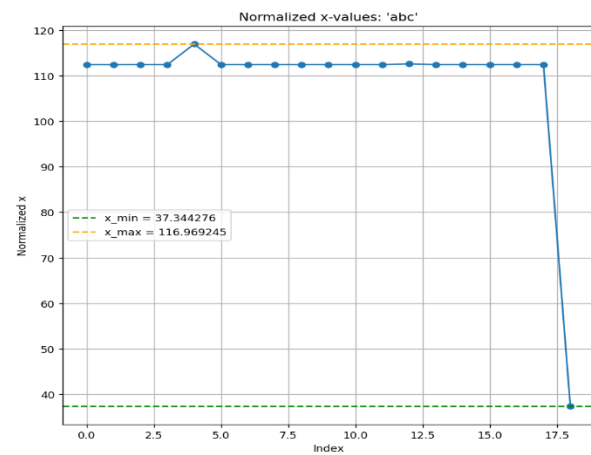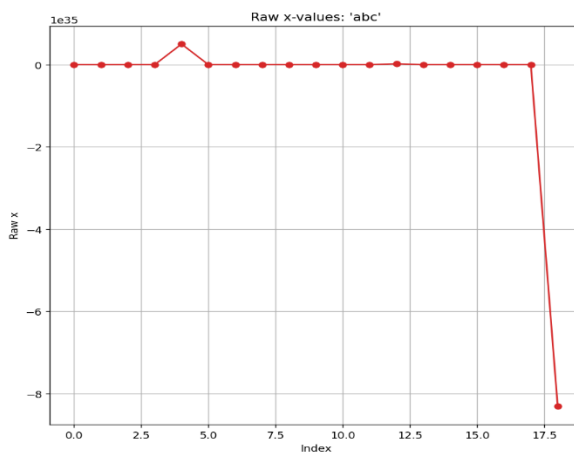# *Test: Normalization techniques used in x values to improve entropy,*
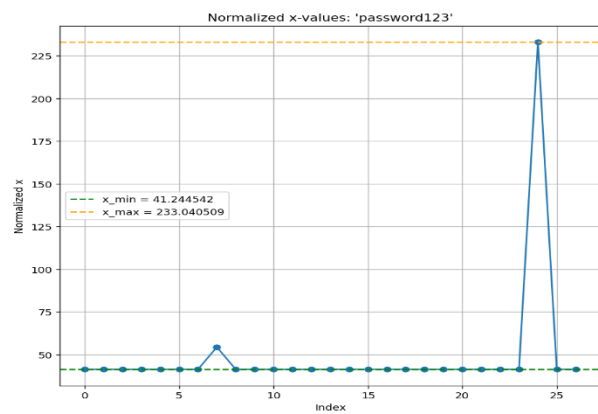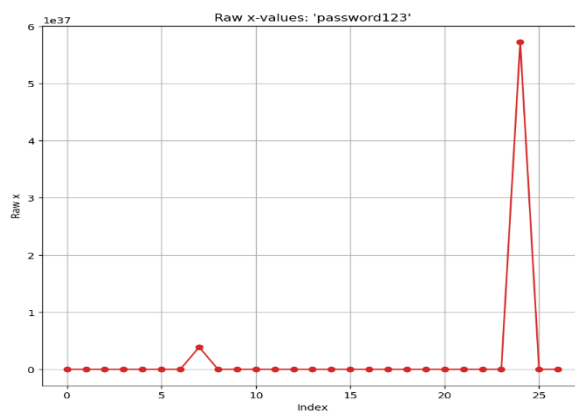
1. Serial Normalization

```
2. def linear_normalization(xs):
3.         x_raw_min = np.min(xs)
4.         x_raw_max = np.max(xs)
