

# CPSC 3210 Intro. to Design & Analysis of Algorithms

## Exam 1

The exam is **take home**. Please provide your answers to each questions using word or Latex (or other digital text processing methods). You need to upload your answer to Canvas by end of the day on March 1<sup>st</sup> (Monday)

1. Design a *deterministic* and a *nondeterministic* finite automata that accepts the set of binary strings having a substring of 0101.
2. Derive an asymptotically tight bound for the sum  $\sum_{k=1}^n k^r$ , where  $r \geq 0$  is a constant.
3. Consider the recurrence  $T(n) = 2T\left(\frac{n}{2}\right) + \lg n$ . Draw a recursion tree that represents this recurrence relation, and use it to find the closed form solution.
4. Consider a Turing machine that, at each transition, can either move its R/W head to the right or leave it in place; that is, it cannot move the R/W head left. Is this Turing machine variant equivalent in terms of computational power to the standard Turing machine model defined in class? If not, is it more powerful than a deterministic finite automata? In either case, explain your answer.