

*I must study politics and war that my sons may have liberty to study mathematics and philosophy.*

—John Adams

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GUIDELINES

- All work must be shown for full credit.
- You can choose to use SageMath code to help you solve the problems. If you do, print out your code and attach it with the assignment.
- Either print out this assignment and write your answers on it, or edit the latex source and type your answers in the document. Make sure you still show your work!
- You may work with classmates, but be sure to turn in your own written solutions. Write down the name(s) of anyone who helps you.
- Check one:
  - I worked with the following classmate(s): \_\_\_\_\_
  - I did not receive any help on this assignment.

1. GRADED PROBLEMS

1. Encrypt **letters** using the affine function  $15x + 3 \pmod{26}$ . What is the decryption function? Check that it works.

2. Consider an affine cipher (mod 26). You do a chosen plaintext attack using `hahaha`. The ciphertext is `NONONO`. Determine the encryption function.

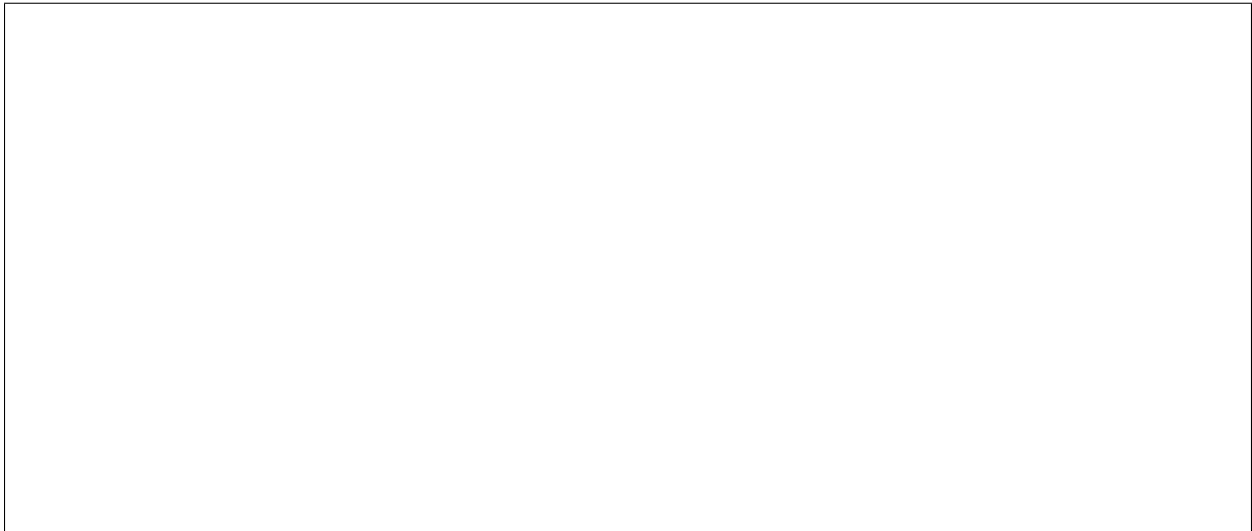
3. This problem involves the Dancing Men code from a Sherlock Holmes story.
- a. Read Section 2.5 (Sherlock Holmes), and describe (in a paragraph) how Sherlock figures out which dancing man represents the letter `e` as well as the letter `r`.

- b. Explain in one sentence what the little flags mean.

4. (T&W 2.14 # 6) Suppose you encrypt using an affine cipher  $E_1(x) = \alpha_1x + \beta_1$ , then encrypt the encryption using a second affine cipher  $E_2(x) = \alpha_2x + \beta_2$  (both are working mod 26). What is the resulting (combined) double encryption Is there any advantage to doing this rather than using a single affine cipher? Why or why not?



5. Decrypt the ciphertext DRLUKDOSGDASACAOF, which was encrypted with a Vigenère cipher using the key CRAB.



## 2. RECOMMENDED EXERCISES

These will not be graded but are recommended if you need more practice.

- Section 2.13: # 1, 5, 7