Problem 1

1. Confidentiality and integrity. We want only the authorized people to view and modify these keys for communication. (ASK UDAY integrity)
2. The protocol does not satisfy both security properties since if you can get *x* and *y* one can derive the secret key. So, it does not satisfy confidentiality property.

Problem 2

1.

{A,B,…,Z} turns into {0,1,…25}. So p0 turns into 0123 and p1 1436.

T=1,

If the period is one, then the key does not really do anything and changes the values by 1. Therefore, So the two passwords are disjoint, and you can calculate the correct password.

T=2,

Here the sets of possible encryptions are C0 = {(k1, k2 + 1, k1 + 2, k2 + 3) | k1, k2 ∈ Σ} and C1 = {(k1 + 1, k2 + 4, k1 + 3, k2 + 6) | k1, k2 ∈ Σ}. It is easy to see that C0 = C1: let (k1, k2 + 1, k1 + 2, k2 + 3) ∈ C0 for some fixed k1, k2 ∈ Σ. Then it is also in C1, because k 0 1 = k1 + 1 and k 0 2 = k2 + 3 are in Σ. The converse is also true. In other words, for every possible encryption c of p0 under key k there is a key k 0 that would have encrypted p1 to c. Since k and k 0 are equally likely (since they are chosen from the uniform distribution over Σ × Σ), the adversary has no way of knowing which password was encrypted.

T=3,

This is the same problem as period 1 since the two passwords do not overlap with t=3.

T=4,

This is pretty much a onetime pad encryption since the length match up and therefore not hackable.

2.

Mono-alphabetic ciphers are easy to break with a chosen plaintext attack since you can find the one to one corresponding values of each key. You do not even need to brute force it. You can choose a sentence that contains all letters in the alphabet, and you have all encodings. To answer the last two questions, you need 25 unique letters to recover the entire key without having to guess. There are 26 letters and if you have 25 of the encodings you can deduce the 26th letter quite easily. So 25 letters would also be the minimum needed to crack the encoding properly. If you had 20 letters however you can sort of guess what the last few letters are if you have enough ciphertext and are translating into plain English. This encryption would only work securely against an attacker if you had a small enough message that there could be multiple meanings for the message that you are trying to encode. (Anything less than 25 unique chars technically)

Problem 3

See python program attached.