Logic and Artificial Intelligence Programming
Logic coursework 1
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i) Every registered company has exactly one director.

$$\forall C\left(reg(C)\rightarrow\exists D\left(dir(D,C)\wedge\forall X\left(dir(X,C)\rightarrow(X=D)\right)\right)\right)$$

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.

$$\forall C1,D,S\left(\exists C2(reg(C2)\wedge(C1=C2))\vee(dir(D,C1)\wedge disq(D))\vee((S$$
$$<5000)\wedge share(C1,S))\rightarrow\forall ID(reqReg(ID,C1,D,S)\rightarrow reject(ID))\right)\wedge\forall C1,D,S\left(\neg\left(\exists C2(reg(C2)\wedge(C1$$
$$=C2))\vee(dir(D,C1)\wedge disq(D))\vee((S<5000)\wedge share(C1,S))\rightarrow\forall ID(reqReg(ID,C1,D,S)\rightarrow accept(ID))\right)\right)$$

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.

$$\forall D\left(\exists C(reg(C)\wedge dir(D,C)\wedge insolvent(C))\rightarrow\left(disq(D)\wedge\forall X(reg(X)\wedge dir(D,X)\rightarrow share(X,0))\right)\right)$$

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.

$$\forall D2,D4,C,X\left(\exists P1,P2,D1,D3(reg(C)\wedge dir(X,C)\wedge\neg disq(X)\wedge acc\_due(C,P1,D1)\wedge\neg acc\_filed(C,P1,D2)\wedge(D2$$
$$\leq D1)\wedge acc\_due(C,P2,D3)\wedge\neg acc\_filed(C,P2,D4)\wedge(D4\leq D3)\wedge\neg(P1=P2))\rightarrow warn(X,C)\right)$$

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. (Use the predicate share(C,Value) here to denote the share value of the company.)

$$\forall D\left(\exists C,ID,S,Value(dir(D,C)\wedge warn(D,C)\wedge reqReg(ID,C,D,S)\wedge accept(ID)\wedge(Value$$
$$<0.2*S)\wedge share(C,Value))\rightarrow disq(D)\right)$$