9 Logic and Proof (MJ)

(*a*) Outline the basic ideas behind Fourier-Motzkin variable elimination, demonstrating them by applying the technique to the following set of constraints:

$$x - z \leq 2 \qquad x + y - z \geq 5 \qquad y + 2z \leq 6 \qquad x + 2 \geq 3y$$

[8 marks]

(*b*) Give and explain the inference rules of binary resolution and factoring, in the context of automated theorem proving. [4 marks]

(*c*) For the following clauses in Kowalski form, express each clause as a set of literals. For the resulting set of clauses, either exhibit a model or show that none exists. Notice that a, b and c are constants, while x, y and z are variables. Briefly justify your answer.

$$\begin{aligned} P &\rightarrow Q(a) \vee S(x) \vee T(y) \\ T(b) &\rightarrow \\ Q(z) &\rightarrow \\ U(b) \wedge S(c) &\rightarrow T(y) \\ U(y) &\rightarrow T(y) \vee P \\ &\rightarrow U(b) \end{aligned}$$

[8 marks]