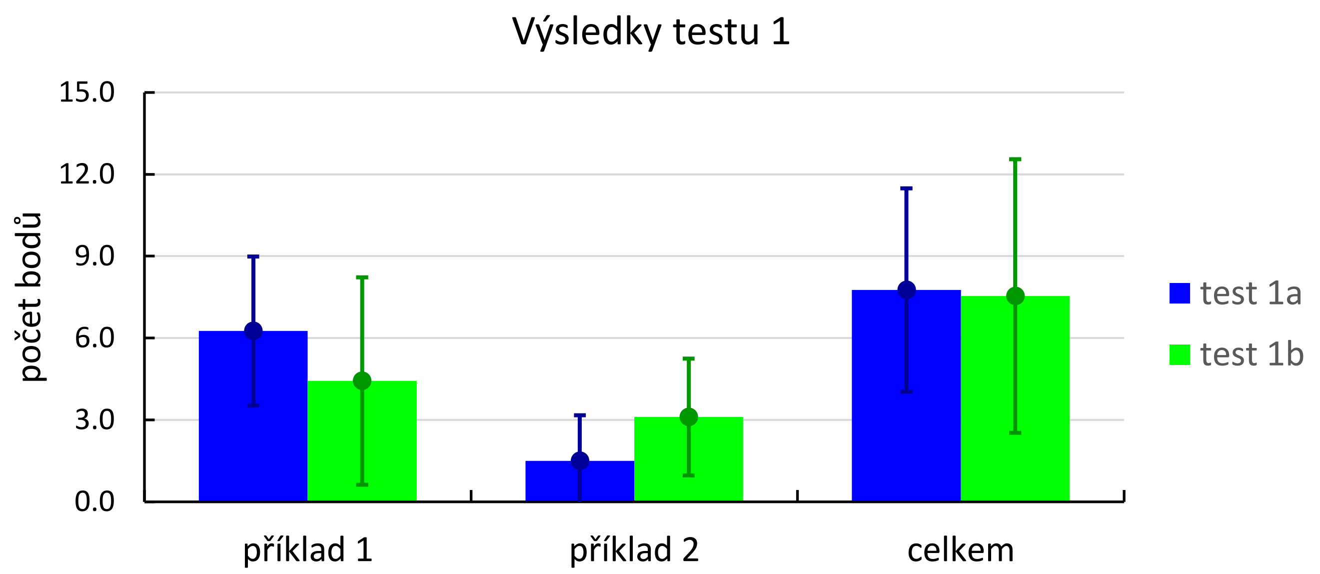
Výsledky testu 1

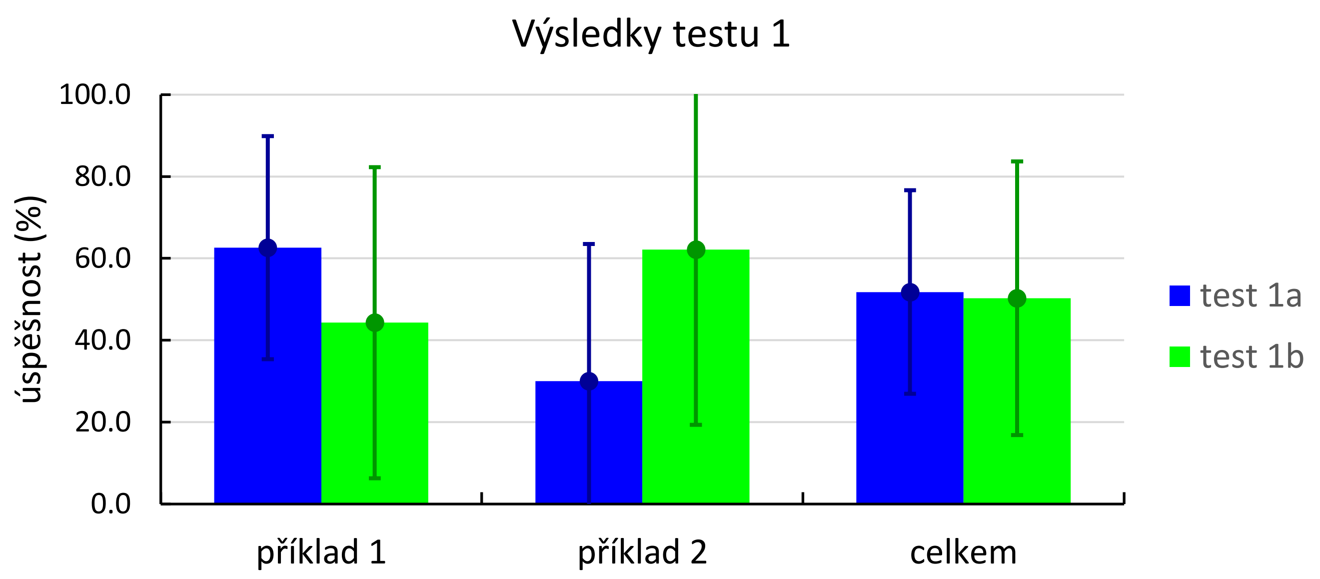
- test 1a
  skupina 1 (29. 11., 9:00)

  (8 ± 4) bodů

- test 1b
  skupina 2 (30. 11., 8:10)

  (8 ± 5) bodů





Příklad 1a – výsledky testu 1a

- test 1a – skupina 1 (29. 11., 9:00)
- x – odhadovaný počet bodů

$$N = 19$$

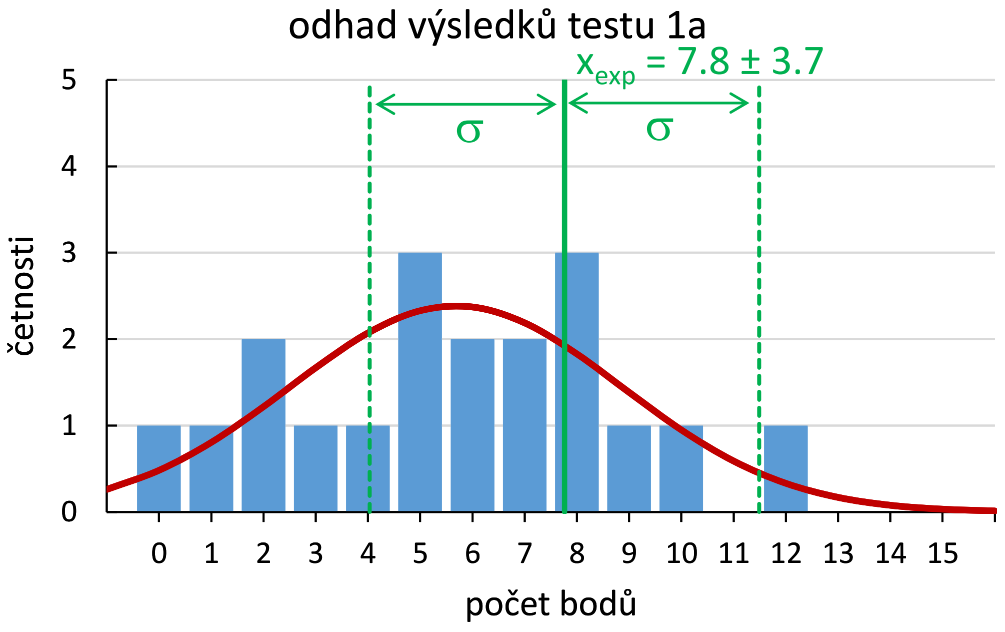
$$\hat{\mu}_x = 5.7 \qquad \hat{\sigma}_x = 3.2$$

- histogram hodnot x

$$f(x) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}^2}} \exp\left[-\frac{(x-\hat{\mu}_x)^2}{2\hat{\sigma}^2}\right]$$

- skutečný počet bodů

$$\hat{\mu}_{exp} = 7.8 \qquad \hat{\sigma}_{exp} = 3.7$$



Příklad 1a – výsledky testu 1a

- test 1a – skupina 1 (29. 11., 9:00)