5.         if abs(x_raw_max - x_raw_min) < 1e-6:
6.             x_raw_max = x_raw_min + 1.0
7.         normalized = (xs - x_raw_min) / (x_raw_max - x_raw_min)
8.         return x_min + normalized * (x_max - x_min)
```
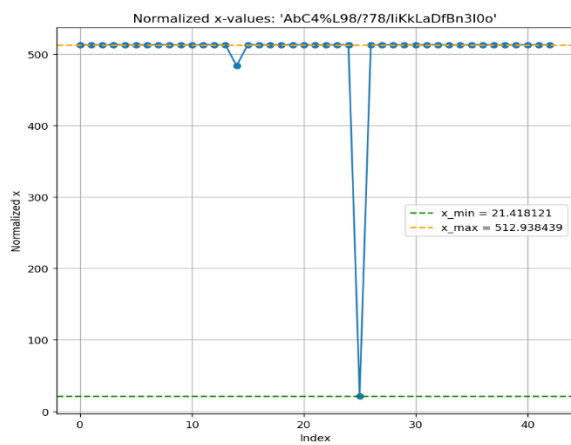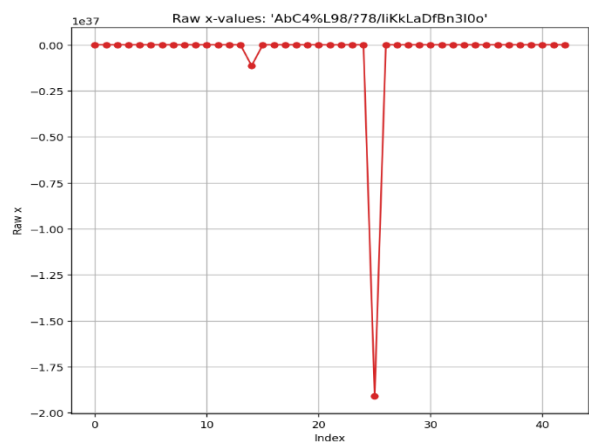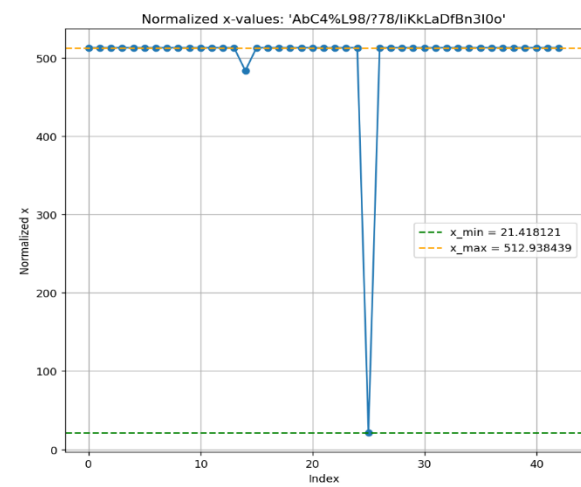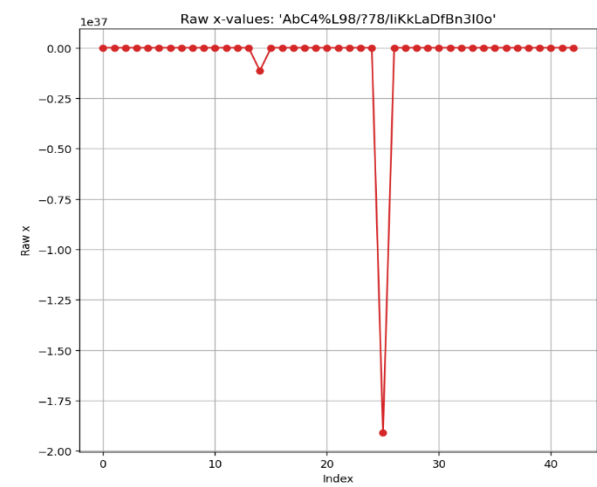
Password 1: abc

