

Uitwerking 13-10-197

① a) genormeerd: $\int_{-a}^0 f(x) dx = 1$

$$\int_2^4 A(1 - (x-3)^2) dx = A(-5\frac{1}{3} + 6\frac{2}{3}) = \frac{1}{3}A = 1 \Rightarrow A = \frac{3}{4}$$

b) $M = \int_{-a}^0 x f(x) dx = \int_2^4 \frac{3}{4} (-x^2 + 6x - 9) x dx = 3$

c) $\sigma^2 = \overline{x^2} - \bar{x}^2$
 $\overline{x^2} = \int_2^4 \frac{3}{4} x^2 (-x^2 + 6x - 9) dx = 9\frac{1}{5}$
 $\bar{x}^2 = 3^2 = 9$
 $\sigma^2 = 9\frac{1}{5} - 9 = \frac{1}{5} \Rightarrow \sigma = \sqrt{\frac{1}{5}} = \frac{1}{5}\sqrt{5}$

② a) $N=7$ $m = \frac{1}{N} \sum_{i=1}^N x_i = \frac{1}{7} (1101 + 1100 + 1097 + 1099 + 1102 + 1100 + 1101) = 1100 \text{ mm}$

b) $s_m^2 = \frac{\sum (x_i - m)^2}{N(N-1)} = \frac{1^2 + 0^2 + 3^2 + 1^2 + 2^2 + 0^2 + 1^2}{7 \cdot 6} = \frac{8}{21} \text{ mm}^2$

$s_m \approx 0.6 \text{ mm}$

c) A: $l = (1100,0 \pm 0,6) \text{ mm}$ B: $l = (1102,0 \pm 0,8) \text{ mm}$, $w_i = \frac{1}{s_i^2}$
 $\bar{l} = \frac{l_A w_A + l_B w_B}{w_A + w_B} = \frac{1100,0 \frac{1}{(0,6)^2} + 1102,0 \frac{1}{(0,8)^2}}{\frac{1}{(0,6)^2} + \frac{1}{(0,8)^2}} = 1100,8 \text{ mm}$

$\frac{1}{s_{\bar{l}}^2} = \frac{1}{s_A^2} + \frac{1}{s_B^2} \Rightarrow s_{\bar{l}}^2 = 0,5 \text{ mm} \Rightarrow \bar{l} = (1100,8 \pm 0,5) \text{ mm}$

③ a) $r_{ico} = \frac{mg}{cL} = a$
 $\sum_{i=1}^n D_i^2 = \sum (u_i - a h_i)^2 = \text{Minimaal}$
 $\frac{\partial}{\partial a} : \sum 2(u_i - a h_i)(-h_i) = 0$
 $\sum u_i h_i - a \sum h_i^2 = 0$

delen door N $\overline{u h} - a \overline{h^2} = 0 \Rightarrow a = \frac{\overline{u h}}{\overline{h^2}} = \frac{mg}{cL}$

b) $\overline{u h} = \frac{\sum u_i h_i}{N} = 481,92$ $\overline{h^2} = \frac{\sum h_i^2}{N} = 379,17$

$a = \frac{481,92}{379,17} = 1,27$

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$$\textcircled{3} \textcircled{c} \quad a = (1,27 \pm 0,01) \quad , \quad a = \frac{mg}{cL} \quad , \quad c = \frac{mg}{aL} \quad \left(\frac{N}{m} \right)$$

$$s_c^2 = \left(\frac{\partial c}{\partial m} \right)^2 s_m^2 + \left(\frac{\partial c}{\partial L} \right)^2 s_L^2 + \left(\frac{\partial c}{\partial a} \right)^2 s_a^2$$

$$= \left(\frac{g}{aL} \right)^2 s_m^2 + \left(-\frac{mg}{L^2 a} \right)^2 s_L^2 + \left(-\frac{mg}{La^2} \right)^2 s_a^2$$

$$\Rightarrow s_c = 0,025 \quad \frac{N}{m}$$

$$\Rightarrow c = (3,17 \pm 0,03) \quad \frac{N}{m}$$