MA0301
ELEMENTARY DISCRETE MATHEMATICS
NTNU, SPRING 2022

Set 6

Deadline: Monday 28.02.2022, 23:59

Exercise 1. *Lewis, Zax: Exercise 6.3a.*

Exercise 2. *Lewis, Zax: Exercise 6.7.*

Exercise 3. *Use induction to show that: if n is a positive integer, then* $\sum_{m=1}^{n} m = 1+2+3+...+n = \frac{n(n+1)}{2}$.

Exercise 4. *Lewis, Zax: Exercise 3.7.*

Exercise 5. *a) Find a formula for* $\frac{1}{1\cdot 2} + \frac{1}{2\cdot 3} + ... + \frac{1}{n(n+1)}$ *by examining the values of this expression for small values of n.*
b) Use induction to prove the formula you conjectured in part a.

Exercise 6. *What is wrong with this "proof"?*
"Theorem" For every positive integer n, if x and y are positive integers with $max(x, y) = n$, then $x = y$.
Basis Step: Suppose that $n = 1$. If $max(x, y) = 1$ and x and y are both positive integers we have $x = y$.
Inductive Step: Let k be a positive integer. Assume that whenever $max(x, y) = k$ and x and y are positive integers, then $x = y$. Now let $max(x, y) = k + 1$, where x and y are positive integers. Then $max(x - 1, y - 1) = k$, so by the inductive hypothesis, $x - 1 = y - 1$. It follows that $x = y$, completing the inductive step.

Exercise 7. *Use induction to prove that $3^n < n!$ if n is an integer greater than 6.*

Exercise 8. *Use induction to prove that 6 divides $n^3 - n$ whenever n is a nonnegative integer.*

Date: February 17, 2022.