Password 2: Password123

Password 3: 12345678

Raw x-values: 'AbC4%L98/?78/IiKkLaDfBn3I0o'

Normalized x-values: 'AbC4%L98/?78/IiKkLaDfBn3I0o'

Password 4: AbC4%L98/?78/IiKkLaDfBn3I0o

Raw x-values: 'AbC4%L98/?78/IiKkLaDfBn3I0o'
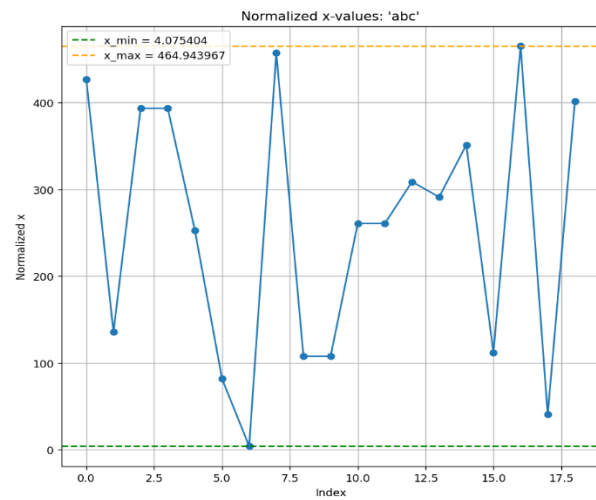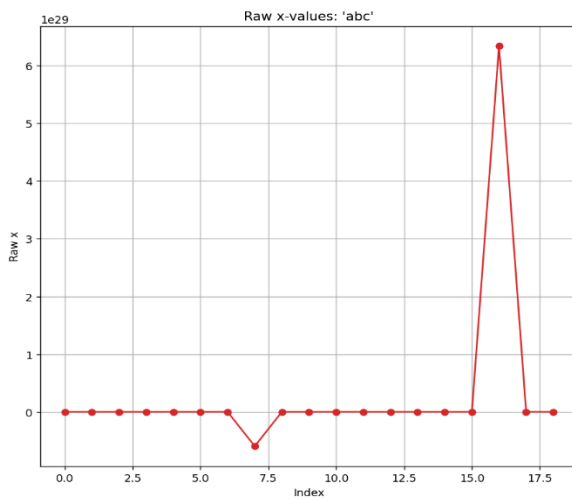

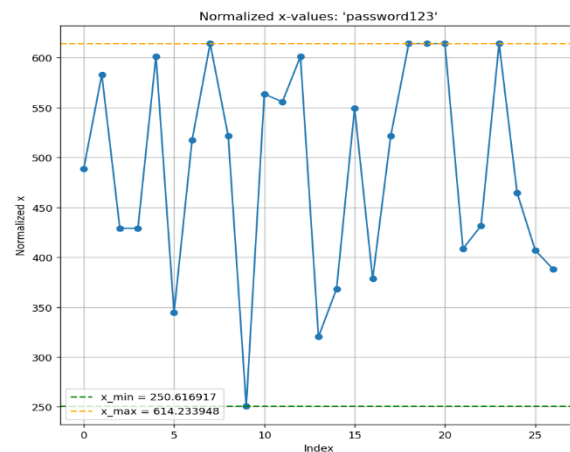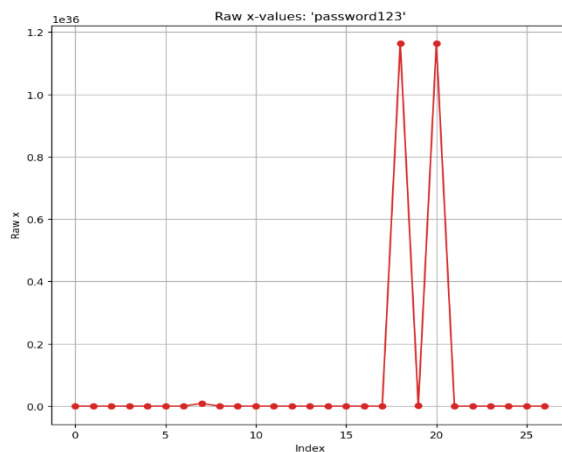Normalized x-values: 'AbC4%L98/?78/IiKkLaDfBn3I0o'

