

# IA168 — Problem set 3

## Problem 1 [8 points]

Find a perfect-information extensive-form game with pure strategies only where all of the following conditions are satisfied:

- there is a strategy profile whose outcome is for both players better than that of any Nash equilibrium;
- there is a Nash equilibrium whose outcome is for both players better than that of any subgame-perfect equilibrium;
- there are exactly **two** subgame-perfect equilibria  $s, s'$ , and the outcome of  $s$  is for both players better than that of  $s'$ .

## Problem 2 [8 points]

For a strategy profile  $s$  of an imperfect-information extensive-form game  $G$  with pure strategies only, consider the following property (\*):

For every information set  $I$ , there exists a node  $h \in I$   
such that  $s^h$  is a Nash equilibrium in  $G^h$ .

Prove or disprove the following two propositions: In every imperfect-information game where no path leads twice through the same information set, it holds that:

- every subgame-perfect equilibrium satisfies (\*);
- every strategy profile which satisfies (\*) is a subgame-perfect equilibrium.

## Problem 3 [4 points]

Consider this strategic-form game  $G$ :

	$A_2$	$B_2$	$C_2$
$A_1$	$(x, x)$	$(0, 0)$	$(10y, 0)$
$B_1$	$(0, 0)$	$(3x, 3x)$	$(0, 0)$
$C_1$	$(0, 10y)$	$(0, 0)$	$(y, y)$

Consider game  $G_{t-rep}$ . Find the necessary and sufficient condition for  $x, y, t$  so that there is an SPE  $\tau$  such that  $u_1(\tau) > 3xt$ . Shortly explain why your answer is correct.