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**FAKULTA INFORMATIKY A STATISTIKY**  
Katedra statistiky a pravděpodobnosti

# **STATISTIKA**

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# Popisná statistika

$$p_i = \frac{n_i}{n} \quad \sum_{i=1}^k n_i = n \quad \sum_{i=1}^k p_i = 1 \quad i = 1, 2, \dots, k$$

$$n \cdot \frac{p}{100} < z_p < n \cdot \frac{p}{100} + 1$$

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} \quad \bar{x} = \frac{\sum_{i=1}^k x_i n_i}{n} \quad \bar{x} = \sum_{i=1}^k x_i p_i \quad \bar{x} = \frac{\sum_{i=1}^n x_i w_i}{\sum_{i=1}^n w_i}$$

$$\bar{x}_H = \frac{n}{\sum_{i=1}^n \frac{1}{x_i}} \quad \bar{x}_H = \frac{\sum_{i=1}^n w_i}{\sum_{i=1}^n \frac{w_i}{x_i}} \quad \bar{x}_H = \frac{1}{\sum_{i=1}^n \frac{p_i}{x_i}}$$

$$\bar{x}_G = \sqrt[n]{\prod_{i=1}^n x_i} = \sqrt[n]{x_1 \cdot x_2 \cdot \dots \cdot x_n} \quad \bar{x}_G = \sum w_i \sqrt[n]{\prod_{i=1}^n x_i^{w_i}}$$

$$R = x_{\max} - x_{\min}$$

$$R_Q = \tilde{x}_{75} - \tilde{x}_{25}$$

$$s_x^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n} \quad s_x^2 = \overline{x^2} - \bar{x}^2 = \frac{\sum_{i=1}^n x_i^2}{n} - \left( \frac{\sum_{i=1}^n x_i}{n} \right)^2$$

$$s_x^2 = \frac{\sum_{i=1}^k (x_i - \bar{x})^2 n_i}{\sum_{i=1}^k n_i} \quad s_x^2 = \frac{\sum_{i=1}^k x_i^2 n_i}{n} - \left( \frac{\sum_{i=1}^k x_i n_i}{n} \right)^2$$

$$s_x^2 = \sum_{i=1}^k (x_i - \bar{x})^2 p_i \quad s_x^2 = \sum_{i=1}^k x_i^2 p_i - \left( \sum_{i=1}^k x_i p_i \right)^2$$

$$s_x^2 = \overline{s^2} + s_{\bar{x}}^2 = \frac{\sum_{i=1}^k s_i^2 n_i}{\sum_{i=1}^k n_i} + \frac{\sum_{i=1}^k (\bar{x}_i - \bar{x})^2 n_i}{\sum_{i=1}^k n_i} \quad \bar{x} = \frac{\sum_{i=1}^k \bar{x}_i n_i}{n}$$

$$s_x^2 = \sum_{i=1}^k s_i^2 p_i + \sum_{i=1}^k (\bar{x}_i - \bar{x})^2 p_i \quad \bar{x} = \sum_{i=1}^k \bar{x}_i p_i$$

$$s_x = \sqrt{s_x^2} \quad V_x = \frac{s_x}{\bar{x}}$$

$$v = 1 - p_{Mo} = 1 - n_{Mo} / n$$

$$nomvar = 1 - \sum_{i=1}^k p_i^2 = \sum_{i=1}^k (p_i(1-p_i)) \quad nomvar = 1 - \sum_{i=1}^k \left(\frac{n_i}{n}\right)^2 = \frac{n^2 - \sum_{i=1}^k n_i^2}{n^2}$$

$$norm. nomvar = k \cdot nomvar / (k-1),$$

$$H = -\sum_{i=1}^k p_i \ln p_i$$

$$H^* = H / \ln k$$

$$dorvar = 2 \sum_{i=1}^{k-1} P_i(1-P_i)$$

$$norm. dorvar = 2 \cdot dorvar / (k-1).$$

## Analýza závislostí

### Korelační analýza

$$r_{yx} = r_{xy} = \frac{s_{xy}}{s_x s_y} = \frac{\overline{xy} - \bar{x}\bar{y}}{\sqrt{(\overline{x^2} - \bar{x}^2) \cdot (\overline{y^2} - \bar{y}^2)}}$$

### Analýza rozptylu

$$S_y = \sum_{i=1}^k \sum_{j=1}^{n_i} (y_{ij} - \bar{y})^2 = S_{y,m} + S_{y,v}$$

$$S_{y,m} = \sum_{i=1}^k (\bar{y}_i - \bar{y})^2 n_i \quad S_{y,v} = \sum_{i=1}^k \sum_{j=1}^{n_i} (y_{ij} - \bar{y}_i)^2$$

$$P^2 = \frac{S_{y,m}}{S_y} \quad P = \sqrt{P^2}$$

### Kontingenční tabulka (r x s)

$$n_{i+} = \sum_{j=1}^s n_{ij} \quad n_{+j} = \sum_{i=1}^r n_{ij} \quad n'_{ij} = \frac{n_{i+} n_{+j}}{n}$$

$$G = \sum_{i=1}^r \sum_{j=1}^s \frac{(n_{ij} - n'_{ij})^2}{n'_{ij}} \quad C = \sqrt{\frac{G}{n+G}} \quad V = \sqrt{\frac{G}{n(m-1)}} \quad m = \min \{r, s\}$$