2. Log Normalization

```python
def log_normalization(xs):
    safe_vals = np.clip(np.abs(xs), 1e-30, 1e+30)
    log_vals = np.log10(safe_vals)
    log_min = np.min(log_vals)
    log_max = np.max(log_vals)
    if abs(log_max - log_min) < 1e-6:
        log_max = log_min + 1.0
    normalized = (log_vals - log_min) / (log_max - log_min)
    return x_min + normalized * (x_max - x_min)
```
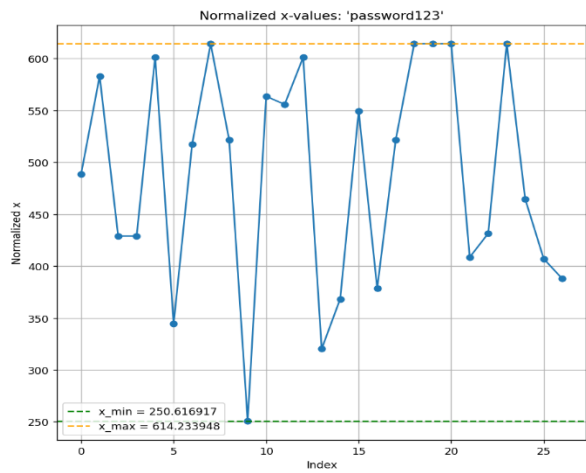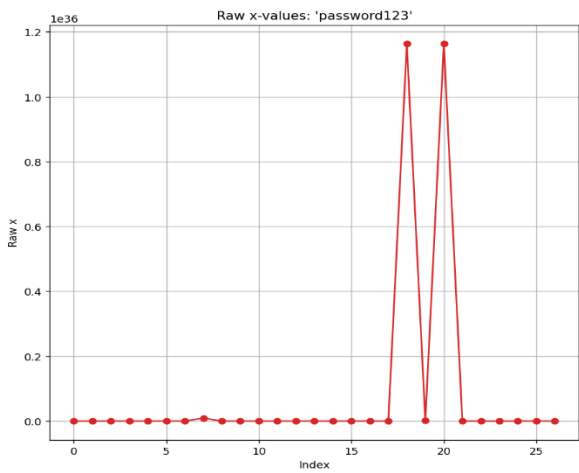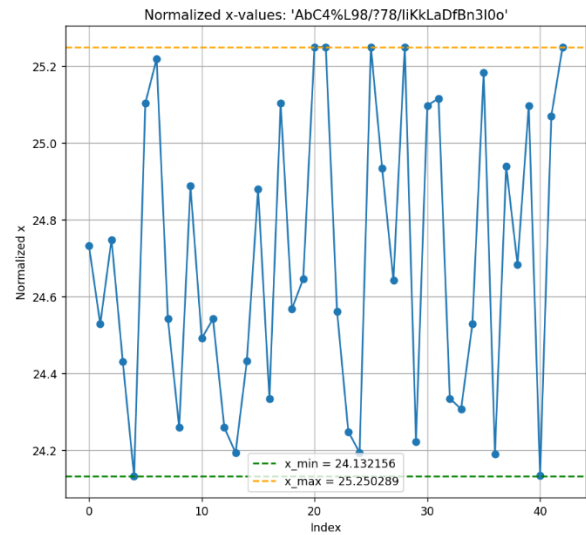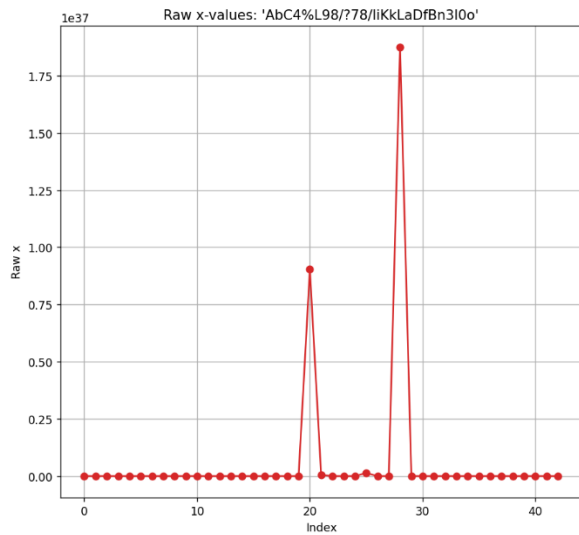
Password 1: abc