- $\bar{x}$ – odhadovaný průměrný počet bodů

$$N = 19$$

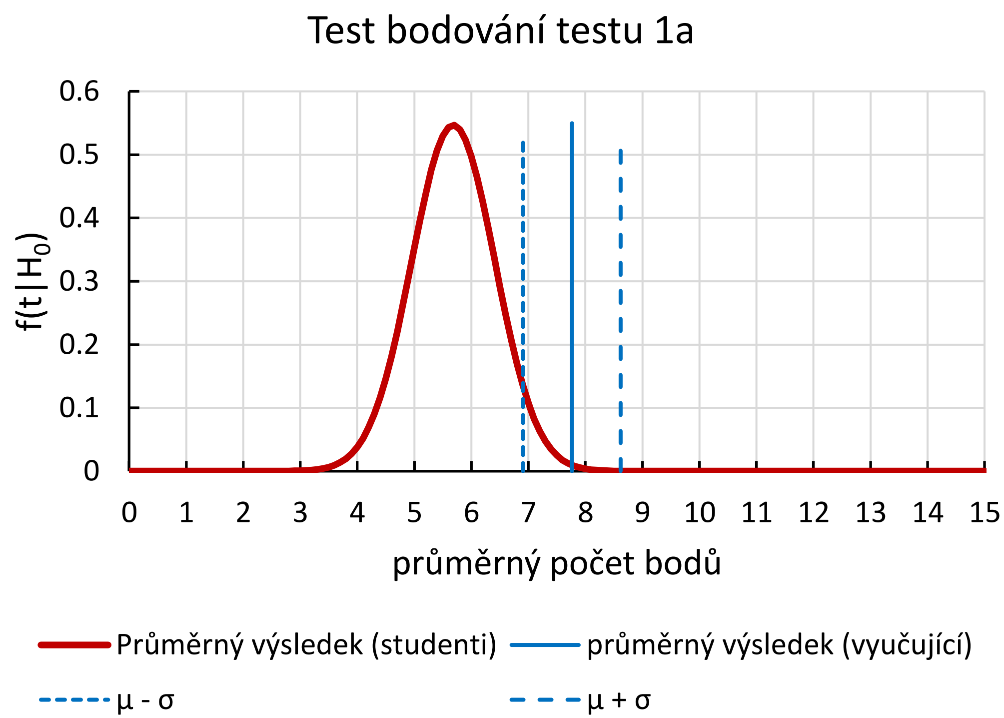
$$\hat{\mu}_{\bar{x}} = 5.7 \qquad \hat{\sigma}_{\bar{x}} = \frac{\hat{\sigma}_x}{\sqrt{N}} = 0.7$$

- hustota pravděpodobnosti $\bar{x}$

$$f(\bar{x}) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}_{\bar{x}}{}^2}} \exp\left[-\frac{(\bar{x}-\hat{\mu}_{\bar{x}})^2}{2\hat{\sigma}_{\bar{x}}{}^2}\right]$$

- skutečný počet bodů

$$\hat{\mu}_{avg} = 7.8 \qquad \hat{\sigma}_{avg} = 0.9$$



Příklad 1a – výsledky testu 1a

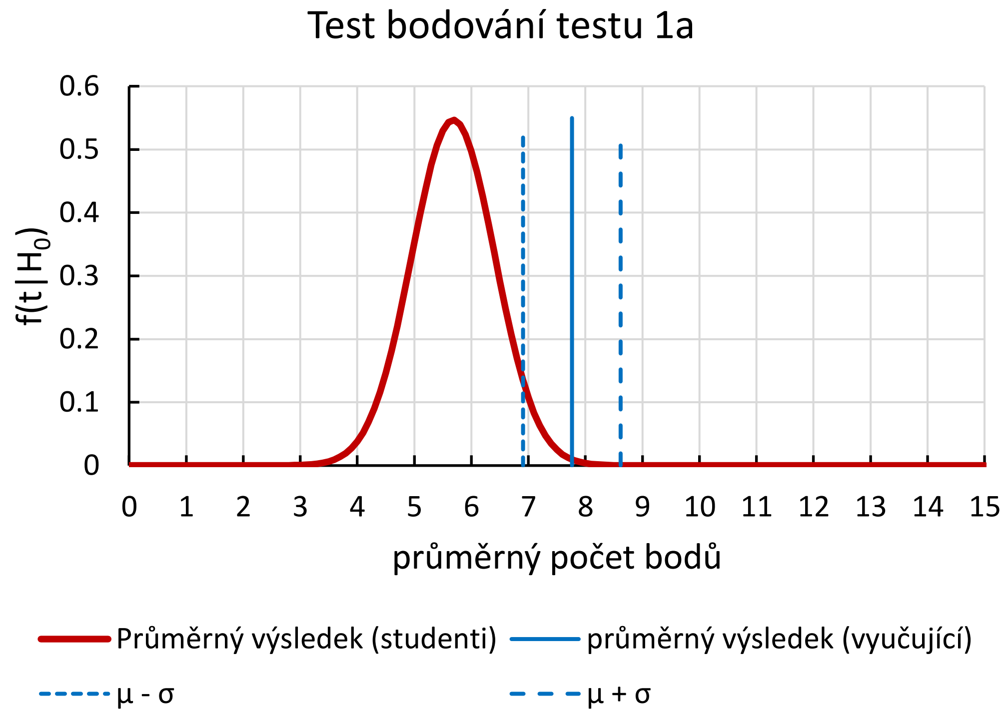
- test 1a – skupina 1 (29. 11., 9:00)
- Nulová hypotéza H_0

  Hodnocení testu bylo spravedlivé.

- testovací statistika ($\hat{\mu}_{\bar{x}} = 5.7$, $\hat{\sigma}_{\bar{x}} = 0.7$)

$$f(\bar{x}|H_0) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}_{\bar{x}}^{\,2}}} \exp\left[-\frac{(\bar{x}-\hat{\mu}_{\bar{x}})^2}{2\hat{\sigma}_{\bar{x}}^{\,2}}\right]$$

- testovací proměnná (t-hodnota)



$$t_1 = \hat{\mu}_{avg} - \hat{\sigma}_{avg} = 6.9 \qquad P(\bar{x} > t_1) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_1 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 4.7\%$$

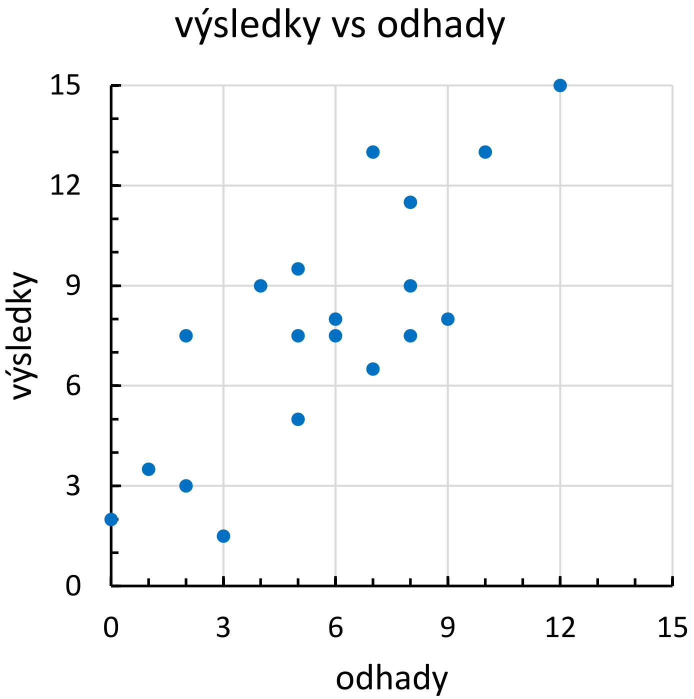
$$t_2 = \hat{\mu}_{avg} = 7.8 \qquad P(\bar{x} > t_2) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_2 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 0.2\%$$

$$t_3 = \hat{\mu}_{avg} + \hat{\sigma}_{avg} = 8.6 \qquad P(\bar{x} > t_3) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_3 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 0.003\%$$

Příklad 2a – korelace veličin skupiny 1

- x – počet bodů z testu (výsledek)

