8.2. Knuth-Morris-Pratt Pattern Matching

```
/**
 * ========================================================================
 *                  KNUTH-MORRIS-PRATT PATTERN MATCHER
 * ========================================================================
 */

public class KMP {

 private static void printar(int[] array, int size) {
   for (int k=0; k<size; k++) {System.out.print(array[k]+" ");}
   System.out.println();
  }
 /** ----------------------------------------------------------------------
  *                     main
  * -----------------------------------------------------------------------
  */
 public static void main(String[] args) {

 boolean traceon = true;    // tracing variable
 String s, p;               // s: given subject, p: pattern to find.
 int   sl,pl;
 s = "aabacaabaabaa";
 p = "aabaa";
 sl = s.length();
 pl = p.length();
 System.out.println("\nThe given subject string s of " + sl +
                   " elements is:\n " + s);
 System.out.println("\nThe given pattern p of "+pl+" elements is:\n "+ p);

/* -----------------------------------------------------------------------
 * indexing in Java begins from 0 (as in C++):
 *       stp=abcab  length(stp)=5   stp.charAt(2) is c.
 * index:     01234  lstp1=4
 * -----------------------------------------------------------------------
 */
 /** ----------------------------------------------------------------------
  *                     computing pi
  * -----------------------------------------------------------------------
  */
 int [] pi = new int [pl];  // the length of pi is equal to the length of
                            // the pattern
 int i, j;
 pi[0]=0;
 j=0;
 for (i=1; i<pl; i=i+1) {
     while (j>0 && p.charAt(j)!=p.charAt(i)) {j=pi[j-1];};
     if (p.charAt(j)==p.charAt(i)) {j=j+1;};
     pi[i]=j;
    };
//------------------------------------------------------------------------
 System.out.print("\nThe pi array of " + pl +  " elements is:\n ");
 printar(pi,pl); System.out.println();
//------------------------------------------------------------------------
```

```
 j=0;
 for (i=0; i<sl; i=i+1) {
     while (j>0 && p.charAt(j)!=s.charAt(i)) {j=pi[j-1];};
     if (p.charAt(j)==s.charAt(i)) {j=j+1;};
     if (traceon) {System.out.println(" i="+i+" j="+j);};  // tracing
     if (j==pl) {
       System.out.println("The pattern occurs at position "+(i-pl+1)+"\n");
       j=pi[j-1];
       };
    }; // end of for
 }     // end of main
}

/**
 * input:      output:  (with traceon == true)
 * ------------------------------------------------------------------------
 * java5c KMP.java
 * java5  KMP
 *
 *             The given subject string s of 13 elements is:
 *              aabacaabaabaa
 *
 *             The given pattern p of 5 elements is:
 *              a a b a a
 *
 *             The pi array of 5 elements is:
 *              0 1 0 1 2
 *
 *              i=0 j=1
 *              i=1 j=2
 *              i=2 j=3
 *              i=3 j=4
 *              i=4 j=0
 *              i=5 j=1
 *              i=6 j=2
 *              i=7 j=3
 *              i=8 j=4
 *              i=9 j=5
 *             The pattern occurs at position 5
 *
 *              i=10 j=3
 *              i=11 j=4
 *              i=12 j=5
 *             The pattern occurs at position 8
 *
 * ------------------------------------------------------------------------
 */
```