

*Exercise 1.* Assume that the co-action  $\bar{e}$  never occurs in contracts and consider the relation

$$\rho \bowtie \sigma \stackrel{\text{def}}{\iff} \rho \dashv \sigma \wedge \sigma \dashv \rho$$

which is the symmetric of the strong compliance relation (Definition 3). Give significant examples of relations  $\rho \dashv \sigma$  such that  $\rho \not\bowtie \sigma$ .

*Exercise 2.* Let  $\ll$  be the subcontract relation induced by  $\bowtie$ , namely  $\sigma \ll \tau$  if  $\rho \bowtie \sigma$  implies  $\rho \bowtie \tau$  for every  $\rho$ : What is the relationship between  $\sqsubseteq$  and  $\ll$ ? Is  $\sqsubseteq$  included in  $\ll$ ? Is  $\ll$  included in  $\sqsubseteq$ ? Provide evidence for your answers and give significant examples to show that the two relations are different.

*Exercise 3.* Show that  $\ll$  is *not* a precongruence with respect to the external choice. Is  $\sqsubseteq$  the largest precongruence with respect to  $+$  that is included in  $\ll$ ? Justify your answer.

*Exercise 4.* Provide a coinductive characterization for  $\ll$  in the spirit of Definition 7 and prove it sound and complete in the spirit of Theorem 1.