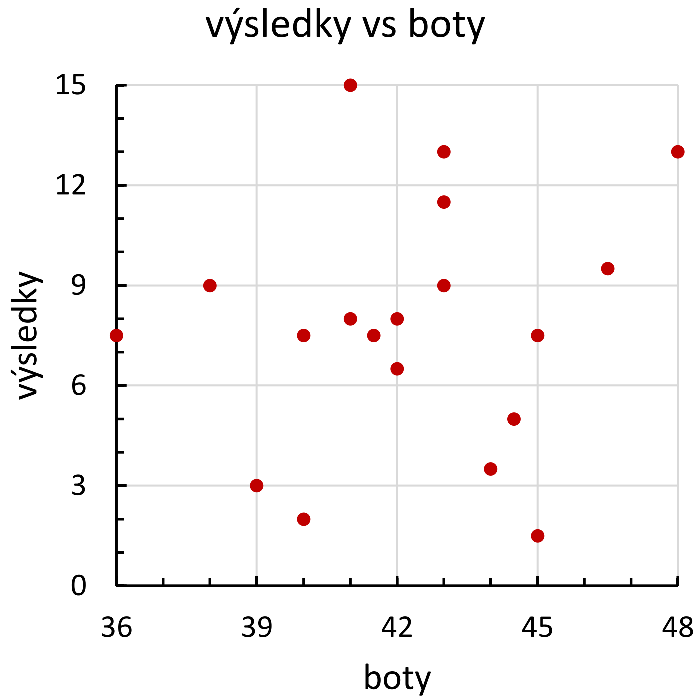
$\hat{\mu}_x = 7.8 \qquad \hat{\sigma}_x = 3.7$



- korelace $\hat{\rho}(x, y) = 0.8 \pm 0.1$
- Fisher $(t = 4.021) \to P = 0.01\%$
- student $(t = 4.878) \to P = 0.01\%$

- y – počet bodů z testu (odhad)

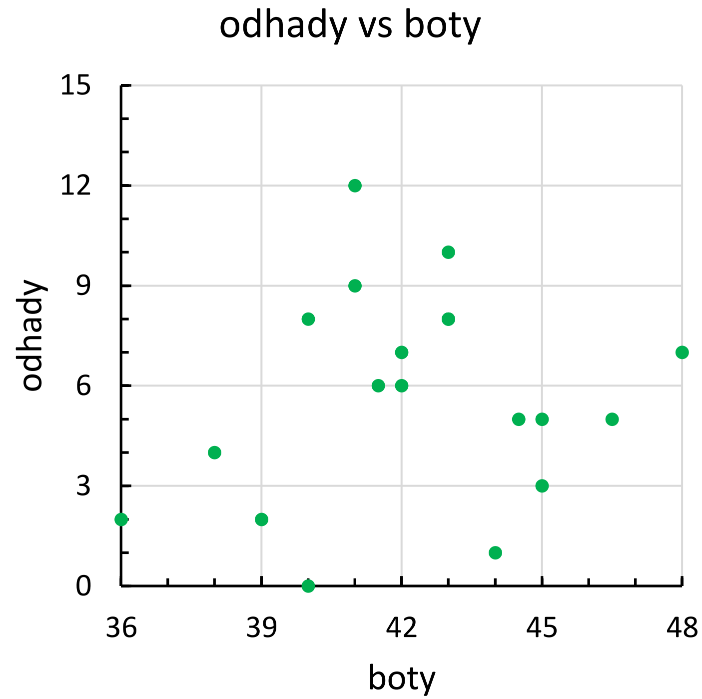
$\hat{\mu}_y = 5.7 \qquad \hat{\sigma}_y = 3.2$



- korelace $\hat{\rho}(x, y) = 0.1 \pm 0.2$
- Fisher $(t = 0.578) \to P = 56.4\%$
- student $(t = 0.598) \to P = 55.8\%$

- z – číslo bot (EU)

$\hat{\mu}_z = 42 \qquad \hat{\sigma}_z = 3$

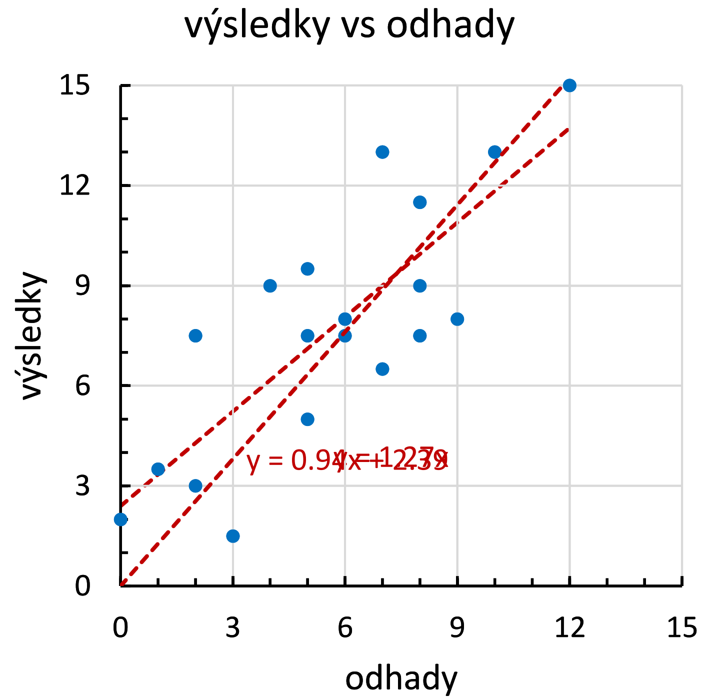


- korelace $\hat{\rho}(x, y) = 0.2 \pm 0.2$
- Fisher $(t = 0.664) \to P = 50.7\%$
- student $(t = 0.688) \to P = 50.1\%$

Příklad 2a – korelace výsledků a odhadů

- y – počet bodů z testu (odhad)

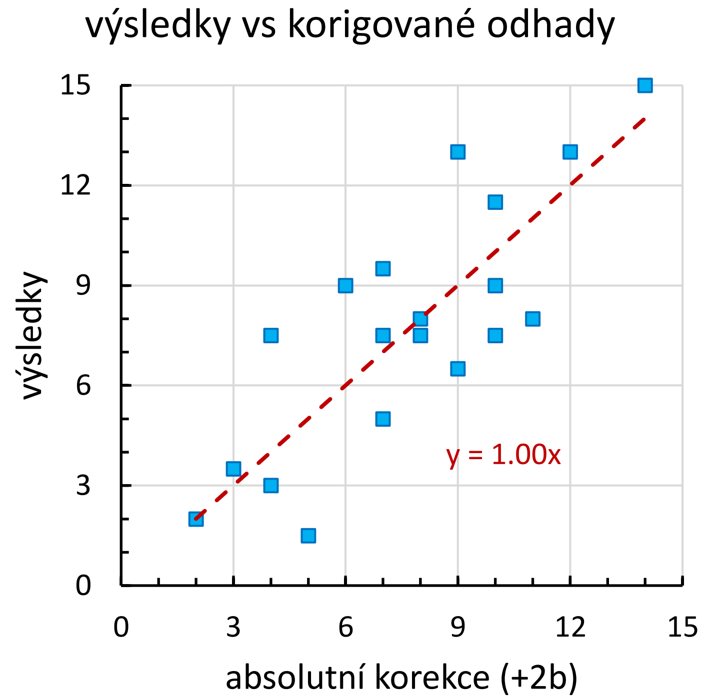
$\hat{\mu}_y = 5.7 \qquad \hat{\sigma}_y = 3.2$



- korelace $\hat{\rho}(x, y) = 0.8 \pm 0.1$
- Fisher ($t = 4.021$) → $P = 0.01\%$
- student ($t = 4.878$) → $P = 0.01\%$

- y_1 – korigovaný odhad (+2 body)

