EXAM OF STATISTICS (DESCRIPTIVE STATISTICS AND REGRESSION)

Pharmacy/Biotechnology 1st year — Version A — **December, 16 2019**

Duration: 1 hour.

(5 pts.) 1. The table below summarizes the time (in minutes) required to remove anesthesia after a surgery in a sample of 50 patients.

Time	Patients
$10-30$	2
$30-45$	11
$45-60$	18
$60-90$	9
$90-120$	8
$120-180$	2

(a) Are there some outliers in the sample?

(b) Compute the mean. Is it representative?

(c) If according to a postoperative protocol the 15% of patients that require more time to remove the anesthesia must be monitored, above what time should a patient be monitored?

(d) If we apply a drug that is anesthesia antagonist, it is known that the time required to remove the anesthesia decreases a 25%. How will the time decrease affect the representativeness of the mean?

(e) If it is known that another type of anesthesia B has mean 50 minutes and standard deviation 15 minutes, what time is relatively greater, 70 minutes with this type of anesthesia or 60 minutes with the type B?.

Use the following sums for the computations: $\sum x_i n_i = 3212.5$ min, $\sum x_i^2 n_i = 249706.25$ min^2, $\sum (x_i - \bar{x})^3 n_i = 1400531.25$ min^3 y $\sum (x_i - \bar{x})^4 n_i = 143958437.7$ min^4.

Solution

(a) $Q_1 = 44.3182$, $Q_3 = 81.6667$, $IQR = 37.3485$, $f_1 = -11.7045$ and $f_2 = 137.6894$. Since the last class contains values above the upper fence, there could be outliers.

(b) $\bar{x} = 64.25$ min, $s^2 = 866.0625$ min^2, $s = 29.4289$ min and $cv = 0.458$ Thus the representativity of the mean is moderate.

(c) $P_{85} = 99.375$ min.

(d) Applying the linear transformation $y = 0.75x$, $\bar{y} = 48.1875$ min, $s_y = 22.0717$ min and $cv = 0.458$. Thus the representativity of the mean is the same.

(e) Standard score in first anesthesia: $z(70) = 0.1954$.
Standard score in anesthesia B: $z(60) = 0.6667$.
Thus, 60 min with anesthesia B is relatively greater.

(5 pts.) 2. The table below summarizes the scores of a group of 10 students in three practical exams of Maths.

Exam 1(X)	Exam 2(Y)	Exam 3(Z)
5.5	3.2	5.0
7.5	6.5	2.0
2.5	4.0	1.0
6.0	4.0	6.0
8.0	7.5	6.0
4.0	3.5	1.0
7.0	5.5	4.0
9.5	10.0	9.0
10.0	9.5	8.0
1.0	3.0	0.5

(a) Which two scores are more linearly correlated?

(b) Using linear models, what are the expected scores of the second and third exams for a student with a score 6.5 in the first exam?

Use the following sums for the computations:
$\sum x_i = 61$, $\sum y_i = 56.7$, $\sum z_i = 42.5$,
$\sum x_i^2 = 449$, $\sum y_i^2 = 382.49$, $\sum z_i^2 = 264.25$,
$\sum x_i y_j = 405.85$, $\sum x_i z_j = 327$, $\sum y_j z_j = 295$.

Solution

(a) $\bar{x} = 6.1$, $s_x^2 = 7.69$,
$\bar{y} = 5.67$, $s_y^2 = 6.1001$,
$\bar{z} = 4.25$, $s_z^2 = 8.3625$,
$s_{xy} = 5.998$, $s_{xz} = 6.775$, $s_{yz} = 5.4025$,
$r_{xy}^2 = 0.7669$, $r_{xz}^2 = 0.7138$ and $r_{yz}^2 = 0.5722$.
Thus, the two variables more linearly related are X and Y, since their coefficient of determination is greater.

(b) Regression line of Y on X: $y = 0.9122 + 0.78x$ and $y(6.5) = 5.982$.
Regression line of Z on X: $z = -1.1242 + 0.881x$ and $z(6.5) = 4.6024$.
