

AP Computer Science  
Final Exam Program

Name \_\_\_\_\_

The following test is due on or before Friday, May 29, 2015 **the end of the school day (3:00 P.M.)**. It will not be accepted after this time. Note: if you cannot find me, you may submit this sheet to my mailbox in room 702 by the deadline. Mrs. Sampson may assist you if you need it.

This test is to be done independently, without the aid of websites, knowledgeable acquaintances and classmates or any other aid that would not be available during a normal in-class exam. The one exception is consulting the Java API for reference. There is no time limit on the exam, only the condition that once you open the exam you do not consult any of the above-disallowed references.

Hereunder I sign that I've read these conditions and will abide by them. I understand that Mr. Harris will grade the exam fairly. I also understand that Mr. Harris finds academic dishonesty increasing, and totally reprehensible as well as personally insulting.

Signed: \_\_\_\_\_

## AP Computer Science

### Final Exam Project: Cryptography

**Objective:** To design and implement a complete software solution with an efficient data structure using all of your current programming knowledge.

**Program Description:** During all the major wars and conflicts, maintaining secrecy was a top priority for both sides. Having a strong encryption or cipher allowed communication to continue between the various leaders within each side without the fear of that valuable information be discovered by the opposition. Your task will be to write a classic cipher algorithm and its complimentary decipher code along with a complete program that demonstrates all of its features.

**The Cipher:** A rotating set of 3 concentric rings is used with the following rules:

#### Encryption:

- Find the character on the inner circle and observe the character aligned with it in outermost circle. Find that character on the middle circle and output the one aligned with it on the outer circle.
- Once that character is encrypted, rotate the inner circle clockwise one step. When that circle has completed a full rotation, the middle circle then turns one step, like an old fashioned car odometer.
- Example: In the image below the character 'A' would be encrypted as 'Q', since 'A' on the inner circle is aligned with 'P' on the outer circle, and 'P' on the middle circle is aligned with 'Q' on the outer circle. After performing this encryption, the inner circle is rotated clockwise, so the letter 'A' would next be encrypted as 'P'.

#### Decryption:

- Follow all the above steps but in reverse.
- Find the character on the outer circle, note the character aligned with it on the middle circle, find that character on the outer circle, then output the character aligned with it on the inner circle.

#### Example:

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

- Original - Final
- Encrypted - Yntzs

## Program Details:

- The program should establish the cipher machine. Perhaps preset the keys and then get fancy by randomly generating them.
- The program should contain a repeating menu with the following features:
  - Prompt the user for a text file name to encrypt.
  - Prompt the user for a text file name to decrypt.
  - Prompt the user for a quick text input to encrypt and decrypt displaying both results.
  - Exit the program.
- A Cryptography class should contain the encryption code. Perhaps storing the cipher in a text file for continued usage of previous encrypted text.
- A way to verify the message should be provided. Perhaps display to screen and write to a file.
- The text may include upper and lowercase letters as well as punctuation. Hint: your cipher is all upper or lower.
- Digits in a cipher will not be tested for full credit, but may be checked for additional credit if the programmer requests it in the program.

## Preplanning requirement:

- Given the time constraint I am requiring you to do a little thinking before coding. On the back of the cover please hand write out your plan of attack. What data structure will you use, how will you handle the encryption and decryption. This should not be any code, only a bunch of notes as to the files and methods you may need to write and what they do.

Realize that I am attempting to ascertain what you have learned in this course, and how you handle the above scenario. Please do your best.

## Submissions for the exam should include:

1. The **original** attached cover sheet, signed and with your preplanning on the reverse side.
2. This assignment sheet stapled to the above
3. Your electronic submission of all the required files .zip'd together and emailed to *[harris@lexingtonma.org](mailto:harris@lexingtonma.org)*

**AP Computer Science**  
*Final Exam Project: Cryptography*

Scoring Rubric

<b>Concept</b>	<b>Points</b>
Preplanning exercise	5
Cryptography Class - 45 points	
Data Structure Choice	5
Constructors	10
Encrypt methods	10
Decrypt methods	10
Storage / Treatment of data	5
Dealing with all character	5
Runner Program - 40 points	
Creation of Cypher key	5
Menu	10
File Reading	10
File Writing	10
Simple encryption	5
Verification of Message	5
Compiles and Runs	5
Extra Credit: digits	5
<b>Total</b>	

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