

Some notations:

t_{ij} = time taken by participant i to read question j , where $j = 1$ to 15 (or 5 or 10 depending on the case)

\bar{t}_j = median reading time for question j , considering all participants

$Q1_j$ = first quartile reading time for question j , considering all participants

$Q3_j$ = third quartile reading time for question j , considering all participants

\bar{t}_{Cj} = median reading time for question j , considering only participants who answered correctly

$Q1_{Cj}$ = first quartile reading time for question j , considering only participants who answered correctly

$Q3_{Cj}$ = third quartile reading time for question j , considering only participants who answered correctly

a_{ij} = answer of participant i to question j (1 = correct, 0 = wrong)

l_{ij} = label of participant i relating to question j (UP = has effort, NP = no effort)

$$IQR_j = Q3_j - Q1_j$$

$$LB_j = Q1_j - (1.5 * IQR_j)$$

Tester/Question

Not valid if $t_{ij} < LB_j$

Only on valid testers apply as follow:

$$IQR_{Cj} = Q3_{Cj} - Q1_{Cj}$$

$$UF_{Cj} = Q3_{Cj} + (1.5 * IQR_{Cj})$$

Then the label is:

$$l_{ij} = \begin{cases} UP, & \begin{cases} a_{ij} = 1 \wedge tc_{ij} > UF_C_j \\ a_{ij} = 0 \end{cases} \\ NP, & otherwise \end{cases}$$

What we need to do:

1. Find invalid in term of data (zero value)
2. Find invalid in term of time (ex. Answer too fast)
3. Define label (case: timelimit/no timelimit)
4. Create column for areas (Question/Choices/Time/Submit...)
5. Analysis 2 Phases: reading question phase and start reading answer phase