Password 2: Password123
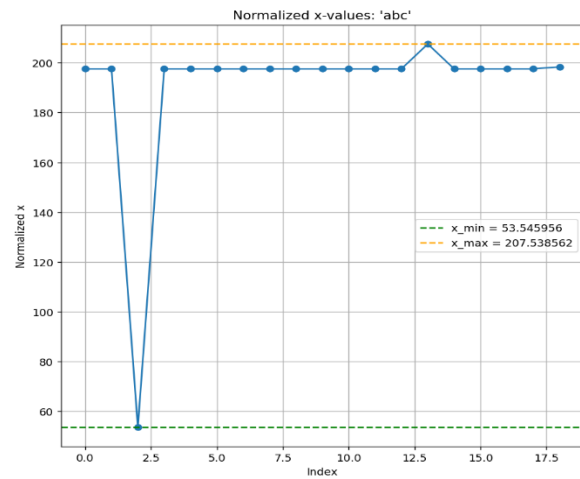
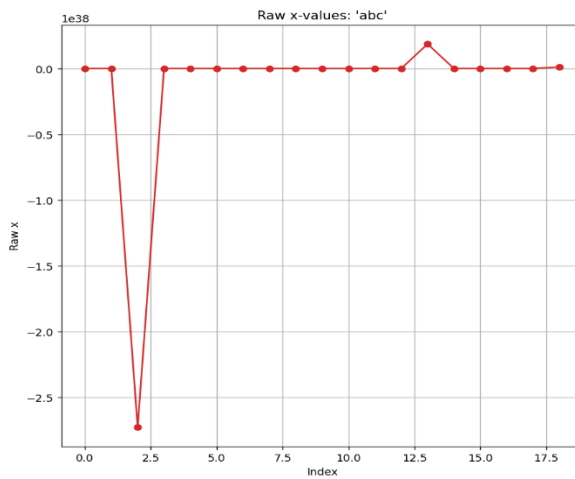## Password 3: 12345678

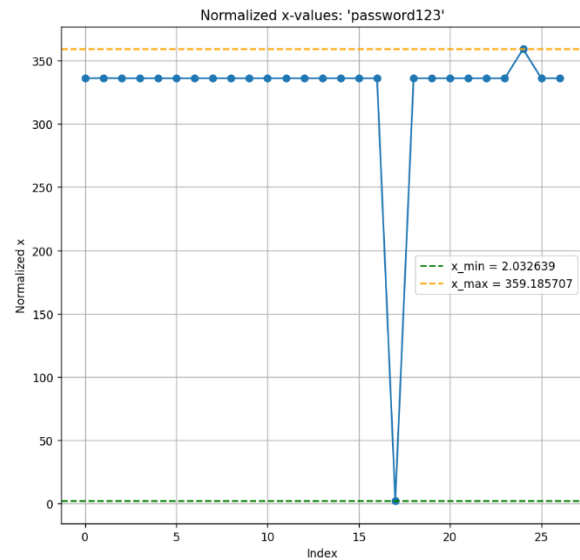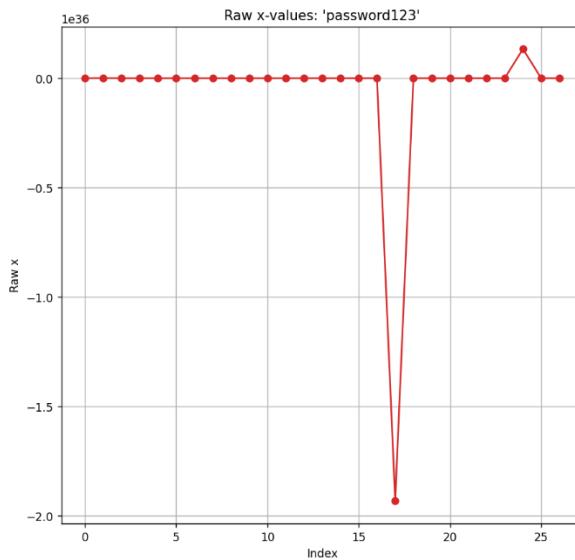## Password 4: AbC4%L98/?78/IiKkLaDfBn3I0o

