Autumn 2023, ISTM, FCU-Purdue 2+2 ECE Program
ISTM116 Programming Applications for Engineers, Quiz 2

Use file name "quiz2_DXXXXXXX_1.c" for Question 1 and file name "quiz2_DXXXXXXX_2.c" for Question 2 for your source, where "DXXXXXXX" is your student ID. When you finish a question, upload the source code file to the instructor's computer.

1. (50 points) You may start with program skeleton **quiz2_skeleton_1.c** and change the file name to **quiz2_DXXXXXXX_1.c**. Write a C program to do the following steps: (a) input a hexadecimal numeral ***string*** of length 8, including leading zeros. You may assume the input string is a valid hexadecimal numeral with digits and uppercase letters 'A' to 'F'. (b) Convert this string to a 32-bit non-negative integer n with the value less than or equal to 4,294,967,295. Print the decimal value of n without leading zeros. (c) Print n as the 32-bit binary numeral representation, including zeros, in the following format $b_{31}b_{30}b_{29}b_{28}b_{27}b_{26}b_{25}b_{24}$ $b_{23}b_{22}b_{21}b_{20}b_{19}b_{18}b_{17}b_{16}$ $b_{15}b_{14}b_{13}b_{12}b_{11}b_{10}b_9b_8$ $b_7b_6b_5b_4b_3b_2b_1b_0$, that is, every eight bits are separated by a space. Repeat this process until the input string is "00000000".

   Example of program execution:

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d:\>quiz2_1
Input a hexadecimal numeral string of length 8, including leading zeros: 00006451
The input hexadecimal numeral 00006451 is of the decimal value: 25681
Binary numeral:      00000000 00000000 01100100 01010001

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Input a hexadecimal numeral string of length 8, including leading zeros: ABC82DE3
The input hexadecimal numeral ABC82DE3 is of the decimal value: 2882022883
Binary numeral:      10101011 11001000 00101101 11100011

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Input a hexadecimal numeral string of length 8, including leading zeros: FFFFFFFF
The input hexadecimal numeral FFFFFFFF is of the decimal value: 4294967295
Binary numeral:      11111111 11111111 11111111 11111111

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Input a hexadecimal numeral string of length 8, including leading zeros: 00000000

d:\>
```

(continue to the next page).

1. (50 points) You may start with program skeleton **quiz2_skeleton_2.c** and change the file name to **quiz2_XXXXXXX_2.c**. A right-shift Vigenère square with a keyword is used to encode a text of English letters. The first row of a right-shift Vigenère square is 26 English letters in the alphabetical order, then each of the following row is the ***cyclic right rotation*** of the row right on the top of it. A right-shift Vigenère square is given as the following tables:

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

A keyword can be any English word, it will be repeatedly concatenate itself until the same length as the encoded text. The encoded text and the repeated keyword is aligned and then a code book is selected. Selection of the code book is to match the aligned letter of the keyword with the letter in the green box of the the first column. With the selected code book, the letter of the encoded text is then translated to a ciphered letter. For example, if the keyword is "FENGCHIA" and the text is "Programming Applications for Engineer", the encoding of the text is shown as below.

Input text	P	R	O	G	R	A	M	M	I	N	G	A	P	P	L	I	C	A	T	I	O	N	S	F	O	R	E	N	G	I	N	E	E	R
keyword	F	E	N	G	C	H	I	A	F	E	N	G	C	H	I	A	F	E	N	G	C	H	I	A	F	E	N	G	C	H	I	A	F	E
Encoded text	K	N	B	A	P	T	E	M	D	J	T	U	N	I	D	I	X	W	G	C	M	G	K	F	J	N	R	H	E	B	F	E	Z	N

The encoded text is "KNBAPTEMDJTUNIDIXWGCMGKFJNRHEBFEZN". Write a C program to perform the following steps:

1. Input a keyword and an English text;
2. Output the keyword the original text;
3. Remove white spaces and punctuation symbols;
4. Convert all lower case letters to upper case letters;
5. Encode the text using the right-shift Vigenère square and output the encoded text;
6. Decode the encoded text and output the decoded result.

Assume the maximum characters in the input length is 1,000. You may use MDOS pipeline command to input (<) the testing original text and the encoded text. The the first word in the

testing text data.txt is the keyword.

Example of program execution:

```
d:\>quiz2_2 < data.txt
**** The keyword is: FENGCHIA

>>>> The input original text:

Programming Applications for Engineer

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>>>> The encoded text:

KNBAPTEMDJTUNIDIXWGCMGKFJNRHEBFEZN

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>>>> The decoded text:

PROGRAMMINGAPPLICATIONSFORENGINEER

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