

# Intelligent Autonomous Agents and Cognitive Robotics

## Exercise Sheet 10

1. Explain the difference between normal form and extensive form games.
2. In Multi-Agent environments agents are trying to find a strategy that is optimal for them. This strategy might depend on the strategy decision of other agents. In this context explain the following concepts:
  - Strategy
  - Strategy Profile
  - Dominant Strategy Equilibrium
3. Acme, a video game hardware manufacturer, has to decide whether its next game machine will use DVDs or CDs. Meanwhile, the video game software producer Best needs to decide whether to produce its next game on DVD or CD. The profits of both will be positive if they agree and negative if they disagree, as is shown in the following payoff matrix:

	Acme: dvd	Acme: cd
Best: dvd	A=9, B=9	A=-4, B=-1
Best: cd	A=-3, B=-1	A=5, B=5

Is there a dominant strategy?  
 Are there Nash equilibria?  
 What is the Pareto-optimal solution?  
 What does happen to the above if we change (dvd, dvd) to (A=5, B=5)?  
 Discuss the problem!

4. Show that a dominant strategy equilibrium is a Nash equilibrium, but not vice versa.
5. The payoff matrix below, from Blinder (1983) by way of Bernstein (1996), shows a game between politicians and the Federal Reserve. Politicians can expand or contract fiscal policy, while the Fed can expand or contract monetary policy. And of course either side can choose to do nothing. Each side also has preferences for who should do what—neither side wants to look like the bad guys. The payoffs shown are simply the rank orderings; 9 for first choice through 1 for last choice. Find the Nash equilibrium of the game in pure strategies. Is this a Pareto optimal solution?

	Fed: contract	Fed: do nothing	Fed: expand
Pol: contract	F=7, P=1	F=9, P=4	F=6, P=6
Pol: do nothing	F=8, P=2	F=5, P=5	F=4, P=9
Pol: expand	F=3, P=3	F=2, P=7	F=1, P=8

6. In the game three-finger Morra, two players, O (Odd) and E (Even), simultaneously display one, two or three fingers. Let the total numbers of fingers be  $f$ . If  $f$  is odd, O collects  $f$  dollars from E, and if  $f$  is even, E collects  $f$  dollars from O. Determine the mixed strategies for the players.
7. There are three candidates or choices A, B and C. The voters have to define a preference list. The results are given below:

<b>Rang</b>	<b>u</b>	<b>v</b>	<b>w</b>	<b>x</b>	<b>y</b>	<b>z</b>
<b>1</b>	A	A	B	B	C	C
<b>2</b>	B	C	A	C	A	B
<b>3</b>	C	B	C	A	B	A

u persons like A more than B and B more than C, v persons have the preference list ACB, w persons have the preference list BAC, etc.

Give general conditions on the numbers for a win of A. Use the Condorcet Criteria.

Discuss the case:  $u = x = y$  and  $v = w = z = 0$ .