$l = 0.5p + 0.5p'$

$l = (l_1, l_2, l_3) = (0.6, 0.325, 0.075)$

where $l_1 = 0.5(\underset{p_1}{0.4}) + 0.5(\underset{p_1'}{0.8}) = 0.6$

$l_2 = 0.5(0.6) + 0.5(0.05) = 0.325$

$l_3 = 0.5(0) + 0.5(0.15) = 0.075$

Preferences over Lotteries

→ Next, we need to define preferences over lotteries. This is different from preferences over the set of outcomes/prizes.

* Preferences are defined by the relation $\succsim$ on $\mathcal{P}$.
* What conditions do we require the preference relation $\succsim$ to satisfy?
  (i) Axiom 1: Completeness (The decision maker expresses a preference for every pair of lotteries.)
  (ii) Axiom 2: Transitivity (For any 3 lotteries, $p, q, r \in \mathcal{P}$, if $p \succsim q$ and $q \succsim r$, then we must have $p \succsim r$.
  (iii) Axiom 3: Continuity (Archimedian Axiom: A preference relation $\succsim$ on $\mathcal{P}$ is continuous if, for any 3 lotteries, $p, q, r \in \mathcal{P}$ w/ $p \succsim q \succsim r$, there exists some $\alpha \in [0,1]$ such that $\alpha p + (1-\alpha) r \sim q$
  > Interpretation: No lottery in $\mathcal{P}$ can be infinitely more (or less) desirable than any other lottery.
* Alternative formulation for Axiom 3: For any $p \succ q \succ r$
  (1) $\exists$ $\alpha \in (0,1)$ s.t. $\alpha p + (1-\alpha) r \succ q$
  (2) $\exists$ $\beta \in (0,1)$ s.t. $q \succ \beta p + (1-\beta) r$