## COMPUTER SCIENCE TRIPOS Part IA - 2023 - Paper 3

## 7 Machine Learning and Real-world Data (sht25)

In an annotation task with 4 classes (I, II, III and IV), three annotators (A, B, C) are making decisions, as in Figure 1.

|  | A | B | C |
| :--- | ---: | ---: | ---: |
| Item1 | III | III | I |
| Item2 | IV | I | III |
| Item3 | II | II | I |
| Item4 | I | IV | IV |
| Item5 | II | IV | II |
| Item6 | I | I | I |
| Item7 | IV | IV | III |
| Item8 | II | I | II |

(a) Raw agreement amongst $k>2$ annotators can be calculated based on pairwise agreement. Explain how this can be done, and calculate the value in the above case, showing your workings.
(b) We now want to use a chance-corrected agreement metric and choose Kappa.
(i) Explain why chance-corrected agreement metrics are useful.
(ii) How is chance agreement in Kappa calculated? Give the formula and calculate the value in the case above.
(iii) Give the formula for Kappa and calculate its value in our situation.
(c) New annotated data is discovered, which stems from two other annotators. Annotatator D only participated in annotation from item3 onwards, whereas Annotator E stopped annotating after item8 due to sickness. We want to use their partial annotation data, together with that from annotators A-C.
(i) One possible treatment is to pretend that annotators D and E were a single person, by randomly discarding one judgement for the doubly annotated items. Give at least two reasons why this is problematic.
(ii) Adapt the Kappa metric given above so that it can deal with partial annotation data. Give the motivation behind your idea as well as a formula for the final metric.
(iii) The annotation is now parcelled out into small sections (2 items each) and moved to a crowd-sourcing platform. Describe at least one potential problem with your agreement metric from $(c)(i i)$ in this setting.