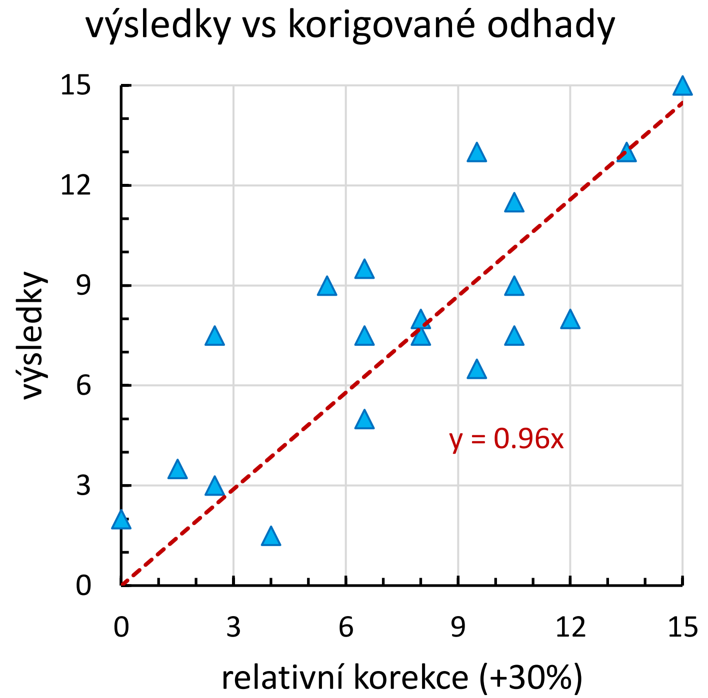
$\hat{\mu}_{y_1} = 7.7 \qquad \hat{\sigma}_{y_1} = 3.2$



- korelace $\hat{\rho}(x, y_1) = 0.8 \pm 0.1$
- Fisher ($t = 4.021$) → $P = 0.01\%$
- student ($t = 4.878$) → $P = 0.01\%$

- y_2 – korigovaný odhad (+30%)

$\hat{\mu}_{y_2} = 7.5 \qquad \hat{\sigma}_{y_2} = 4.2$

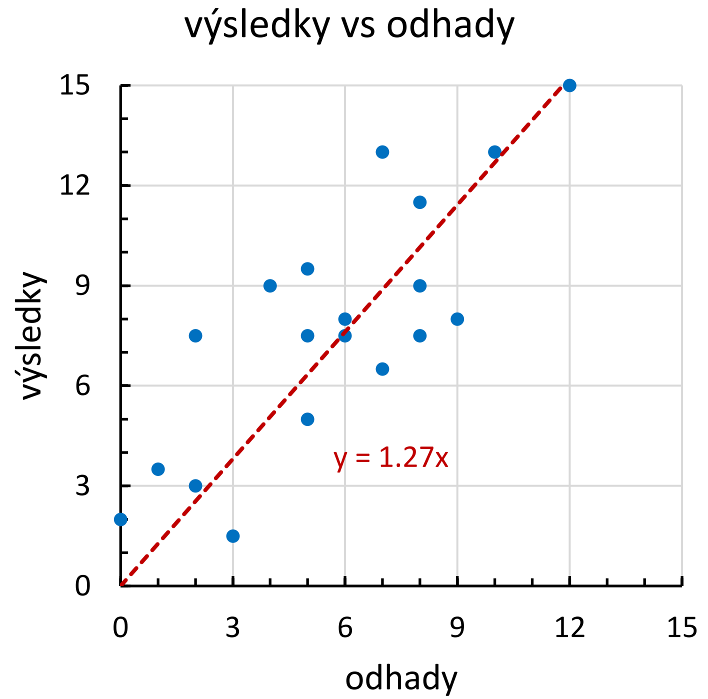


- korelace $\hat{\rho}(x, y_2) = 0.8 \pm 0.1$
- Fisher ($t = 3.994$) → $P = 0.01\%$
- student ($t = 4.835$) → $P = 0.02\%$

Příklad 2a – korelace výsledků a odhadů

- y – počet bodů z testu (odhad)

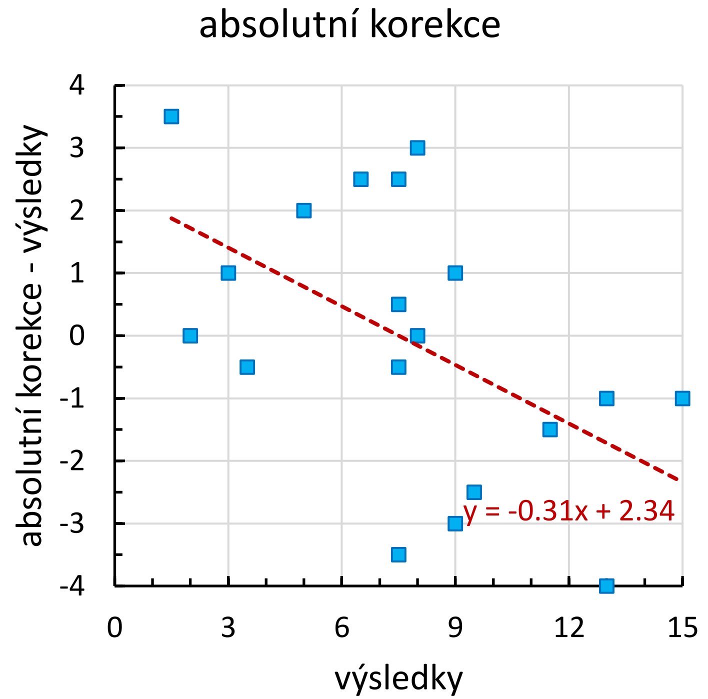
$\hat{\mu}_y = 5.7$ $\hat{\sigma}_y = 3.2$



- korelace $\hat{\rho}(x, y) = 0.8 \pm 0.1$
- Fisher ($t = 4.021$) $\rightarrow P = 0.01\%$
- student ($t = 4.878$) $\rightarrow P = 0.01\%$

- y_1 – korigovaný odhad (+2 body)

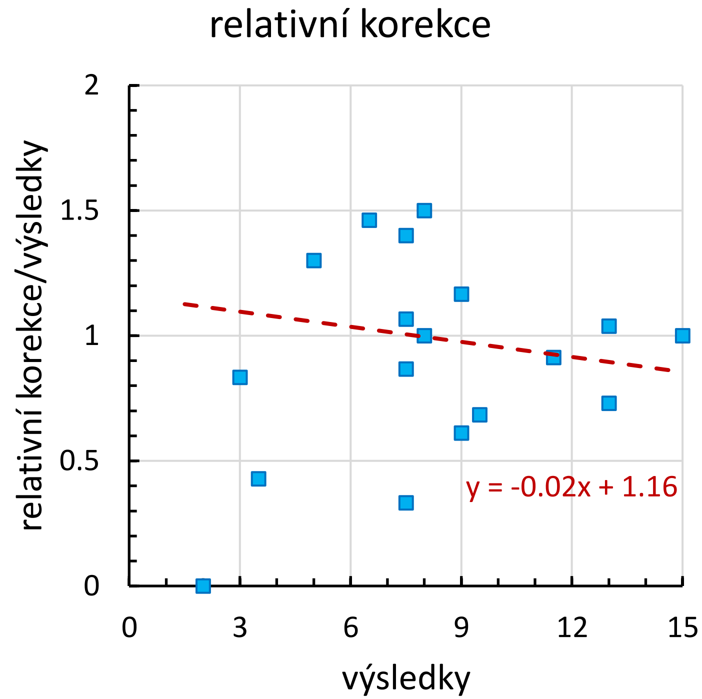
$\hat{\mu}_{y_1} = 7.7$ $\hat{\sigma}_{y_1} = 3.2$



- korelace $\hat{\rho}(x, y_1 - x) = -0.5 \pm 0.2$
- Fisher ($t = -2.188$) $\rightarrow P = 2.8\%$
- student ($t = -2.370$) $\rightarrow P = 3.0\%$

- y_2 – korigovaný odhad (+30%)

$\hat{\mu}_{y_2} = 7.5$ $\hat{\sigma}_{y_2} = 4.2$



- korelace $\hat{\rho}(x, y_2/x) = -0.1 \pm 0.2$
- Fisher ($t = -0.506$) $\rightarrow P = 61.3\%$
- student ($t = -0.524$) $\rightarrow P = 60.7\%$

