Problem 2. Prove that CRYPT is not regular.

Proof:
We assume CRYPT is regular. We choose a word "w" in CRYPT and pump it to get a contradiction.

Pumping Lemma says that "w" can be written as xyz, with |y| >= 1 such that all xy^nz is also in CRYPT.

Suppose w = VIGENERE (LOCTRAN (SIMPLESUB (E, STRING), DIGIT), STRING) which can be generated by the given grammar.

Therefore xy only contains VIGENERE (LOCTRAN (SIMPLESUB (

We get contradiction on the following cases:

Case 1: y is SIMPLESUB (
xyyz is not a word in CRYPT since there is no key available for the relevant SIMPLESUB(and also does not support the given grammar.

Case 2: y is VIGENERE (
xyyz is not a word in CRYPT since there is no key available for the relevant VIGENERE (and also does not support the given grammar.

Case 3: y is LOCTRAN (
xyyz is not a word in CRYPT since there is no key available for the relevant LOCTRAN (and also does not support the given grammar.

Case 4: y is (
xyyz is not a word in CRYPT since there is no) for relevant (.

Therefore, by contradiction, we can prove that CRYPT is not regular.