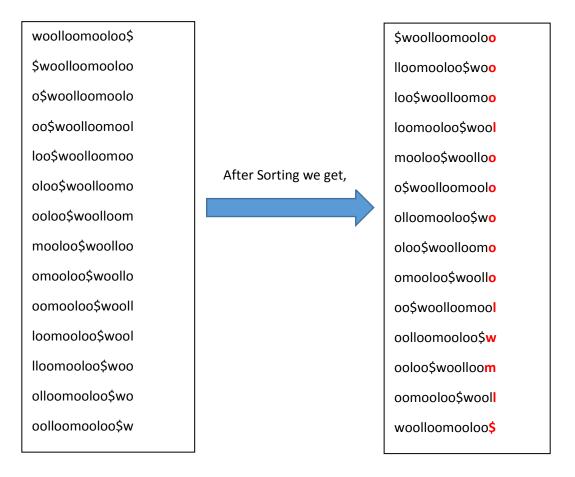
FIT2004 S2_2016 Tute Week 9 Solutions

Question 1:

First, we have to list down all possible cyclic rotations of the given text "woolloomooloo\$"



The last column in red of the sorted matrix is Burrows-Wheeler Transform

Question 2:

- a) Using BWT, find substring "olo"
 - Initially the range contains all rows of BWT
 - Starting from right most character "olo"
 - Find first occurrence of character in the range and the last occurrence of character in the range in the Last column
 - Find the corresponding characters in the first column and update the range



\$woolloomooloo1 I₁oomooloo\$woo₂ I200\$wookoomoo3 I300mpoloo\$wool1 m₁oloo\$woolloo₄ O1\$woolloomoolO5 O2lloomooloo\$wO6 03loo\$woolloom07 04mooloo\$woollo8 050\$woolloomool2 O60lloomooloo\$w1 070 00\$ woolloom1 080mooloo\$wooll3 w₁oolloomooloo\$



\$woolloomooloo1 100mooloo\$woo2 200\$woolloomoo3 l300mooloo\$wool1 00\$woolloo4 m\00 oomool**o**5 01\$V 0211001 080mooloo\$wooll3 w₁oolloomooloo\$



\$woolloomooloo1 I100mooloo\$woo2 l200\$woolloomoo3 I300mooloo\$wool1 m₁ooloo\$woolloo₄ 01\$woolloomoolo5 O2lloomooloo\$wO6 O₃loo\$woolloomO₇ O4mooloo\$woollO8 050\$woolloomool2 o6olloomooloo\$w1 o70loo\$woolloom1 080mooloo\$wooll3 w₁oolloomooloo\$

\$woolloomooloo1 I100mooloo\$woo2 l200\$woolloomoo3 300mooloo\$wool1 m100l00\$w00ll004 O1\$woolloomoolO5 O2lloomooloo\$wO6 03loo\$woolloom07 O4mooloo\$woollO8 050\$woolloomool2 O60lloomooloo\$w1 o70l00\$wooll00m1

080mooloo\$wooll3

w₁oolloomooloo\$

b) Using BWT, find substring "oll" Starting from right most character "oll"

\$woolloomooloo1

I100mooloo\$woo2

I200\$woolloomoo3

I300mooloo\$wool1

m100loo\$woolloo4

01\$woolloomooloo\$wo6

03loo\$woolloomo7

04mooloo\$woollo8

050\$woolloomool2

060lloomooloo\$wooll3



\$woolloomooloo1

lacomocloo\$woO2
l2co\$wolloomcO3
l3comocloo\$wool1
m1coloo\$woolloo4
O1\$woolloomcoloo\$wo6
O3loo\$woolloomco7
O4mocloo\$woollo8
O50\$woolloomcol2
O6colloomcoloo\$w1
O7cloo\$woolloom1



