UW Math Circle
March 21, 2013

A man provided with paper, pencil, and rubber, and subject to strict discipline, is in effect a universal machine. –Alan Turing

1. Can you decrypt the following message, encrypted with a certain substitution cipher?

   Q KFHNIWQBNWHK FHWEFK BSIFFY LRBNHRSN BQDB QK WXNHQ-SVHHRSVYQH "ZFAPRW

   BVHMRMQY SYQBB" QN Q ARLLYW BSIFFY RB KF AFHW. RN IQB PWWK HWJYQSWL PD

   QK "WXJYFHQNFHD HWQLRKE SYQBB." BVJWHRKNWKLWKN OHWL AQRFSSF BQDB IW CQB

   VKQCQHW FO NIW ZFAPRW SYQBB VKNRY IW HWQL Q KWCBJQJWH QHNRSYW QPFVN RNB

   JFJVYQHRND. AQRFSSF BQDB IW "SFVYLK'N PWYRWMW NIQN CFVYL QSNVQYYD PW Q

   SYQBB." BFAW JQHWKNB IQL GVWBNRFKWL NIW WLVSQNRFKQY MQYVW FO NIW SYQBB

   QKL CFHHRWL QPFVN MRFYWKN BVPUWSB AQNNWH.

2. Brave Sir Cosmo wants an encrypted message to his English-speaking friend on the ex-planet Pluto.

   He encrypts his block of text with Cosmo's Secret Substitution Scheme #1. But, for an extra layer of security, he decides to encrypt the now-encrypted text with *another* substitution cipher, Cosmo's Secret Substitution Scheme #2.

   (a) Has Cosmo actually added a new layer of security by encrypting his message twice?

   (b) Can you think of two substitution ciphers that give different outcomes depending on the order in which they are applied? That is, if you first apply #1 and then #2, the outcome is not the same as if you had applied #2 and then #1.

3. Fill in the blank with an English word meaning a positive integer to make the sentence correct:

   "THIS SENTENCE CONTAINS _____ LETTERS."

   (There are two solutions! Can you find them both?)