

YOUR NAME:

REGISTRATION #:

(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

332221432241423411222143224142341331

### Does anyone copy

3323332214313142343324221124232342343331

### be vewy vewy qwiet im hunting wabbits

23412112342213443431234221344343123442344412122141243123124  
14222414234113443123412341412243331

### Mission failed Tango not eliminated

332434143434132421244314123221233133223142341321423222121232412434142312221233331

### my boss Z is a pain in the

24334312341324343133234441414313113423141421414212223121331

### uh oh no backspace on this thing

24123113223114232123413124223434334231242211324212223141431222314142341331

### just kiddin boss

2344324143221234341233233414212341324343331



# (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)

23|2|23223232|4|43|3|42343234|32233343|2324|43222|424|4234|33|




# (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!

