Submit your solutions for (up to) three of the following four exercises. If you solve all four, we will consult a random number generator to decide which three to look at and grade.

**Question 1** (10 marks)
Consider the following game. There are three kinds of prizes: *small* (worth 10 utility points), *medium* (worth 20 points), and *big* (worth 30 points). Player 1 moves first and can either claim a small prize or pass. In the former case, the game ends; in the latter case, it is Player 2’s turn and she can either award a medium prize to both players or claim a big prize for herself. Thus, the game has the following extensive form:

```
1
  /\  
small  pass
      /
   2 
  \ /  
medium  big
     /
  (20, 20) (0, 30)
```

Answer the following questions:

(a) Formally define the extensive form of this game.
(b) Compute the set of all (pure) subgame-perfect equilibria of this game.
(c) Represent the same game as a normal-form game.
(d) Compute the set of all (mixed and pure) Nash equilibria of this game.

**Question 2** (10 marks)
In class, we formally defined how to translate any given extensive game (of perfect information) into a normal-form game and we also noted that the exact same method can be used to translate imperfect-information games into the normal form. We furthermore hinted at a method for translating any given normal-form game into an extensive game of imperfect information. Provide a clear description of the latter method for the case of arbitrary two-player normal-form games.

Using the methods of translation mentioned, one can find an extensive game $G$ such that, if we first translate $G$ into a normal-form game $G'$ and if we then translate $G'$ into an extensive-form game $G''$, then $G''$ need not be the same game as $G$. Find an example to show that this is indeed so. Then explain in what sense $G$ and $G''$ are nevertheless equivalent.
Question 3 (10 marks)

Prove the converse of Kuhn’s Theorem: In a (finite) imperfect-information game with perfect recall, for any given behavioural strategy of a given player, there exists an outcome-equivalent mixed strategy for the same player.

Question 4 (10 marks)

Conduct and report on an experimental study to find out how well people can play Simplified Poker and how well they fare against the equilibrium strategies discussed in class. This exercise leaves you a lot of freedom regarding the experiment you want to run and the questions you want to try and answer.

We will grade this exercise as follows: 10 marks for an excellent study that provides some original insight. 8 marks for a very good study that meets all the basic requirements we could reasonably ask for. 6 points for a fair attempt. No points for anything else.