

“Alice in Wonderland” – Lewis Carroll

Homework assignment Introduction to Computing 2004-2005



Most people probably know the story of Alice in Wonderland by Lewis Carroll. This started as a bedside story that he told to his children. Later it was published and now the entire world can enjoy the wondrous world invented by Carroll.

What most people don't know is that Carroll was not only an inventive writer, filling his stories with language games, but also a master in mathematical puzzles and riddles. One of the inventions he concocted is the coding scheme described in this exercise.

The simplest coding scheme is “shifting of a character”. It works as follows. Imagine the text

WHAT A BEAUTIFUL DAY

If we replace every letter in the text by its successor in the alphabet, according to the table below (note the cyclic property; “Z” shifted right one place becomes “A”),

TABLE I: “SHIFT RIGHT 1” CODING SCHEME

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A

we get

XIBU B CFBVUJGV EBZ

This doesn't make sense for someone who doesn't know how the text is coded. However, the coding is rather simple and it doesn't take very long to crack it, even for the amateur. A more sophisticated version is one in which every letter of the source text gets its own code. The code for every letter is then given by a keyword. If the corresponding letter of the keyword is an “A”, the letter is directly copied, without coding. If the letter in the keyword is “B”, the letter in the source text is shifted up one place, just as in Table I. For a “C”, the letter is shifted right two places, etc. In this way, our text, with keyword “HELLO” becomes

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WHAT A BEAUTIFUL DAY
HELL O HELLOHELL OHE
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DLLE O IILFHPJFW RHC
    
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This is still quite easy to crack because it can easily be recognized where the words start and finish. To avoid this, we also want to code spaces in our coding. Per definition we make a space the 27th character of the alphabet and use the same scheme as above. Furthermore, we would like to write in uppercase and lowercase and also code this. The idea will be as follows: the coded letter will be uppercase if the source letter *and* the keyword letter are both uppercase or both lowercase, otherwise it will be lowercase. Table II on the next page summarizes this coding scheme.

TABLE IIA: FULL CODING SCHEME

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc
B	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B
D	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C
E	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D
F	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F
H	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G
I	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L
N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Z	Z	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
spc	spc	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

(Note: other characters are not coded but copied directly)

TABLE IIB: CASE CODING SCHEME

	UPPERCASE	lowercase
UPPERCASE	UPPERCASE	lowercase
lowercase	lowercase	UPPERCASE

(Note: space is considered UPPERCASE)

Example:

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What a beautiful day, isn't it?      <-- Source text
heLLoheLLoheLLoheLLo heLL oheL    <-- Keyword "heLLo"
-----
cLldnHdmpOAXtqHSdoll,gMcy' GgMd?  <-- Resulting text
    
```



- Write a program that codes and decodes text based on the description and the tables given in these pages.