$$\Delta = \sum_\alpha A_\alpha n_\alpha \text{ - прибыль},$$

штраф $(P_1 - \sum_\alpha q_{\alpha 1} n_\alpha)^2 =$

$= \underbrace{P_1^2}_{const} + \sum_{\alpha\alpha'} q_{\alpha 1} q_{\alpha' 1} n_\alpha n_{\alpha'} -$

$- 2P_1 \sum_\alpha q_{\alpha 1} n_\alpha$

$$n_\alpha = \sum_{\beta=0}^{[\log_2 u_\alpha]} 2^\beta y_{\alpha\beta} \qquad ; \quad u_\alpha < \frac{P_1}{q_{\alpha 1}}$$

$$\sum A_\alpha n_\alpha = \sum_\alpha A_\alpha \sum_\beta 2^\beta y_{\alpha\beta} \qquad H^{(1)} = \overset{\max}{\Delta} - \overset{\min}{\text{штраф}}$$

$$H^{(1)} = \sum A_\alpha \sum_\beta 2^\beta y_{\alpha\beta} +$$

$$+ 2P_1 \sum_\alpha q_{\alpha 1} \sum_\beta 2^\beta y_{\alpha\beta} - \sum_{\alpha\alpha'} q_{\alpha 1} q_{\alpha' 1} \sum_\beta 2^\beta 2^{\beta'} y_{\alpha\beta} y_{\alpha'\beta'}$$

$$\boxed{\begin{aligned} h_{\alpha\beta} &= A_\alpha \cdot 2^\beta + 2P_1 q_{\alpha 1} \cdot 2^\beta \\ J_{\alpha\alpha'\beta\beta'} &= -q_{\alpha 1} q_{\alpha' 1} 2^\beta \cdot 2^{\beta'} \end{aligned}}$$

$$Q_{\alpha\alpha'\beta\beta'} = J_{\alpha\alpha'\beta\beta'} + h_{\alpha\beta} \delta_{\alpha'\beta'}$$

$y_{\alpha\beta}$; $\alpha = \overline{1, 100}$

$\beta = \overline{\cancel{1}0, u} = \overline{0, 10}$

$\downarrow$

x_γ ; $\gamma = \overline{0, 100 \cdot u}$ $\left(\vdots\right)$

$\gamma = \cancel{100} \cdot \alpha \cdot u + \beta$

~~x_γ~~ for α (1, 100)

for β (0, u)

$x[\cancel{100}u\alpha + \beta] = y_{\alpha\beta}$

$y \downarrow x$

$x_\gamma \longrightarrow y_{\alpha\beta}$

$\alpha = \gamma // 100$

$\beta = \gamma \% u$

$x \rightarrow y$

$\cancel{J_{\alpha\beta}}\ J_{\alpha\alpha'\beta\beta'} = J_{\gamma\gamma'}$

$n_\alpha = \sum_\beta 2^\beta \cdot y_{\alpha\beta}$

$$\sigma^2 = n\sum_{i=1}^{n} \frac{(r_i-\bar{r})^2}{n-1} \le const$$

$$\frac{n}{n-1}\sum_{i=1}^{n}\left(r_i-\frac{1}{n}\sum_{k=1}^{n} r_k\right)^2 =$$

$$\cancel{= \frac{n}{n-1}\sum_{i=1}^{n} r_i^2 - \frac{2}{n-1}\sum r_i r_k + \frac{1}{n-1}\sum_{i=1}^{n} r_i r_k}$$

$$\frac{n}{n-1}\sum_{i=1}^{n}\left(r_i^2-\frac{2}{n}r_i\sum r_k+\frac{1}{n^2}\sum r_k r_j\right) =$$

$$= \frac{n}{n-1}\sum_{i=1}^{n} r_i^2 - \frac{2}{n-1}\sum r_i r_k + \frac{1}{n-1}\sum r_i r_k =$$

$$= \frac{n}{n-1}\sum_{i=1}^{n} r_i^2 - \frac{1}{n-1}\sum_{i=1}^{n} r_i r_k =$$

$$= \frac{n}{n-1}\sum_{ij=1}^{n} r_i r_j \delta_{ij} - \frac{1}{n-1}\sum_{ij=1}^{n} r_i r_j =$$

$$= \left(\frac{1}{n-1}\right)\sum_{i,j=1}^{n}(n\delta_{ij}-1)\, r_i r_j$$

$$\sigma^2 = \sum_{ij=1}^{n} \frac{n\delta_{ij}-1}{n-1} r_i r_j \le \sigma_0^2$$

$$\tilde{r}_i \tilde{r}_j = \frac{P_{i+1} - P_i}{P_i} \frac{P_{j+1} - P_j}{P_j} =$$

$$= \frac{\sum n_\alpha (q_{\alpha,i+1} - q_{\alpha,i})}{\sum n_{\alpha'} q_{\alpha' i}} \frac{\sum n_\beta (q_{\beta,j+1} - q_{\beta,j})}{\sum n_{\beta'} q_{\beta' j}} =$$

$$P_i \to P_1$$

$$= \frac{1}{P_1^2} \sum_{\alpha\beta} (q_{\alpha,i+1} - q_{\alpha,i})(q_{\beta,j+1} - q_{\beta,j}) n_\alpha n_\beta$$

$$\sigma^2 = \sum_{ij=1}^{n} \frac{n\delta_{ij} - 1}{n-1} \frac{1}{P_1^2} \sum_{\alpha\beta} (q_{\alpha,i+1} - q_{\alpha,i})(q_{\beta,j+1} - q_{\beta,j}) n_\alpha n_\beta$$

$$(\sigma^2 - \sigma_0^2) = 0$$

$$\sigma^2 \le \sigma_0^2 \Rightarrow \text{хорошо}$$

$$\cancel{\sigma^2 - \sigma_0^2}\ \sigma^2 > \sigma_0^2 \Rightarrow \text{плохо}$$

$$\Delta^{(\sigma^2)} = \sigma_0^2 - \sigma^2$$

$$\Delta = - \varkappa \sigma^2$$

$$\sigma^2 \leq \sigma_0^2$$

$$\sigma^2 = \sum_{ij=1}^{n} \frac{n\delta_{ij}-1}{n-1} \frac{1}{P_1^2} \sum (q_{\alpha,i+1}-q_{\alpha,i})(q_{\alpha',j+1}-q_{\alpha',j}) r_\alpha r_{\alpha'}$$

$$= \sum_{ij=1}^{n} \frac{n\delta_{ij}-1}{n-1} \frac{1}{P_1^2} \sum_{\alpha\alpha'} (q_{\alpha,i+1}-q_{\alpha,i})(q_{\alpha',j+1}-q_{\alpha',j}) \sum_{\beta\beta'} 2^{\beta} y_{\alpha\beta} 2^{\beta'} y_{\alpha'\beta'}$$

$$R_{\alpha\alpha'\beta\beta'} = \sum_{ij=1}^{n} \frac{n\delta_{ij}-1}{n-1} \frac{1}{P_1^2} (q_{\alpha,i+1}-q_{\alpha,i})(q_{\alpha',j+1}-q_{\alpha',j}) 2^{\beta} 2^{\beta'}$$

$$\sigma^2 = \sum_{\substack{\alpha\alpha' \\ \beta\beta'}} R_{\alpha\alpha'\beta\beta'} y_{\alpha\beta} y_{\alpha'\beta'}$$