

- i) Every registered company has exactly one director.

$$\forall X (\text{reg}(X) \rightarrow \\ \exists D \text{ dir}(D, X) \wedge \forall D1, D2 (\text{dir}(D1, X) \wedge \text{dir}(D2, X) \rightarrow D1=D2)$$

- ii) Any request for registering a company is rejected if a company of that name is already registered, or if the director is disqualified, or if the share capital of the company is less than £5000, otherwise the request is accepted.

$$\forall ID, X, D, S (\text{reqReg}(ID, X, D, S) \rightarrow \\ [(\text{reg}(X) \vee \text{disq}(D) \vee S < 5000 \rightarrow \text{reject}(ID)) \wedge \\ (\neg \text{reg}(X) \wedge \neg \text{disq}(D) \wedge \neg S < 5000 \rightarrow \text{accept}(ID))])$$

- iii) A director is disqualified and the share capital of all of his registered companies is set to zero if at least one of his registered companies becomes insolvent.

$$\forall D (\exists X (\text{reg}(X) \wedge \text{dir}(D, X) \wedge \text{insolvent}(X)) \rightarrow \\ [\text{disq}(D) \wedge \forall X (\text{reg}(X) \wedge \text{dir}(D, X) \rightarrow \text{share}(X, 0))])$$

- iv) The director of a registered company who is not disqualified is warned if on at least two occasions the company's accounts have not been filed by the due deadlines.

$$\forall X, D (\text{reg}(X) \wedge \text{dir}(D, X) \wedge \neg \text{disq}(D) \wedge \\ \exists D1, D2 (\text{acc_due}(X, P1, D1) \wedge \text{acc_due}(X, P2, D2) \wedge \neg D1=D2 \wedge \neg P1=P2 \wedge \\ \neg \exists F1 (\text{acc_filed}(X, P1, F1) \wedge F1 \leq D1) \wedge \\ \neg \exists F2 (\text{acc_filed}(X, P2, F2) \wedge F2 \leq D2) \\ \rightarrow \text{warn}(D, X))$$

- v) If a director has been warned about one of his companies and the share capital of that company falls more than 80% below its initial capital (as noted in the request for the company's registration) then the director is disqualified.

$$\forall C, D, ID, S1, S2 \\ [\text{warn}(D, C) \wedge \text{share}(C, S1) \wedge \text{reqReg}(ID, C, D, S2) \wedge S1 < S2 * 20\% \rightarrow \text{disq}(D)]$$

The questions have equal marks.

Total 100.