	85	680	64	7225
n = 27	333	1900	163	22845

$$\bar{x} = \frac{1}{n} \sum x = \frac{27}{5} = 5.4$$

$$\bar{y} = \frac{1}{n} \sum y = \frac{333}{5} = 66.6$$

$$SS_{xx} = \sum x^2 - \left(\frac{1}{n} \sum x \right)^2 = 163 - 5.4^2 = 17.2$$

$$SS_{yy} = \sum y^2 - \frac{1}{n} (\sum y)^2 = 22849 - \frac{333^2}{5} = 671.2$$

$$SS_{xy} = \sum xy - \frac{1}{n} \sum x \sum y = 1900 - \frac{(27 \times 333)}{5} = 101.8$$

$$y = mx + b$$

$$m = \frac{SS_{xy}}{SS_{xx}} = \frac{101.8}{17.2} = 5.9186$$

$$b = \bar{y} - \bar{x}m = 66.6 - 5.4 \times 5.9186 \\ = 34.6395$$

$$y = 34.6395 + 5.9186x$$

At $x=10$

$$y = 34.6395 + 5.9186(10) = \underline{\underline{93.8255}}$$

Yes - As age increases, the weight of the dolphin also increases and therefore, this model uses shown data to predict the ~~the~~ exact value following the trend.

Question 8

$$\text{Mean} = \frac{\sum x}{n} = \frac{168.78}{12} = 14.065$$

$$\begin{aligned} \text{sd} &= \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} \\ &= \sqrt{\frac{(14.02 - 14.065)^2 + \dots + (14.12 - 14.065)^2}{12-1}} \\ &= \sqrt{\frac{0.0415}{11}} \\ &= \sqrt{0.003773} \\ &= \underline{\underline{0.0614}} \end{aligned}$$

98% Confidence Interval

$$\begin{aligned} \text{CI} &= \bar{x} \pm z_c \frac{s}{\sqrt{n}} \\ &= 14.065 \pm 2.326 \left(\frac{0.0614}{\sqrt{12}} \right) \\ &= (14.024, 14.106) \end{aligned}$$

Yes - There is a reason for concern
Since the labelled weight of 14.02 is
not covered by the 98% confidence
interval.

Question 9

$$H_0: \mu = 3$$

$$H_a: \mu \neq 3$$

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{3.09 - 3}{2.87/\sqrt{1298}}$$

$$t = 1.13$$

Using $t = 1.13$ and $\alpha = 0.05$,

$$P\text{-value} = 0.2588$$

$P\text{-value} > \alpha \Rightarrow$ Do not reject the H_0 .

There is not enough evidence to claim that the average time people watch TV is different from 3 hours at 5% level of significance.

Question 10

$$H_0: p_0 = 0.45$$

$$H_a: p_0 < 0.45$$

Claim: Alternative hypothesis.

$$Z = \frac{\bar{p} - p_0}{\sqrt{p_0(1-p_0)/n}} = \frac{0.4305 - 0.45}{\sqrt{\frac{0.45(1-0.45)}{1015}}}$$

$$= -1.246$$

Using $Z = -1.246$, $\alpha = 0.05$

$$P\text{-value} = 0.1064.$$

$P\text{-value} > \alpha \Rightarrow$ Do not reject the null hypothesis.

There is not enough evidence to claim that the population proportion is less than 45%.
Support such a tax.