\$woolloomooloo1

w₁oolloomooloo\$

I100mooloo\$woo2

I200\$woolloomoo3
I300mooloo\$wool1
m100loo\$woolloo4
01\$woolloomooloo\$wo6
02lloomooloo\$wo6
03loo\$woolloomo7
04mooloo\$woollo8
050\$woolloomool2
060lloomooloo\$w1
070loo\$woolloom1
080mooloo\$wooll3

\$woolloomooloo1 I100mooloo\$woo2 I200\$woolloomoo3 I300mooloo\$woolloo4 O1\$woolloomoolo5

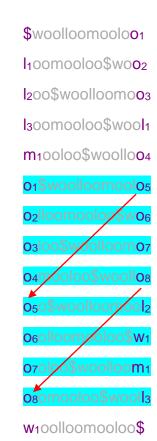
W₁oolloomooloo\$

02lloomooloo\$w06

03loo\$woolloomo7
04mooloo\$woollo8
050\$woolloomool2
060lloomooloo\$w1
070loo\$woolloom1
080mooloo\$wooll3
w100lloomooloo\$

c) Using BWT, find substring "oo" Starting from right most character "oo"

\$woolloomooloo1
I100mooloo\$woo2
I200\$woolloomoo3
I300mooloo\$wool1
m100loo\$woolloo4
01\$woolloomooloo\$wo6
03loo\$woolloomo7
04mooloo\$woolloom07
04mooloo\$woolloom1
070loo\$woolloom1
080mooloo\$wooll3
w100lloomooloo\$



"oo"

\$woolloomooloo1
I100mooloo\$woo2
I200\$woolloomoo3
I300mooloo\$wool1
m100loo\$woolloo4
01\$woolloomooloo\$wo6
03loo\$woolloomooloo\$woolloo
04mooloo\$woolloomool2
0601loomooloo\$w1
070loo\$woolloom1
080mooloo\$wooll3
w100lloomooloo\$

d) Using BWT, find substring "wol"↓Starting from right most character "wol"

\$woolloomooloo1
I100mooloo\$woo2
I200\$woolloomoo3
I300mooloo\$wool1
m100loo\$woolloo4
01\$woolloomooloo\$wo6
03loo\$woolloomooloo\$woolloo
04mooloo\$woolloomooloo\$w1
070loo\$woolloom1
080mooloo\$wooll3
w100lloomooloo\$



\$woolloomooloo1

lacomocloo\$woO2
l2coo\$woolloopicO3
l3comocloo\$woolloo4
O1\$woolloomocloo\$woolloowO2
lloomocloo\$woolloomocloo\$woolloowO6
O3loo\$woolloomocloo\$woolloowO6
O5o\$woolloomocloo\$w1
O7oloo\$woolloom1
O8omocloo\$wooll3
w1colloomocloo\$



\$woolloomooloo1 I1oomooloo\$woo2 I2oo\$woolloomoo3 I3oomooloo\$wool1 m1ooloo\$woolloo4 o1\$woolloomoolo5



O₃loo\$woolloomo₇

04mooloo\$woolloa 050\$woolloomoolo 060lloomooloo\$w1 070loo\$woolloom1 080mooloo\$wooll3 w100lloomooloo\$



There is no 'w' in the last column of the range. So there is no 'wol' substring.

Question 3:

Source vertex: Z

Discovered
Z,0
W, 18 17 16
Y, 3
X, 8
V, 18 13
U, 19 18
T, 19
S, 23 22
R, 29 24
Q, 31 23
P, 29 28

Finalized
Z, 0
Y, 3
X, 8
V, 13
W, 16
U, 18
T, 19
S, 22
Q, 23
R, 24
P, 28

Question 4:

Below is a sample linked list representation:

A4	L2
A6	L4 L5
T3	L1 L2
T5	L2 L3
T7	L4 L5
L1	L2 L3 L4 L5 L6 L7 L8
L2	L2 L3 L4 L5 L6 L7 L8
L3	L4 L5 L6 L8
L4	L4 L6 L7 L8
L5	L6 L7 L8
L6	L6 L7
L7	L7
L8	L8
L9	L9