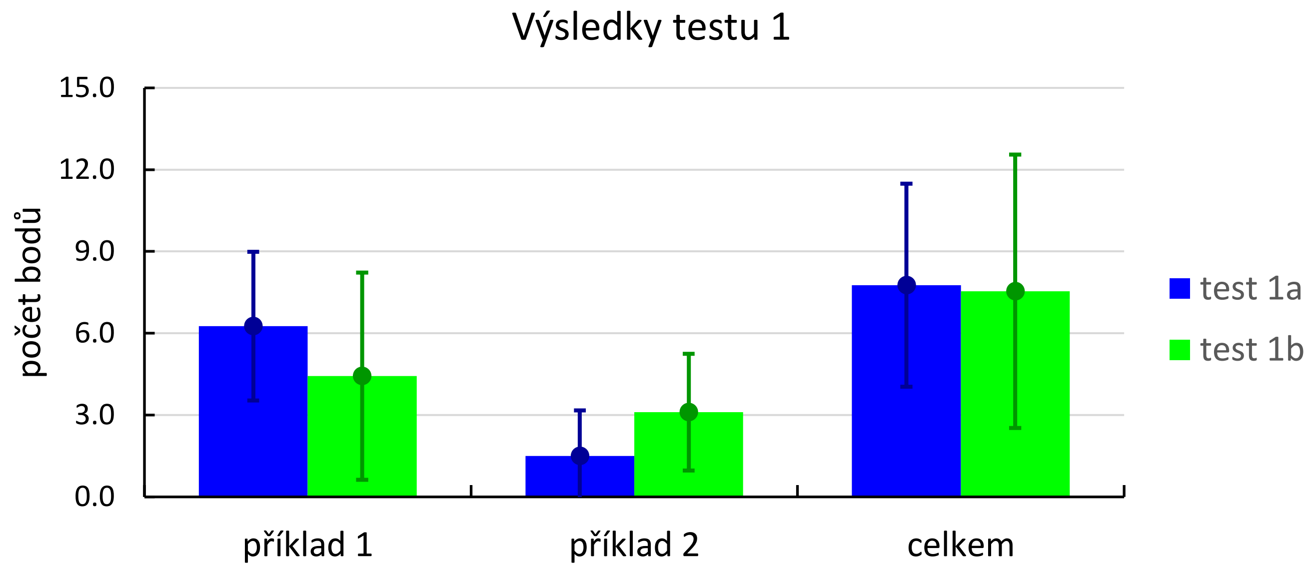
Výsledky testu 1

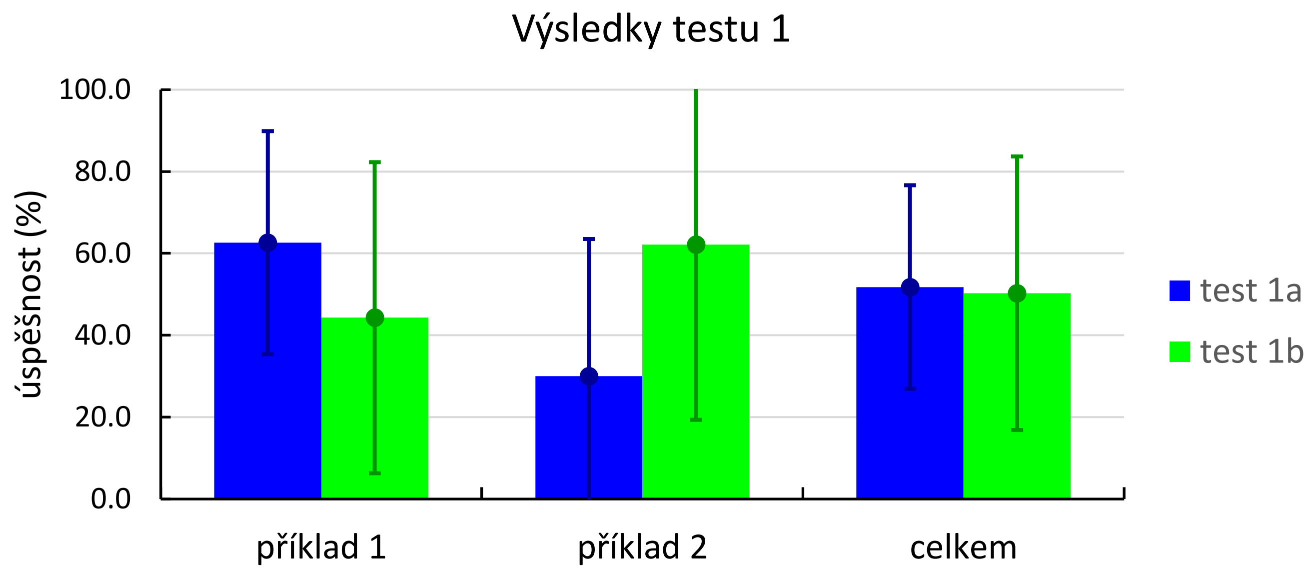
- test 1a
  skupina 1 (29. 11., 9:00)

  (8 ± 4) bodů

- test 1b
  skupina 2 (30. 11., 8:10)

  (8 ± 5) bodů





Příklad 1b – výsledky testu 1b

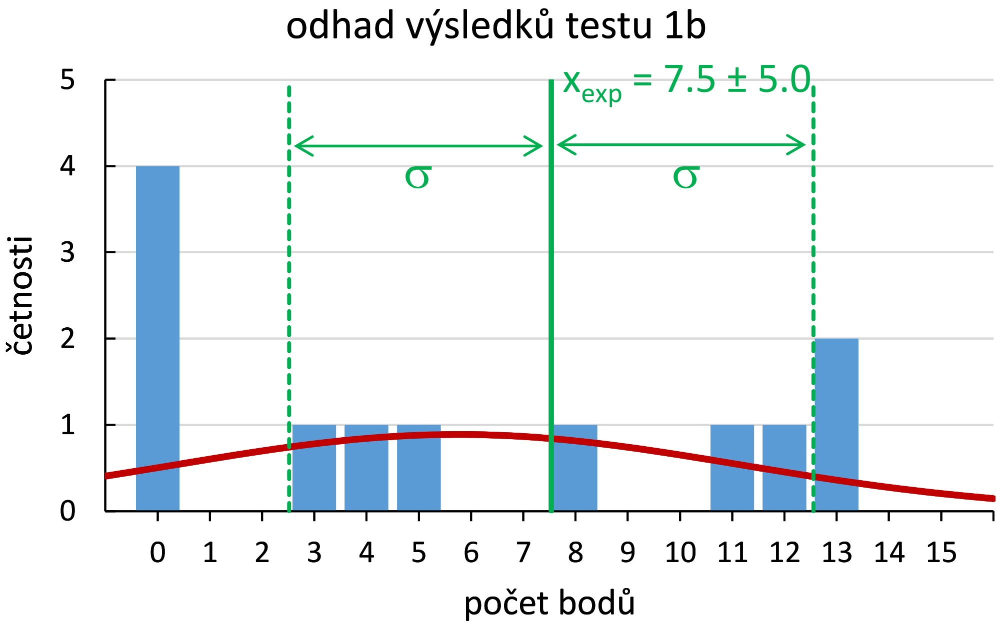
- test 1b – skupina 2 (30. 11., 8:10)
- x – odhadovaný počet bodů

$$N = 12$$

$$\hat{\mu}_x = 5.8 \qquad \hat{\sigma}_x = 5.4$$

- histogram hodnot x

$$f(x) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}^2}} \exp\left[-\frac{(x-\hat{\mu}_x)^2}{2\hat{\sigma}^2}\right]$$