### Regresní analýza

$$b_{yx} \cdot b_{xy} = r_{yx}^2 \quad |r_{yx}| = \sqrt{R^2}$$

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## Časové řady

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$$\bar{y} = \frac{\sum_{t=1}^n y_t}{n} \qquad \bar{y} = \frac{\frac{y_1 + y_2}{2} + \frac{y_2 + y_3}{2} + \dots + \frac{y_{n-1} + y_n}{2}}{n-1} = \frac{\frac{1}{2}y_1 + \sum_{t=2}^{n-1} y_t + \frac{1}{2}y_n}{n-1}$$

$$\bar{y} = \frac{\sum_{t=1}^n y_t d_t}{\sum_{t=1}^n d_t} \qquad \bar{y} = \frac{\frac{y_1 + y_2}{2}d_2 + \frac{y_2 + y_3}{2}d_3 + \dots + \frac{y_{n-1} + y_n}{2}d_n}{\sum_{t=2}^n d_t}$$

$$\Delta y_t = y_t - y_{t-1} \qquad \bar{\Delta} = \frac{\sum_{t=2}^n \Delta y_t}{n-1} = \frac{y_n - y_1}{n-1}$$

$$\delta_t = \frac{\Delta y_t}{y_{t-1}} = \frac{y_t - y_{t-1}}{y_{t-1}} = \frac{y_t}{y_{t-1}} - 1$$

$$k_t = \frac{y_t}{y_{t-1}} \qquad \bar{k} = \sqrt[n-1]{\prod_{t=2}^n k_t} = \sqrt[n-1]{\frac{y_n}{y_1}}$$

$$\hat{T}_t = \frac{y_{t-p} + y_{t-p+1} + \dots + y_t + \dots + y_{t+p-1} + y_{t+p}}{m} = \frac{\sum_{i=-p}^p y_{t+i}}{m}$$

$$\hat{T}_t = \frac{y_{t-p} + 2y_{t-p+1} + \dots + 2y_t + \dots + 2y_{t+p-1} + y_{t+p}}{2m}$$

$$I_{t/1} = \frac{y_t}{y_1} = I_{2/1} \cdot I_{3/2} \cdot \dots \cdot I_{t/t-1} \qquad I_{t/t-1} = \frac{y_t}{y_{t-1}} = \frac{I_{t/1}}{I_{t-1/1}}$$

## Indexní analýza

$$Q = p \cdot q$$

$$i_p = \frac{p_1}{p_0} \quad \Delta p = p_1 - p_0 \quad i_q = \frac{q_1}{q_0} \quad \Delta q = q_1 - q_0 \quad i_Q = \frac{Q_1}{Q_0} \quad \Delta Q = Q_1 - Q_0$$

$$I_q = \frac{\sum q_1}{\sum q_0} = \frac{\sum i_q q_0}{\sum q_0} = \frac{\sum q_1}{\sum \frac{q_1}{i_q}} \quad \Delta_q = \sum q_1 - \sum q_0$$

$$I_Q = \frac{\sum Q_1}{\sum Q_0} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \quad \Delta Q = \sum Q_1 - \sum Q_0$$

$$I_p = \frac{\bar{p}_1}{\bar{p}_0} = \frac{\frac{\sum Q_1}{\sum q_1}}{\frac{\sum Q_0}{\sum q_0}} = \frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}} = \frac{\frac{\sum Q_1}{p_1}}{\frac{\sum Q_0}{p_0}} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \cdot \frac{\sum p_0 q_1}{\sum q_1} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \cdot \frac{\sum p_1 q_1}{\sum p_1 q_0}$$

$$\Delta p = \bar{p}_1 - \bar{p}_0 = \frac{\sum p_1 q_1}{\sum q_1} - \frac{\sum p_0 q_0}{\sum q_0}$$

$$I_Q = I_p \cdot I_q$$

$$I_p^{(L)} = \frac{\sum p_1 q_0}{\sum p_0 q_0} = \frac{\sum i_p p_0 q_0}{\sum p_0 q_0} = \frac{\sum i_p Q_0}{\sum Q_0} \quad I_p^{(P)} = \frac{\sum p_1 q_1}{\sum p_0 q_1} = \frac{\sum p_1 q_1}{\sum \frac{p_1 q_1}{i_p}} = \frac{\sum Q_1}{\sum \frac{Q_1}{i_p}}$$

$$I_p^{(F)} = \sqrt{I_p^{(L)} \cdot I_p^{(P)}}$$

$$I_q^{(L)} = \frac{\sum p_0 q_1}{\sum p_0 q_0} = \frac{\sum i_q p_0 q_0}{\sum p_0 q_0} = \frac{\sum i_q Q_0}{\sum Q_0} \quad I_q^{(P)} = \frac{\sum p_1 q_1}{\sum p_1 q_0} = \frac{\sum p_1 q_1}{\sum \frac{p_1 q_1}{i_q}} = \frac{\sum Q_1}{\sum \frac{Q_1}{i_q}}$$

$$I_q^{(F)} = \sqrt{I_q^{(L)} \cdot I_q^{(P)}}$$

$$I_Q = \frac{\sum Q_1}{\sum Q_0} = \frac{\sum p_1 q_1}{\sum p_0 q_0} = \quad \Delta Q = \sum p_1 q_1 - \sum p_0 q_0$$

$$I_Q = I_p^{(L)} \cdot I_q^{(P)}$$

$$I_Q = I_p^{(P)} \cdot I_q^{(L)}$$