CSE 332: Data Abstractions
Assignment #7
August 10, 2011

You do not have to turn in this assignment. It is intended to give you some practice problems before the final exam on material since Assignment #6.

1. Given a (very long) string T called the "text" and a (short) string P called the "pattern", the *string-matching problem* is to find substrings of T that are equal to P. Let n be the length of T. You can assume that the length of P is a constant. All of your algorithms below should have work $O(n)$ and span $O(\log n)$. Be sure to explain for each algorithm why this is true.
   (a) Describe a fork-join parallel algorithm that outputs the index of the leftmost occurrence of the pattern P in T, using a sequential cutoff of 1.
   (b) Describe a fork-join parallel algorithm that outputs an array of the indices of all occurrences of the pattern P in T, using a sequential cutoff of 1. (Hint: use Pack.)
   (c) What changes do you need to make to your solution in part (a) to use a more sensible sequential cutoff?

2. (a) Given an acyclic directed graph $G = (V, E)$ representing course prerequisites, write an algorithm that computes a schedule for completing all the courses in the minimum number of academic terms, with each course completed in the earliest possible term. Your algorithm should assign a term number `v.term` to every vertex `v`, beginning with term number 1. Assume that there is no limit on how many courses can be taken in any given term and that every course is offered every term.
   (b) Show the result of running your algorithm on the graph of Figure 9.3.
   (c) What is the asymptotic running time of your algorithm in terms of $n = |V|$ and $e = |E|$? Justify your answer.

3. Exercise 9.5. Part (a) is asking for least cost paths, and part (b) is asking for shortest paths ignoring the edge costs. Show your work for part (a) as in Figures 9.21-9.27 and for part (b) as in Figure 9.19.