CHAPTER V

FREQUENCY ANALYSIS OF LARGE SAMPLES AND SMALL SAMPLES

EXERCISES V **05.03.2002**

PROBLEM 1

Following crack loads (kg) are measured in the tests on wooden beams:

175 235 210 155 200 145 210 205 150 170

a) Plot the cumulative frequency distribution of the crack load.
b) Compute the mean, standard deviation and coefficient of variation of the crack load.
c) Estimate the median and interquartile range.
d) Compute of the coefficient of skewness and the quartile skewness coefficient.

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EXERCISES V SOLUTIONS 05.03.2002

SOLUTION 1

a)

$f(x_i) = n_i / (N+1)$

$$F(x_i) = [\sum_{j=1}^{i} n_j] / N = \sum_{j=1}^{i} f(x_j)$$

Crack Load (kg)	175	235	205	210	155	200	145	150	170
n_i	1	1	1	2	1	1	1	1	1
N	10								
$f(x) = n_i/(N+1)$	1/11	1/11	1/11	1/11	1/11	1/11	1/11	1/11	1/11
$F(x) = \Sigma f(x_j)$	1/11	2/11	3/11	4/11	5/11	6/11	7/11	8/11	9/11

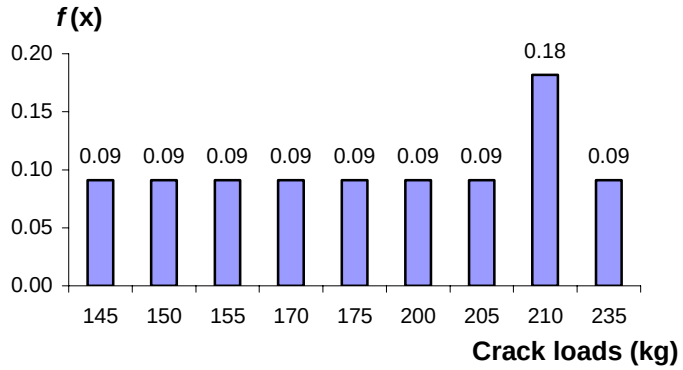

Fig. 1: frequency graph of the crack loads

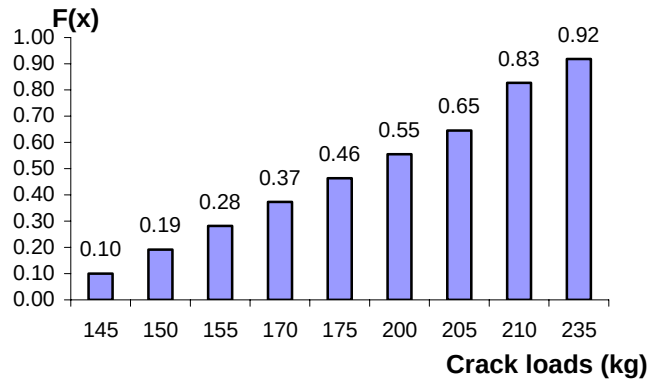

Fig. 2: Cumulative frequency distribution of the crack loads

b)

$$x_m = [\sum_{i=1}^{N} x_i] / N = x_m = [\sum_{i=1}^{m} x_i * n_i] / N = \sum_{i=1}^{m} x_i * f_i$$

=175*0,1+235*0,1 +205*0,1 + 210*0,2 + 155*0,1 + 200*0,1 + 145*0,1 + 150*0,1 + 170*0,1

$x_m = 185,5\ kg$

$$Var(X) = \sum_{i=1}^{N}(x_i - x_m)^2/(N-1) = [\sum_{i=1}^{m} x_i^2 * n_i/(N-1)] - x_m^2 = \{[\sum_{i=1}^{m} x_i^2 * f_i] - x_m^2\} * 10/9$$

Var(X) = {[175^2*0,1 + 235^2*0,1 + 205^2*0,1 + 210^2*0,2 + 155^2*0,1 + 200^2*0,1 + 145^2*0,1 + 150^2*0,1 +170^2*0,1**] – 185,5^2} * 10/9**

$Var(X) = 935,83\ kg^2$

$$s_X = [Var(X)]^{1/2}$$

$S_X = 30,59\ kg$

$$C_{vX} = s_X / x_m$$

$C_{vX} = 30,59/185,5 = 0,17$

c)

145	150	155	170	**175**	**200**	205	210	210	235

M(x) = (175+200)/2

M(x) = 187,5 kg

IRQ = $X_{0,75} - X_{0,25}$

IRQ = (205+210)/2 – (150+155)/2

IRQ = 55 kg

d)

$C_{sX} = M_X^3 / S_x^3$

$$C_{sX} = \{N/[(N-1)(N-2)]\} * \{[\sum_{i=1}^{N}(x_i - x_m)^3] / s_X^3\}$$

$C_{sX} = 0,081$

$$q_{sX} = [(X_{0,75} - X_{0,50}) - (X_{0,50} - X_{0,25})] / (X_{0,75} - X_{0,25})$$

q_{sX} = [207,5 –175-(175-152,5)] / (207,5-152,5)

$q_{sX} = 0,18$