Consider the following sentence that is provided in the problem 6.10 in the textbook,

$$\begin{aligned}\phi_{eq} = &\forall x\,[R_1(x,x)]\\ &\wedge \forall x,y\,[R_1(x,y) \leftrightarrow R_1(y,x)]\\ &\wedge \forall x,y,z\,[(R_1(x,y)\wedge R_1(y,z)) \rightarrow R_1(x,z)]\end{aligned}$$

The above statement explains about the conditions of the equivalence relation. A model (A, R_1), where *A* is any universe and R_1 is the equivalence relation over the elements of *A*. The line 1 describes that for all *x*, *x* is equal to itself. The line 2 describes that for all *x* and *y*, if and only if *x* is equal to *y* then *y* is equal to *x*. The line 3 describes that for all *x, y*, and *z*, if *x* is equal to *y* and *y* is equal to *z* then *x* is equal to *z*.

Consider the following sentence,

$$\begin{aligned}\phi_{lt} = &\phi_{eq}\\ &\wedge \forall x,y\,[R_1(x,y) \rightarrow \neg R_2(x,y)]\\ &\wedge \forall x,y\,[\neg R_1(x,y) \rightarrow (R_2(x,y)\oplus R_2(y,x))]\\ &\wedge \forall x,y,z\,[(R_2(x,y)\wedge R_2(y,z)) \rightarrow R_2(x,z)]\\ &\wedge \forall x \exists y\,[R_2(x,y)]\end{aligned}$$

The above statement explains about the conditions of the equivalence relation and less than relation. A model (A, R_1, R_2), where *A* is any universe, R_1 is the equivalence relation over the elements of *A* and R_2 is the less than relation over *A*.

• The line 1 describes the conditions of the equivalence relation.

• The line 2 describes that for all *x* and *y*, if *x* is equal to *y* then it is tends to complement of less than relation. This means if *x* is equal to *y* then it can be said that *x* is not less than *y*.

• The line 3 describes that for all *x* and *y*, if *x* is not equal to *y* then either *x* less than *y* or *y* less than *x* is true.

• The line 4 describes that for all *x*, *y* and *z*, if *x* is less than *y* and *y* is less than *z* then *x* is less than *z*.

• The line 5 describes that for all *x* there exist *y*, *x* is less than *y*.