CS4335 Design and Analysis of Algorithms
Tutorial 10

Question 1. Construct the failure function for the pattern ***abcabbabcabbabbbb*** using the linear time algorithm. How many comparisons are used in order to compute f(15)?
Answer:

i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P	a	b	c	a	b	b	a	b	c	a	b	b	a	b	b	b	b

$q = 1$	$P(1) = a$		$f(1) = 0$
$q = 2$	$P(2) = b$	$P(f(2-1)+1) = a$	$f(2) = 0$
$q = 3$	$P(3) = c$	$P(f(3-1)+1) = a$	$f(3) = 0$
$q = 4$	$P(4) = a$	$P(f(4-1)+1) = a$	$f(4) = 1$
$q = 5$	$P(5) = b$	$P(f(5-1)+1) = b$	$f(5) = 2$
$q = 6$	$P(6) = b$	$P(f(6-1)+1) = c$	
		$P(ff(6-1)+1) = a$	$f(6) = 0$
$q = 7$	$P(7) = a$	$P(f(7-1)+1) = a$	$f(7) = 1$
$q = 8$	$P(8) = b$	$P(f(8-1)+1) = b$	$f(8) = 2$
$q = 9$	$P(9) = c$	$P(f(9-1)+1) = c$	$f(9) = 3$
$q = 10$	$P(10) = a$	$P(f(10-1)+1) = a$	$f(10) = 4$
$q = 11$	$P(11) = b$	$P(f(11-1)+1) = b$	$f(11) = 5$
$q = 12$	$P(12) = b$	$P(f(12-1)+1) = b$	$f(12) = 6$
$q = 13$	$P(13) = a$	$P(f(13-1)+1) = a$	$f(13) = 7$
$q = 14$	$P(14) = b$	$P(f(14-1)+1) = b$	$f(14) = 8$
$q = 15$	$P(15) = b$	$P(f(15-1)+1) = c$	
		$P(ff(15-1)+1) = c$	
		$P(fff(15-1)+1) = a$	$f(15) = 0$
$q = 16$	$P(16) = b$	$P(f(16-1)+1) = a$	$f(16) = 0$
$q = 17$	$P(17) = b$	$P(f(17-1)+1) = a$	$f(17) = 0$

Number of comparisons are used in order to compute f(15) = 3

Question 2. Let the text be abababcababababcc and the pattern be ababc. Fnd out all the occurrences of the pattern using the KMP scan algorithm?
Answer:

i	1	2	3	4	5
P	a	b	a	b	c

$q = 1$	$P(1) = a$		$f(1) = 0$
$q = 2$	$P(2) = b$	$P(f(2-1)+1) = a$	$f(2) = 0$
$q = 3$	$P(3) = a$	$P(f(3-1)+1) = a$	$f(3) = 1$
$q = 4$	$P(4) = b$	$P(f(4-1)+1) = b$	$f(4) = 2$
$q = 5$	$P(5) = c$	$P(f(5-1)+1) = a$	
		$P(ff(5-1)+1) = a$	$f(5) = 0$

i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T	a	b	a	b	a	b	c	a	b	a	b	a	b	c	c
	a	b	a	b	c										
			a	b	a	b	c								
								a	b	a	b	c			
										a	b	a	b	c	
															a