Statistical Inference in Biomedical Engineering
Assignment-01

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Solution-01:

Sol:-

$$\text{Mean cell death rate} = \frac{\text{Total dead cells}}{\text{Total time taken}}$$

$$= \frac{10^6 + 5\times10^6 + 2\times10^6 + 2\times10^6 \text{ (cells)}}{2+8+4+5 \text{ (hrs)}}$$

$$= 0.5263\times10^6 \text{ cells/hr}$$

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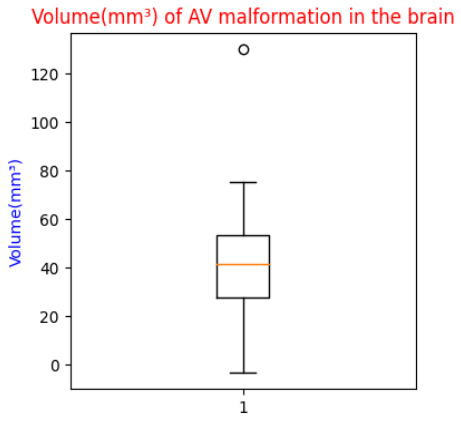
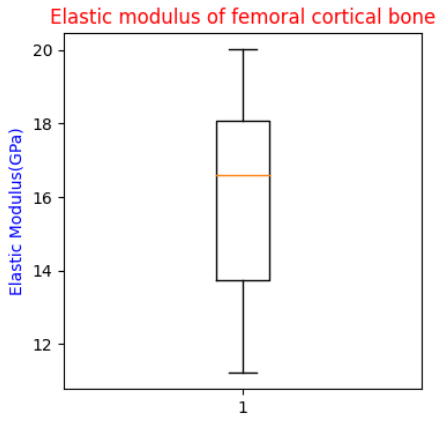
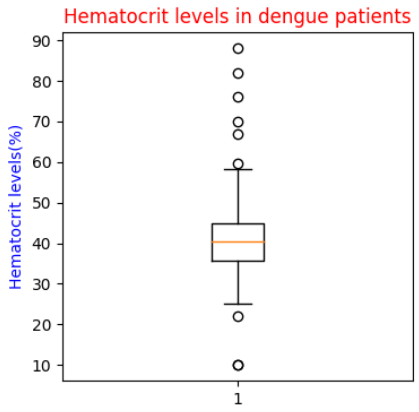
It is better to write it as 5.26×10^5 cells/hr.

Solution-02:

Volume (in mm3) of AV malformation in the brain	lastic modulus (in GPa) of femoral cortical bone	Hematocrit levels (in %) in dengue patients
		

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Volume of AV malformation in the brain	
count	20.000000
mean	43.134744
std	29.118697
min	-3.285399
25%	27.796190
50%	41.563856
75%	53.292637
max	130.000000

Elastic modulus of femoral cortical bone	
count	8.000000
mean	15.972135
std	3.029786
min	11.216731
25%	13.739758
50%	16.582917
75%	18.071467
max	20.012265

Hematocrit levels in dengue patients	
count	200.000000
mean	40.721821
std	9.122184
min	10.000000
25%	35.783991
50%	40.314948
75%	44.924419
max	88.000000

(ii) Justification

(a) Volume (in mm3) of AV malformation in the brain:
The data set for the volume of AV malformations in the brain experiment has outliers. So, the mean will not give an accurate value the median was good for this.

(b) Elastic modulus (in GPa) of femoral cortical bone:
The mean is very sensitive to outliers, and in the data set of the elastic modulus experiment, there are no outliers. So mean is preferred for these experiments.

(c) Hematocrit levels (in %) in dengue patients:
This experiment has most frequent observation and have outliers. So, mode was good choice for this experiment.

which dispersion measure?