- skutečný počet bodů

$$\hat{\mu}_{exp} = 7.5 \qquad \hat{\sigma}_{exp} = 5.0$$

Příklad 1a – výsledky testu 1a

- test 1b – skupina 2 (30. 11., 8:10)
- $\bar{x}$ – odhadovaný průměrný počet bodů

$$N = 12$$

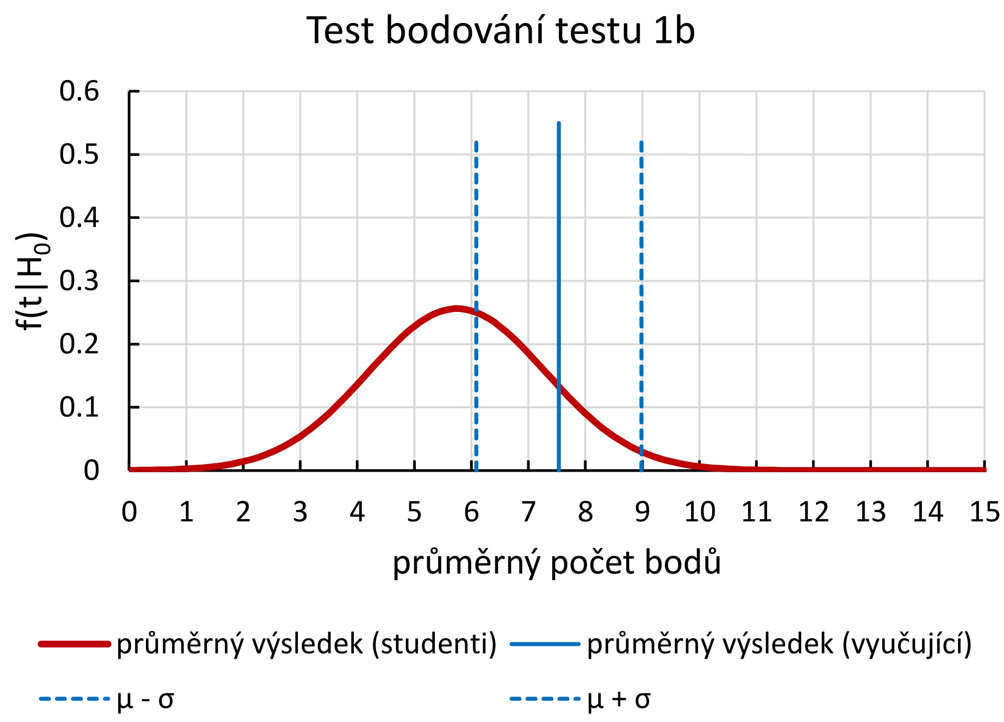
$$\hat{\mu}_{\bar{x}} = 5.8 \qquad \hat{\sigma}_{\bar{x}} = \frac{\hat{\sigma}_x}{\sqrt{N}} = 1.6$$

- hustota pravděpodobnosti $\bar{x}$

$$f(\bar{x}) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}_{\bar{x}}^{\,2}}} \exp\left[-\frac{(\bar{x}-\hat{\mu}_{\bar{x}})^2}{2\hat{\sigma}_{\bar{x}}^{\,2}}\right]$$

- skutečný počet bodů

$$\hat{\mu}_{avg} = 7.5 \qquad \hat{\sigma}_{avg} = 1.5$$



Příklad 1a – výsledky testu 1a

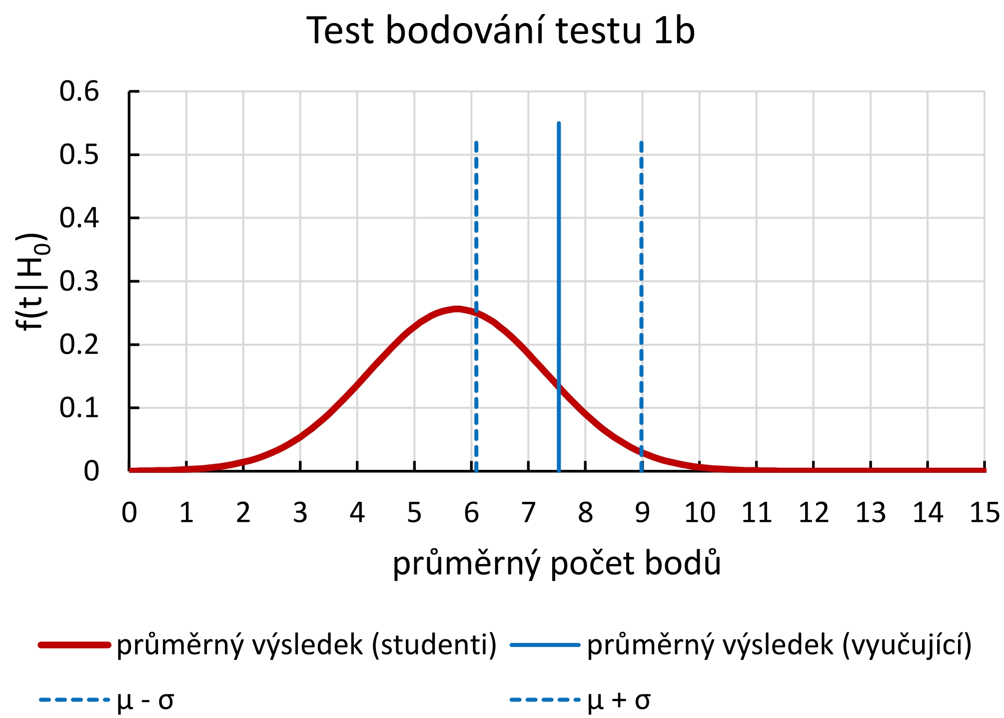
- test 1b – skupina 2 (30. 11., 8:10)
- Nulová hypotéza H_0

  Hodnocení testu bylo spravedlivé.

- testovací statistika ($\hat{\mu}_{\bar{x}} = 5.8$, $\hat{\sigma}_{\bar{x}} = 1.6$)

$$f(\bar{x}|H_0) \approx \frac{N}{\sqrt{2\pi\hat{\sigma}_{\bar{x}}{}^2}} \exp\left[-\frac{(\bar{x} - \hat{\mu}_{\bar{x}})^2}{2\hat{\sigma}_{\bar{x}}{}^2}\right]$$

- testovací proměnná (t-hodnota)



$$t_1 = \hat{\mu}_{avg} - \hat{\sigma}_{avg} = 6.1 \qquad P(\bar{x} > t_1) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_1 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 41.4\%$$

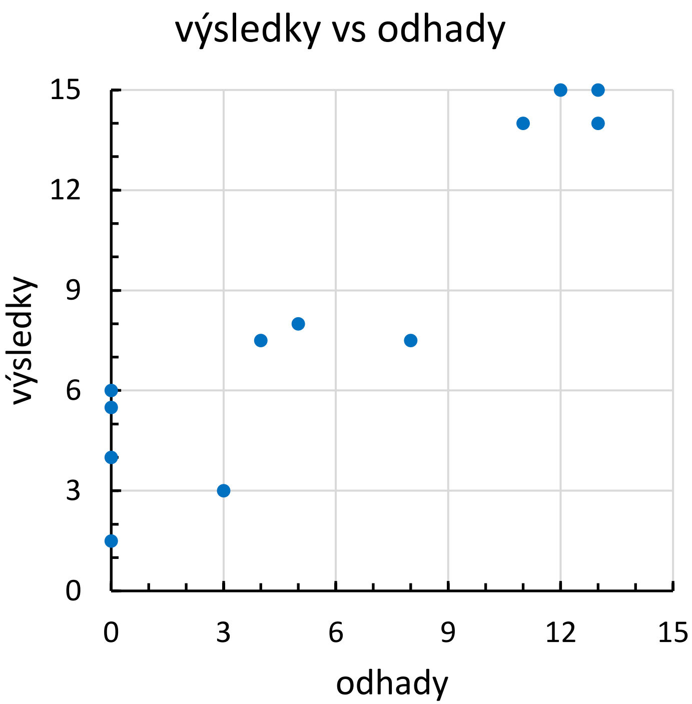
$$t_2 = \hat{\mu}_{avg} = 7.5 \qquad P(\bar{x} > t_2) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_2 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 12.6\%$$

$$t_3 = \hat{\mu}_{avg} + \hat{\sigma}_{avg} = 9.0 \qquad P(\bar{x} > t_3) = 1 - F(\bar{x}|H_0) = \frac{1}{2}\left[1 - \mathrm{erf}\left(\frac{t_3 - \hat{\mu}_{\bar{x}}}{\sqrt{2}\hat{\sigma}_{\bar{x}}}\right)\right] = 1.9\%$$

