# CMPT 307-08-2 Assignment 4

(From lecture on May 27, 2008)

**Deadline: June 3, 5:30pm**

**Problem 4.1.** Show that the running time of the **Quicksort** presented at the lecture is $\Theta(n^2)$ when the elements of the array $A$ are distinct and sorted
(a) in increasing order;
(b) in decreasing order.

**Problem 4.2.** Show that the best-case running time of **Quicksort** is $\Omega(n \log n)$, i.e., show that the recurrence

$$T(n) \geq \min_{0 \leq q \leq n-1} (T(q) + T(n-q-1)) + dn$$

is in $\Omega(n \log n)$.
**Hint:** You can use the fact that the function $f(x) = x \log x + (n-1-x) \log(n-1-x)$ achieves its global minimum at point $x = (n-1)/2$.

**Problem 4.3.** Consider a probability space $S = \{1, 2, \ldots, 8\}$ (outcome of a throw of 8-sided die). Find and example of three events $A, B, C$ of $S$ such that $A, B, C$ are pairwise independent, but events $A$ and $B \cap C$ are not (i.e. $P(A) \cdot P(B \cap C) \neq P(A \cap B \cap C)$).