Artificial Intelligence 2 – SS 2020
Assignment 5: Decisions and Utilities
– Given May 22., Due May 31. –

Hint: Exercises need to be handed in via StudOn at 23:59 on the day they are due or earlier. Please use only the exercise group of your tutor to hand in your work.

If any concepts here seem unfamiliar to you or you have no idea how to proceed, consult the lecture materials, ask a fellow student, your tutor, or on the Forum.

If a problem asks for code, comment it or make it otherwise self-explanatory. You do not need to write a lot, but it should be enough to convince your tutor that you understand what the code does. We may deduct up to 30% for uncommented and unclear code, but would prefer not to.

Problems with no points (0pt) will not be graded, but might appear on the exam in a similar form. For these, we will provide a reference solution after the submission deadline. If you find the reference solution unclear, ask about it on the forum or in in a tutorial.

Problem 5.1 (Decision Theory) 50pt

You are offered the following game: You pay x dollars to play. A fair coin is then tossed repeatedly until it comes up heads for the first time. Your payout is 2^n, where n is the number of tosses that occurred.

- Assume your utility function is exactly the monetary value. How much should you, as a rational agent, be willing to pay to play? Use the formal definition of "expected utility" from the lecture.
- Assume now, that your utility function for having k dollars is $U(k) = m \log_n k$ for some $m, n \in \mathbb{N}^+$. How does this change the result?
- What is "wrong" with the result from the first exercise? Which "implicit assumption" leads to the apparently nonsensical result? Can you think of a way to "repair" our utility function in a more "realistic" way than taking logarithms?

Hint: The series $\sum_{k=1}^{\infty} \frac{k}{2^k}$ is convergent with limit 2.