Data Analysis in Astronomy and Physics (SoSe22)

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Exercise Set 6

Due: **9:30 16 May 2022**
Discussion: **13:00 20 May 2022**
Online submission at via ILIAS in the directory Exercises / Übungen -> Submission of Exercises / Rückgabe des Übungsblätter

1. *Kepler* [60 points]

The *Kepler* mission was a planet-hunting mission from 2009-2018, during which time it observed thousands of stars to search for periodic variability.

a) *Kepler* observed 306604 stars in its lifetime, 3664 of which were identified as candidates for hosting a planet. In total, there were 9564 planet candidates (called Kepler Objects of Interest or KOI) including 4847 false positives. Assume that an object identified as a candidate by *Kepler* has a 50% chance of being a false positive if we account the relevant physics. Do the results from *Kepler* suggest that we accounted for all of the physics? What are the null and alternative hypotheses? Make the relevant plots, including the shaded regions of interest. **30 points**

b) *Kepler* observed 8 planets within the habitable zone. Knowing that 6 of these planets orbit Sun-like stars while the others orbit red dwarfs, can you determine if a correlation must exist between stellar type and the occurance of an Earth-analogue planet? Show the simulation results. What is the probability of observing the planets we did? **30 points**

2. Small sample proportions [40 points]

There was a survey to determine if people were satisfied with their life, and it cross-referenced this with their income. The data is as follows:

GDP	less than €5000	between €5000 and €50000	more than €50000
Satisfied	18	62	6
Unsatisfied	20	34	3

Use a χ^2 test to determine if there is a correlation between income and general life satisfaction. Make the relevant plots. **40 points**