

## Math F113X: Homework Set 9

- Complete problems #1 - 12 from the Encryption section.
- Complete problem A.
- For extra credit, complete the Extra Credit Problem.

**Problem A:** Suppose you find the encrypted message below.

**Znk qke oy zu ynoz he ykbkt. Yu znk rkzzkx g muky zu znk rkzzkx m.**

(a) Fill out the frequency table below for the symbols in the encrypted text.

letter	frequency	letter	frequency	letter	frequency
A or a		J or j		S or s	
B or b		K or k		T or t	
C or c		L or l		U or u	
D or d		M or m		V or v	
E or e		N or n		W or w	
F or f		O or o		X or x	
G or g		P or p		Y or y	
H or h		Q or q		Z or z	
I or i		R or r			

(b) Identify the most frequent symbols and guess which letters they represent based on typical frequency tables of English text and supposing the encryption method is a substitution cipher. (See Example 5 from the text.)

frequency	1st	2nd	3rd	4th	5th
encrypted symbol					
likely/possible decrypted letter					

(c) Suppose the encryption method is a **Caesar (shift) cipher**. Determine the shift and decrypt the message.

**Problem Extra Credit (5 points)** This is a challenging problem. Be patient with yourself. Suppose you find the encrypted message below. Its letter frequency is in the following table.

**RXVKWAMM METBB FT LA VX BTH WAMCARGYVK TV AMGTJBYMEFAVG  
XZ WABYKYXV, XW CWXEYJYG YVK GEA ZWAA AIAWRYMA GEAWAXZ;  
XW TJWYSKYVK GEA ZWAASXF XZ MCAARE, XW XZ GEA CWAMM;  
XW GEA WYKEG XZ GEA CAXCBA CATRATJBP GX TMMAFJBA, TVS GX CAGYGYXV  
GEA KXDAWVFAVG ZXW T WASWAMM XZ KQYADTVRAM.**

letter	frequency	letter	frequency	letter	frequency
A	38	J	5	S	4
B	8	K	9	T	12
C	8	L	1	U	0
D	2	M	15	V	13
E	12	N	0	W	20
F	5	O	0	X	21
G	17	P	1	Y	14
H	1	Q	0	Z	9
I	1	R	6		

(a) Identify the most frequent symbols and guess which letters they represent based on typical frequency tables of English text and supposing the encryption method is a substitution cipher. (See Example 5 from the text.)

frequency	1st	2nd	3rd	4th	5th
encrypted symbol					
likely/possible decrypted letter					

- (b) Based on your work in parts a and b, explain why this is **unlikely** to be a **Caesar cipher**.
- (c) Fill in the decryption key below and decrypt the message. Note that to do this will require ad hoc and guess-and-check strategies.

encrypted symbol	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
decrypted symbol																										

(d) What aspects of the encryption method made it much easier to decrypt?

Remember to write up your homework solutions according to the homework writeup guidelines.

Homework is graded using the following rubric for each problem (or problem part):

**2 points:** You provided a complete answer, with supporting work, written up clearly

**1 point:** Some attempt at a solution, but incomplete writeup / unclear / illegible / no answer

**1 point:** Only an answer, with no supporting work

**0 points:** Missing.

After you do the homework, you need to check your answers against the solutions! Then figure out your errors (if any) and revise your homework before you submit it.

Homework must be submitted on Gradescope.