# Quantitative Logics
# Exercises 3

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1. We will also discuss Exercise 1 of last week: Pick your favourite random game (dice game, card game etc.) and try to model it as a Markov chain.

   Additional problem: Formulate a sensible PCTL property about your Markov chain.

2. Consider the Markov chain for the Craps game, shown in the first lecture. Write PCTL formulas for the following properties:

   (a) In the majority of games, the player loses.

   (b) The probability that the player wins with at most three tosses is at least 0.7.

   (c) The probability that the player loses without throwing a 10 is $< 0.3$.

3. When proving that the sets of paths $Sat(X\,\varphi)$, $Sat(\varphi\,U\,\psi)$ and $Sat(\varphi\,U^{\leq k}\,\psi)$ are measurable, I did not care whether the union of cylinder sets is a disjoint union. Please refine the proof: describe these sets as disjoint unions of cylinder sets.

4. There is a relation between PCTL and CTL: $E\Diamond\,\varphi$ correspondends to $P_{>0}(true\,U\,\varphi)$. To what PCTL formula does $A\Diamond\,\varphi$ correspond? Are these correspondences always exact?