(25 points)

(E) Texting, Texting, One Two Three (1/3)

The respected espionage-supply company Z Enterprises is about to release a new version of their Z1200 model wristwatch, popular among spies (and also among high-school students) for its ability to discreetly send text messages. Although the Z1200 had only four buttons in total, the user could input characters (letters, numbers, spaces, etc.) by pressing three-button sequences. For example, if we call the buttons 1, 2, 3, and 4, *a* was 112, A was 113, *b* was 114, SPACE was 111, the END sequence that finished the message was 444, etc.

The Z1300 has the same button layout, and it was planned that it use the same text-input method. In the design stage, however, a new engineer proposes that he can significantly reduce the number of button presses needed for each message. Unfortunately, the manual had already been printed and the new Z1300 shipped without any information regarding how to use this new input method.

Being a good spy and/or high school student, though, you can figure out how it works just from a few examples, right?

Testing testing
33222143224142341122214322414234133I

Does anyone copy
33233322143131423433242211242323423433331

be vewy vewy qwiet im hunting wabbits
23412112342213443431234221344343123442344412122141243123124
1422241423411344312341234141224333I

Mission failed Tango not eliminated
332434143434132421244314123221233133223142341321423222121232412434142312221233331
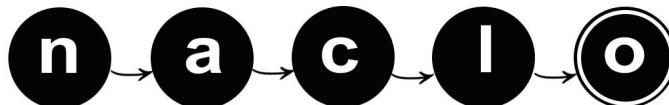
my boss Z is a pain in the
24334312341324343133234441414313113423141421414212223121331

uh oh no backspace on this thing
241231132231142321234131242234343342312422113242122231414312223141423413331

just kiddin boss
23443241432212343412332334142123413243433311

(E) Texting, Texting, One Two Three (2/3)

E0.   What are the input codes for each of the lowercase letters? Not every letter is used in the messages above, but you can still deduce how they are encoded. This table is just for your own use and it will **not be graded**.

a		n	
b		o	
c		p	
d		q	
e		r	
f		s	
g		t	
h		u	
i		v	
j		w	
k		x	
l		y	
m		z	

E1.   What message does the following sequence of button presses encode? Start filling the boxes from the left end, one English letter (or space) in each box. (5 points)

2312123222323214143131423432341322333431232414322214241423413 31

(E) Texting, Texting, One Two Three (3/3)

E2.   With what sequences of button presses would you input the following messages? (5 points)

help

xray

affirmative

Mayday mayday SOS

E3.   This scheme only shortens the number of button presses needed *on average* – most messages are shorter, but there are some that will take more presses than they did on the Z1200*. Can you find a message (using only characters whose codes you know) that will be longer using the above method than it would have been if it used exactly three button presses per character (including the END sequence)? (5 points)

*This is true for every compression scheme, actually – for any method of compressing data into less space, there will always be some example that when "compressed" is larger than it was originally!

n a c l o