Chair for Algorithms
and Data Structures
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Search Engines WS 09/10

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Exercise Sheet 6 — Solutions

Exercise 1

TODO.

Exercise 2

TODO.

Exercise 3

TODO.

Exercise 4 (Hannah)

Define $f(x) = x^2/2 + x - (1 + x) \cdot \ln(1 + x)$. We will show that $f(x) \geq 0$ for all $x \geq 0$. Then also $f(x)/x = x/2 + 1 - (1 + 1/x) \cdot \ln(1 + x) \geq 0$ for $x > 0$, which proves the claim from the exercise for $x > 0$. It's easy to verify that it also holds for $x = 0$.

We can easily compute the derivative $f'(x) = x+1-\ln(1+x)-1 = x-\ln(1+x)$. Since $1+x \leq e^x$ for all x, we have $f'(x) \geq 0$ for all x, that is, f is monotonically increasing over it's whole range. Since $f(0) = 0$ that implies $f(x) \geq 0$ for all $x \geq 0$.