

19. Betrachten Sie folgendes Bi-Matrixspiel in strategischer Form:

		Player II		
		Aktionen	L	R
Player I	T	(1,1)	(4,0)	
	B	(2,10)	(3,5)	

Ermitteln Sie graphisch Nash Gleichgewichte in gemischten Strategien.

20. Betrachten Sie folgendes Bi-Matrixspiel in strategischer Form:

		Player II			
		Aktionen	L	C	R
Player I	T	(0,0)	(7,6)	(6,7)	
	M	(6,7)	(0,0)	(7,6)	
	B	(7,6)	(6,7)	(0,0)	

Ermitteln Sie via Quadratischer Programmierung die Nashgleichgewichte in gemischten Strategien. Berechnen Sie die Lösung mittels Excel oder R oder Matlab oder GAMS oder von mir aus mit irgendeinen anderen Optimierungssolver.

21. **(Inspector Game):** During the 1960s, within the framework of negotiations between the United States (US) and the Union of Soviet Socialist Republics (USSR) over nuclear arms limitations, a suggestion was raised that both countries commit to a moratorium on nuclear testing. One of the objections to this suggestion was the difficulty in supervising compliance with such a commitment. Detecting above-ground nuclear tests posed no problem, because it was easy to detect the radioactive fallout from a nuclear explosion conducted in the open. This was not true, however, with respect to underground tests, because it was difficult at the time to distinguish seismographically between an underground nuclear explosion and an earthquake. The US therefore suggested that in every case of suspicion that a nuclear test had been conducted, an inspection team be sent to perform on-site inspection. The USSR initially objected, regarding any inspection team

sent by US as a potential spy operation. At later stages in the negotiations, Soviet negotiators expressed readiness to accept three on-site inspections annually, while American negotiators demanded at least eight on-site inspections. The expected number of seismic events per year considered sufficiently strong to arouse suspicion was 300.

The model presented in this exercise assumes the following:

- The USSR can potentially conduct underground nuclear tests on one of two possible distinct dates, labeled A and B, where B is the later date.
- The USSR gains nothing from choosing one of these dates over the other for conducting an underground nuclear test, and the US loses nothing if one date is chosen over another.
- The USSR gains nothing from conducting nuclear tests on both of these dates over its utility from conducting a test on only one date, and the US loses nothing if tests are conducted on both dates over its utility from conducting a test on only one date.
- The US may send an inspection team on only one of the two dates, A or B, but not on both.
- The utilities of the two countries from the possible outcomes are:
 - If the Partial Test Ban Treaty (PTBT) is violated by the USSR and the US does not send an inspection team, the US receives -1 and the USSR receives 1 .
 - If the PTBT is violated by the USSR and the US sends an inspection team, the US receives $-\alpha$ and the USSR receives $-\beta$; $\alpha > 0$ and $0 < \beta < 1$.
 - If the PTBT is not violated both US and USSR receive 0 .

Formulieren Sie ein Bi-Matrixspiel in strategischer Form. Für $\alpha=\beta=0.5$ ermitteln Sie Nashgleichgewichte.