## COMPUTER SCIENCE TRIPOS Part IB – 2025 – Paper 7

## 6 Formal Models of Language (pjb48)

- (a) Provide a definition of a formal language and a natural language. With respect to each, what does it mean for a string to be *grammatical*? [3 marks]
- (b) With reference to both formal and natural languages, what is meant by *complexity*? [3 marks]
- (c) Consider the following natural language sentences:
  - i) A student worked hard succeeds.
  - ii) A student that is worked hard succeeds.

You are debating with a friend whether sentence i) or ii) is more difficult for a human to process. Which do you think is more difficult and why? [2 marks]

- (d) You are now considering the following natural language sentences:
  - iii) The notes the supervisor the students like wrote are useful.
  - iv) The notes that were written by the supervisor that the students like are useful.

Which sentence, iii) or iv), do you think is more difficult for a human to process and why? [2 marks]

- (e) Your deliberations on processing language have made you concerned about the language in your upcoming dissertation. You decide to make a tool to: 1) identify sentences that are difficult to process; 2) label the sentences with the reason they are difficult. Describe how your tool works. Explain any theoretical assumptions you are making and describe at least two methods by which you will identify the sentences.
- (f) Your friend suggests that, rather than building your tool, you could reduce the processing difficulty of your dissertation by writing it in a language that can be defined by a finite-state machine. Do you agree? Explain your answer.

[4 marks]