Communicating Automata and Pi Calculus

Define the notions of sort and sorting for the π-calculus, and explain what is meant by the assertion that a process $P$ respects a sorting. Give two reasons why sorting is useful. [7 marks]

Simple data values can be represented as abstractions in the π-calculus. In particular, if $True$ and $False$ are abstractions representing the two truth-values, then $b.True$, $b.False$ are processes in which each truth-value is located at $b$.

Define the abstractions $True$ and $False$. Also, for arbitrary processes $P$ and $Q$, define the abstraction $CASES(P,Q)$ such that

\[
\begin{align*}
CASES(P,Q)(b) & \mid b.True \rightarrow^* P \\
CASES(P,Q)(b) & \mid b.False \rightarrow^* Q
\end{align*}
\]

and demonstrate these reductions. Give a sorting respected by all these constructions. [6 marks]

Discuss, with technical details, the general method by which π-calculus abstractions may also be used to represent compound data structures such as lists. [7 marks]