Příklad 2b – korelace veličin skupiny 1

- x – počet bodů z testu (výsledek)

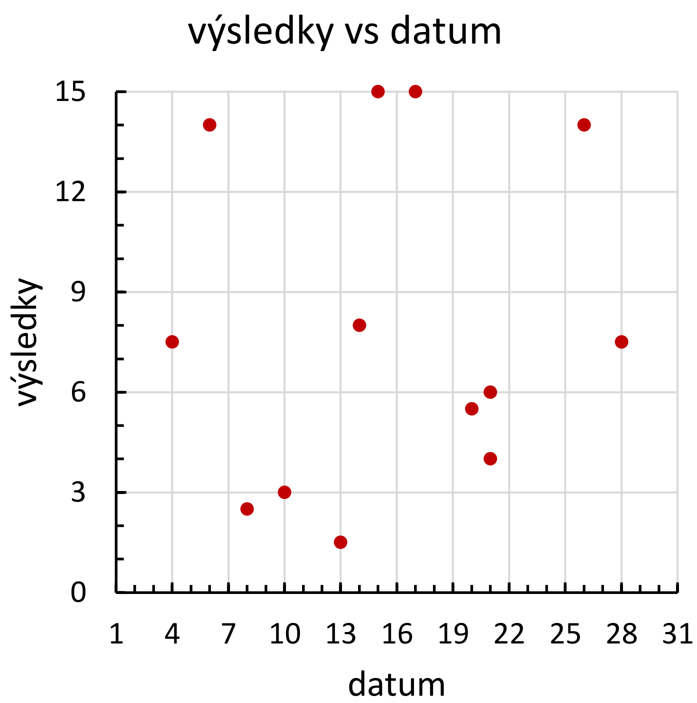
$\hat{\mu}_x = 7.5 \qquad \hat{\sigma}_x = 5.0$



- korelace $\hat{\rho}(x, y) = 0.85 \pm 0.08$
- Fisher ($t = 3.998$) $\rightarrow$ $P = 0.006\%$
- student ($t = 5.402$) $\rightarrow$ $P = 0.03\%$

- y – počet bodů z testu (odhad)

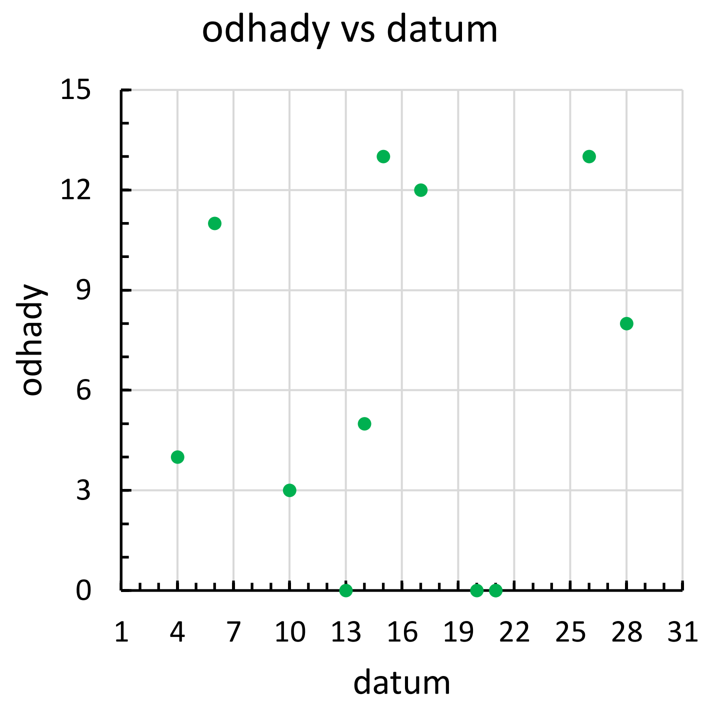
$\hat{\mu}_y = 5.8 \qquad \hat{\sigma}_y = 5.4$



- korelace $\hat{\rho}(x, y) = 0.1 \pm 0.3$
- Fisher ($t = 0.353$) $\rightarrow$ $P = 72.4\%$
- student ($t = 0.371$) $\rightarrow$ $P = 71.9\%$

- z – den narození

$\hat{\mu}_z = 16 \qquad \hat{\sigma}_z = 7$

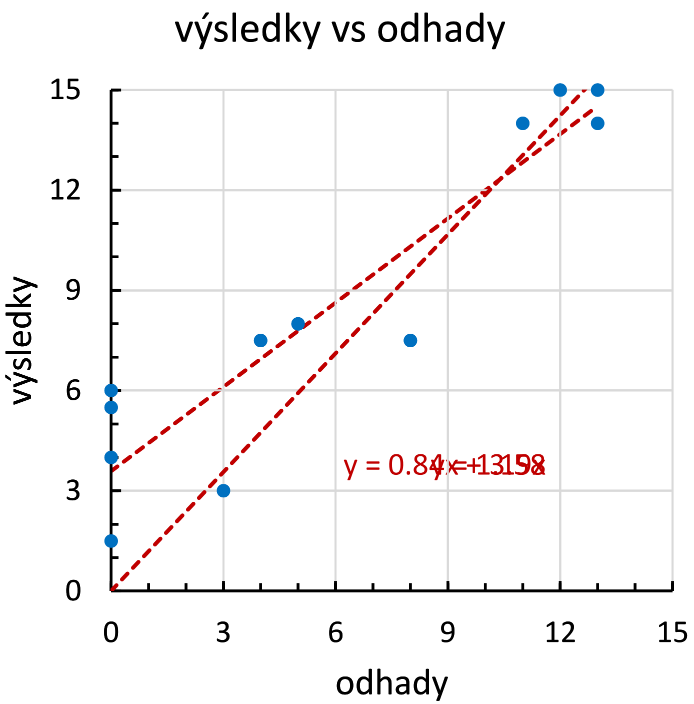


- korelace $\hat{\rho}(x, y) = 0.0 \pm 0.3$
- Fisher ($t = 0.060$) $\rightarrow$ $P = 95.2\%$
- student ($t = 0.063$) $\rightarrow$ $P = 95.1\%$

Příklad 2b – korelace výsledků a odhadů

- y – počet bodů z testu (odhad)

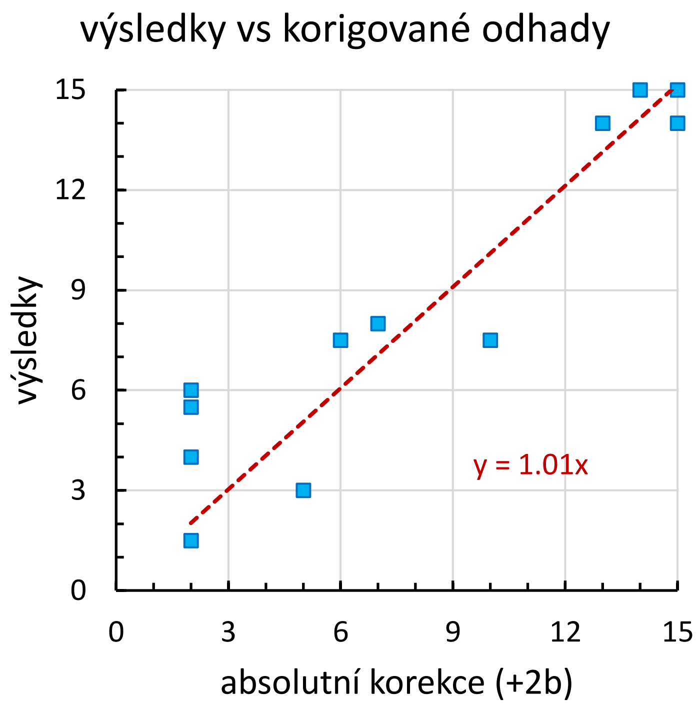
$\hat{\mu}_y = 5.8 \qquad \hat{\sigma}_y = 5.4$



- korelace $\hat{\rho}(x,y) = 0.85 \pm 0.08$
- Fisher $(t = 3.998) \rightarrow$ $P = 0.006\%$
- student $(t = 5.402) \rightarrow$ $P = 0.03\%$

