Multiparty Session Types, Exercise Sheet

1. Give a possible multiparty session for the following scenarios, and show the reductions of the multiparty session (You may omit rule names): Note that you should give syntactically correct and closed multiparty session (without free variables), you may give any arbitrary values/choices when necessary.

   (a) **Two Travellers (Slide 18):** Alice and Bob wish to travel to France, the trip costs £100, but Bob is only happy to go with Alice if he pays less than Alice.

   (b) Alice sends Bob a number and Carol sends David a string. Show all reduction paths. (You may pick some arbitrary number and string)

   (c) Alice sends a number to Bob to begin with, then Bob, Carol and Alice, in a ring fashion, sends the next person the next number repeatly. (You only need to show 1 iteration, pick an arbitrary initial number)

2. Give the global types for the scenarios described in Q1 (b) and (c).

3. Project the following global types onto its participants:

   (a) Your answers to Question 2

   (b) $G = \mathsf{A} \to \mathsf{B} \left\{ \begin{array}{l} \mathit{apples} : \mathsf{B} \to \mathsf{C} : [\mathtt{int}]; \mathsf{C} \to \mathsf{A} : [\mathtt{string}]; \mathtt{end} \\ \mathit{pears} : \mathsf{B} \to \mathsf{C} : [\mathtt{int}]; \mathsf{C} \to \mathsf{A} : [\mathtt{bool}]; \mathtt{end} \end{array} \right\}$

   (c) $G = \mathsf{A} \to \mathsf{B} \left\{ \begin{array}{l} \mathit{apples} : \mathsf{B} \to \mathsf{D} : [\mathtt{int}]; \mathsf{C} \to \mathsf{A} : [\mathtt{string}]; \mathtt{end} \\ \mathit{pears} : \mathsf{C} \to \mathsf{A} : [\mathtt{string}]; \mathsf{B} \to \mathsf{D} : [\mathtt{int}]; \mathtt{end} \end{array} \right\}$

   (d) $G = \mathsf{A} \to \mathsf{B} : [\mathtt{int}]; \mu \mathsf{t}.\mathsf{B} \to \mathsf{C} \left\{ \begin{array}{l} \mathit{retry} : \mathsf{t} \\ \mathit{finish} : \mathtt{end} \end{array} \right\}$

4. Validate one of your multiparty sessions in Question 1 is well-typed against global types in Question 2.

5. Is it possible for a multiparty session to be well-typed under multiple global types? (Hint: You may find a scenario in Question 1)