Peer grade simulator

Assumptions

- S students, H homeworks, K evaluators for each homework
- quality of student s is $X_s \sim \text{uniform}(0, 1)$
- quality of homework h of student s is Q_{hs}
  - $\mathbb{E}[Q_{hs}] = X_s$, $var(Q_{hs}) = \sigma_Q^2$
- evaluation k for homework h of student s is $E_{hs}^{(k)}$
  - $\mathbb{E}[E_{hs}^{(k)}] = Q_{hs}$, $var(E_{hs}^{(k)}) = \sigma_E^2$
- grade (i.e., estimated quality) of homework h of student s:

$$\hat{Q}_{hs} = \frac{1}{K} \sum_{k=1}^{K} E_{hs}^{(k)}$$

- grades and evaluations $\in [0, 1]$

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Output metrics

- (homework-by-homework) average relative grading error

$$\epsilon_1 = \frac{1}{H \times S} \sum_h \sum_s \frac{|\hat{Q}_{hs} - Q_{hs}|}{Q_{hs}}$$

- (final grade) average relative grading error

$$\epsilon_2 = \frac{1}{S} \sum_s \left| \frac{\sum_h \hat{Q}_{hs}}{H} - \frac{\sum_h Q_{hs}}{H} \right| \frac{1}{\frac{\sum_h Q_{hs}}{H}} = \frac{1}{S} \sum_s \frac{|\sum_h (\hat{Q}_{hs} - Q_{hs})|}{\sum_h Q_{hs}}$$