Department of Computer Science **University of San Francisco**

Computer Science 673
Fall 2016
Homework 11: Last
Due Wednesday, December 7th

1. (8 points) Exercise 32.1-4 Gap Character Suppose we allow the patern P to contain occurances of a **gap character** $\diamond$ that can match an *arbitrary* string of characters (even one of zero length). For example, the pattern $ab\diamond ba\diamond c$ occurs in the text *cabccbacbacab* as

   abccbacbacab and as *abccbacbac*. Note that the gap character may occur an arbitrary number of times in the pattern but is assumed not to appear in the text. Give a polynomial-time algorithm to determine if such a pattern P occurs in a given text T, and analyze the running time of your algorithm. Note that you do not need to find all occurances, you just need to determine if the pattern occurs at all. Give pseudocode.

2. (6 points) Construct the string matching automaton for the string ababaab.

3. 32.3-4 (8 points) Given two patterns P and P', describe how to construct a finite automaton that determines all occurances of *either* pattern. (You do not need to minimize the number of states in your automaton). *HINT:* Think about how you could solve the problem if you could use 2 finite automata. How could you modify that solution to use only one?

4. 32.3-5 (6 points) Given a pattern P containing gap characters (see Exercise 32.1-4, above), show how to build a finite automaton that can find an occurence of P in a text T in $O(n)$ time, where $n = |T|$. Note that you do not need to find all ouccurences, just one.

5. (6 points) Exercise 32.4-5 Cyclic Rotations. Give a linear-time algorithm to determine if a text T is a cyclic rotation of another string T'. For example., *arc* and *car* are cyclic rotations of each other.