LZ78 - Exercise

Multimedia Technology,

Tutorial 2, section 3b

LZ78 - Exercise

Consider that we apply LZ78 encoding and start with an empty dictionary.
Show how the sequence "acccccccacacc" is encoded and how the output produced by the encoder is decoded.

accccccacacc

In	Out	Dictionary
a		

The first symbol is 'a'.

accccccacacc

In	Out	Dictionary
a	(0 , a)	

Output: (0 , a)
0 indicates that I haven't seen 'a' before.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a

Add 'a' at index 1 in the Dictionary.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c		

The next string is symbol 'c'.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	

Output: (0 , c)

0 indicates that I have not seen symbol 'c' before.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c

Add 'c' at index 2 in the Dictionary.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc		

The next string is 'cc'.
I have only seen 'c' before.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	

Output: (2 , c)
The number 2 corresponds to index 2 of the Dictionary, meaning 'c'.
The next symbol is 'c'.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc

Add 'cc' at index 3 in the Dictionary.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc		

The next string is 'ccc'.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	

Output: (3 , c)
The number 3 corresponds to index 3 of the Dictionary, meaning 'cc'
The next symbol is 'c'.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc

Add 'ccc' at index 4 in the Dictionary.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac		

The next string is 'ac'.
I have only seen 'a' before.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac	(1 , c)	

Output: (1 , c)
The number 1 corresponds to index 1 in the dictionary.
The next symbol is 'c'.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac	(1 , c)	5: ac

Add 'ac' at index 5 in the Dictionary.

accccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac	(1 , c)	5: ac
acc		

The next string is 'acc'.

acccccccacacc

In	Out	Dictionary
a	(0 , a)	1: a
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac	(1 , c)	5: ac
acc	(5 , c)	

Output: (5 , c)

The number 5 corresponds to index 5 in the Dictionary.

The next symbol is 'c'.

acccccccacacc

In	Out	Dictionary
α	(0 , α)	1: α
c	(0 , c)	2: c
cc	(2 , c)	3: cc
ccc	(3 , c)	4: ccc
ac	(1 , c)	5: ac
acc	(5 , c)	6: acc

Add 'acc' at index 6 in the Dictionary.

Decoding the output from the encoder.

In	Out	Dictionary
		1: a
		2: c
		3: cc
		4: ccc
		5: ac
		6: acc

When decoding I know the Dictionary
The code is the input.
I calculate the output.

In	Out	Dictionary
(0 , a)		1: a
		2: c
		3: cc
		4: ccc
		5: ac
		6: acc

Input: (0 , a)

a

In	Out	Dictionary
(0 , a)	a	1: a
		2: c
		3: cc
		4: ccc
		5: ac
		6: acc

Output: a

a

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)		2: c
		3: cc
		4: ccc
		5: ac
		6: acc

Input: (0 , c)

ac

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
		3: cc
		4: ccc
		5: ac
		6: acc

Output: c

ac

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)		3: cc
		4: ccc
		5: ac
		6: acc

Input: (2 , c)

accc

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
		4: ccc
		5: ac
		6: acc

When I check the Dictionary at index 2 I get 'c'.
Add c from the input code.
Output: cc

accc

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)		4: ccc
		5: ac
		6: acc

Input: (3 , c)

acccccc

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)	ccc	4: ccc
		5: ac
		6: acc

When I check the Dictionary at index 3 I get 'cc'.
Add c from the input code.
Output: ccc

acccccc

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)	ccc	4: ccc
(1 , c)		5: ac
		6: acc

Input: (1 , c)

acccccccac

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)	ccc	4: ccc
(1 , c)	ac	5: ac
		6: acc

When I check the Dictionary at index 1 I get a.
Add c from the input code
Output: ac

acccccccac

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)	ccc	4: ccc
(1 , c)	ac	5: ac
(5 , c)		6: acc

Input: (5 , c)

acccccccacacc

In	Out	Dictionary
(0 , a)	a	1: a
(0 , c)	c	2: c
(2 , c)	cc	3: cc
(3 , c)	ccc	4: ccc
(1 , c)	ac	5: ac
(5 , c)	acc	6: acc

When I check the Dictionary at index 5 I get ac.
Add c from the input code.
Output: acc