- y_1 – korigovaný odhad (+2 body)

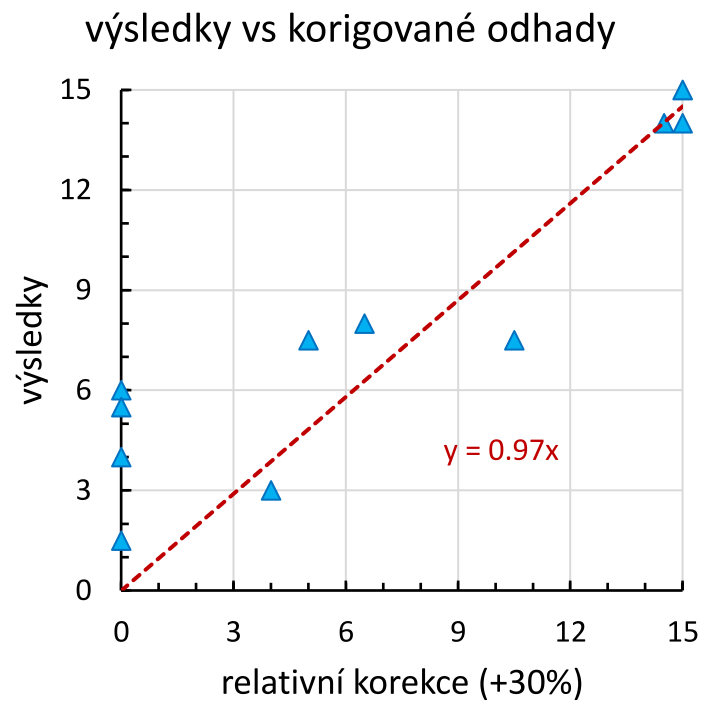
$\hat{\mu}_{y_1} = 7.8 \qquad \hat{\sigma}_{y_1} = 5.4$



- korelace $\hat{\rho}(x,y_1) = 0.85 \pm 0.08$
- Fisher $(t = 3.998) \rightarrow$ $P = 0.01\%$
- student $(t = 5.402) \rightarrow$ $P = 0.03\%$

- y_2 – korigovaný odhad (+30%)

$\hat{\mu}_{y_2} = 7.1 \qquad \hat{\sigma}_{x_2} = 6.5$



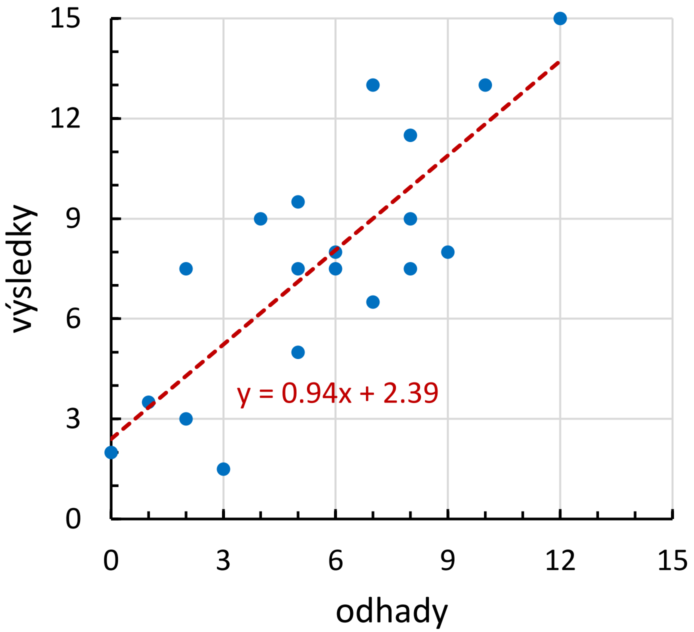
- korelace $\hat{\rho}(x,y_2) = 0.85 \pm 0.09$
- Fisher $(t = 3.926) \rightarrow$ $P = 0.01\%$
- student $(t = 5.261) \rightarrow$ $P = 0.04\%$

Příklad 2b – korelace výsledků a odhadů

- y – počet bodů z testu (odhad)

$\hat{\mu}_y = 5.8 \qquad \hat{\sigma}_y = 5.4$

výsledky vs odhady

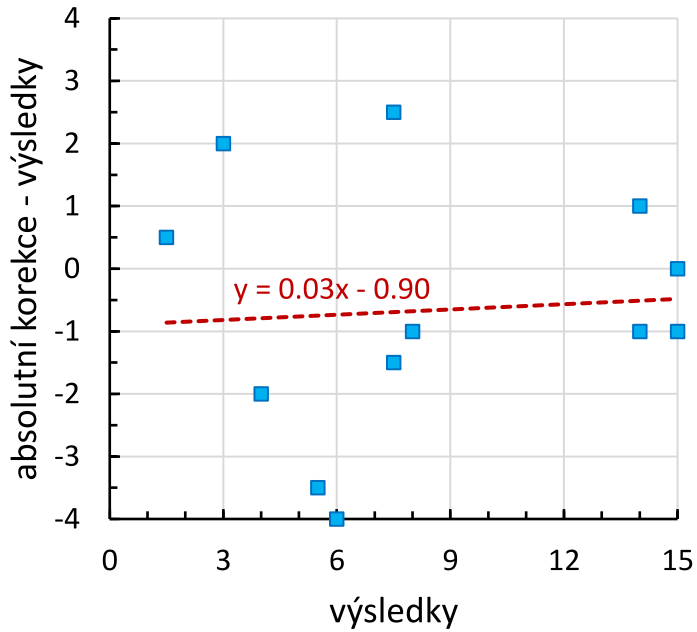


- korelace $\hat{\rho}(x, y) = 0.85 \pm 0.08$
- Fisher $(t = 3.998) \rightarrow P = 0.006\%$
- student $(t = 5.402) \rightarrow P = 0.03\%$

- y_1 – korigovaný odhad (+2 body)

$\hat{\mu}_{y_1} = 7.8 \qquad \hat{\sigma}_{y_1} = 5.4$

absolutní korekce

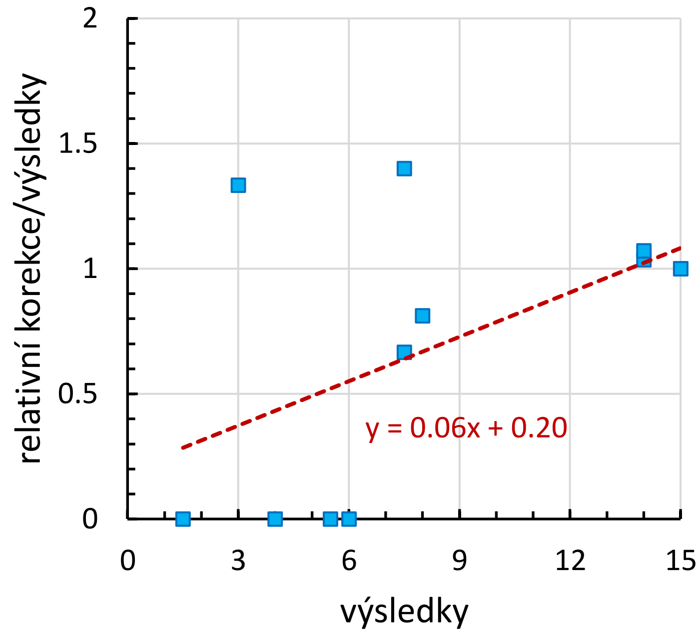


- korelace $\hat{\rho}(x, y_1 - x) = 0.4 \pm 0.3$
- Fisher $(t = 1.346) \rightarrow P = 17.8\%$
- student $(t = 1.455) \rightarrow P = 17.6\%$

- y_2 – korigovaný odhad (+30%)

$\hat{\mu}_{y_2} = 7.1 \qquad \hat{\sigma}_{y_2} = 6.5$

relativní korekce



- korelace $\hat{\rho}(x, y_2/x) = 0.7 \pm 0.1$
- Fisher $(t = 2.836) \rightarrow P = 0.5\%$
- student $(t = 3.390) \rightarrow P = 0.07\%$