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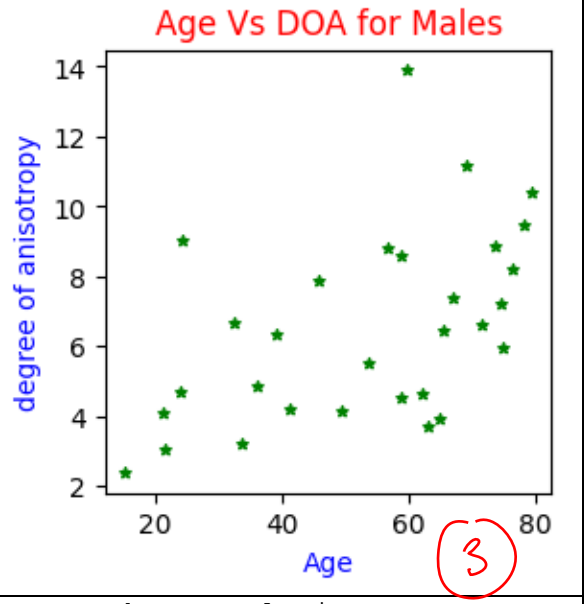
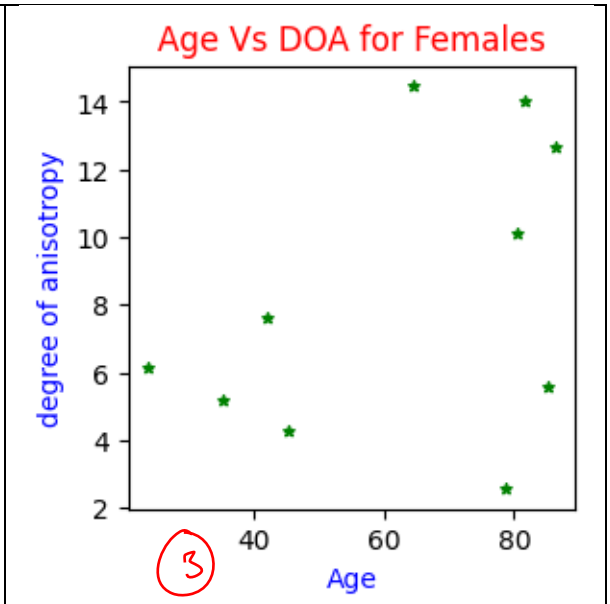
Solution-03:





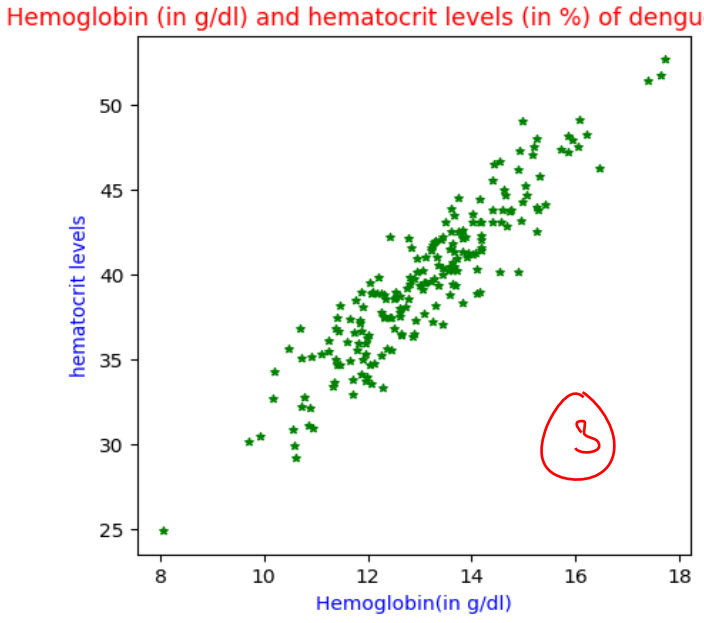
Pearson's correlations:0.502583 Spearmann's correlations:0.531539 Kendall's correlations: 0.391255	Pearson's correlations: 0.393342 Spearmann's correlations: 0.33333 Kendall's correlations: 0.2

Justification:

3a) Degree of anisotropy in compressive strength and age for female and male donors

This scatter plot has outliers, so Pearson correlation gave an overestimated value. But the spearman predicts a better value even if outliers are present. The Spearman correlation was suitable for this experiment.

Solution-3b:

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Pearson's correlations: 0.923156

Spearmann's correlations: 0.9111

Kendall's correlations: 0.74191
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Justification:

This scatter plot has a positive correlation with r = 1, and its positive values indicate a positive association. So, the Pearson correlation can be used for this experiment.

Solution-04:

Sol:-

Data set = { 121, 125, 128, 134, 136, 138, 139, 141, 144, 145, 149, 151 } $N = 12$

(a) Standard error of the Mean:

Std. deviation of sample (σ) $= \sqrt{\frac{1}{(N-1)} \sum_{i=1}^{N} (x_i - \mu)^2}$

$$\text{Mean}(\mu) = \frac{\sum_{i=1}^{N} x_i}{N} = 137.58333333 \simeq 137.5$$

$$\sigma = \frac{1}{(12-1)} \sqrt{(121-137.5)^2 + (125-137.5)^2 + \dots}$$

$\sigma \approx 9.34$ $S = \frac{\sigma}{\sqrt{N}} = \frac{9.34}{\sqrt{12}}$

$$\boxed{S = 2.696}$$

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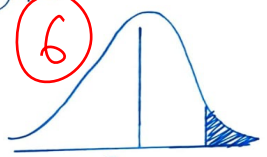

(b) $P(x > 146)$ $Z = \frac{x-\mu}{S} = \frac{146 - 137.5}{2.696}$

$$P\left(\frac{x-\mu}{S} > \frac{146-137.5}{2.696}\right) = P(Z > 3.1528)$$

$$\boxed{P = 0.0008}$$ (from std Normal Table)

Assumptions:- Std. Normal distribution
Symmetric about Mean at $Z = 0$.

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