3. Clipped Normalization

```python
def clipped_normalization(xs):
    lower, upper = np.percentile(xs, [1, 99])
    clipped = np.clip(xs, lower, upper)
    normed = (clipped - lower) / (upper - lower)
    return x_min + normed * (x_max - x_min)
```
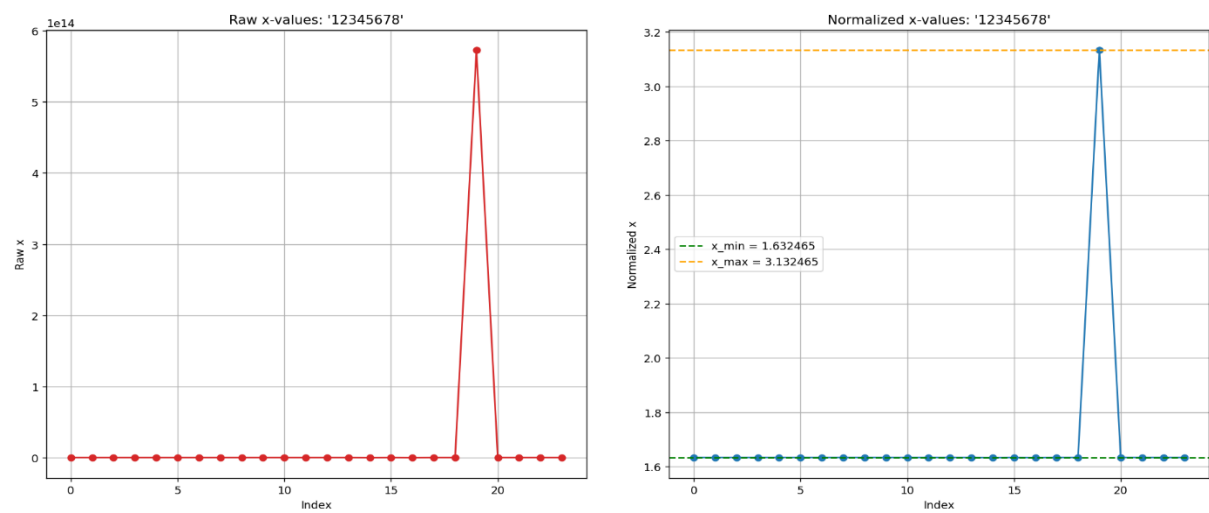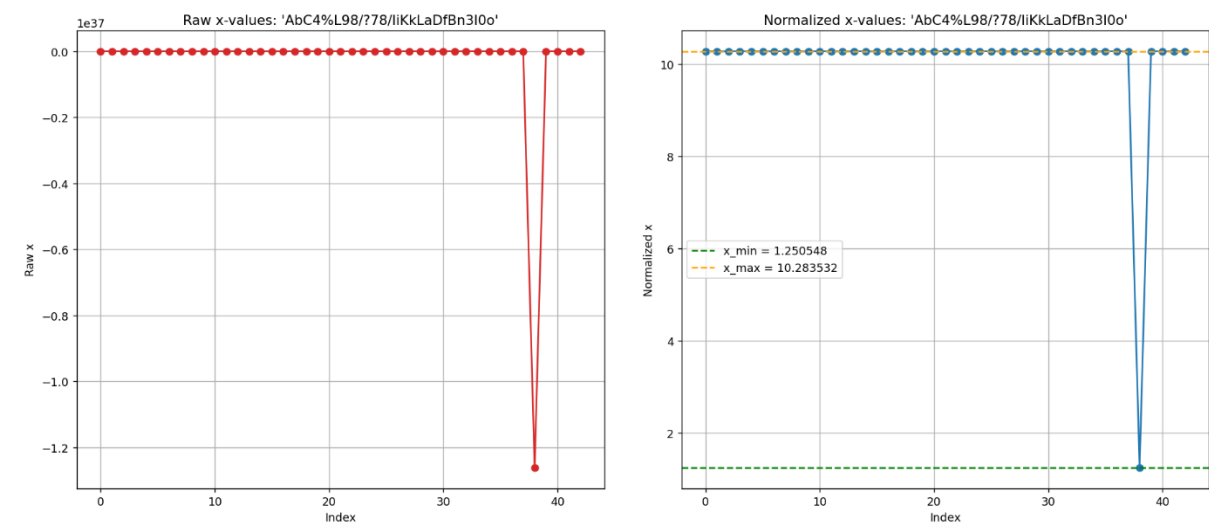
Password 1: abc

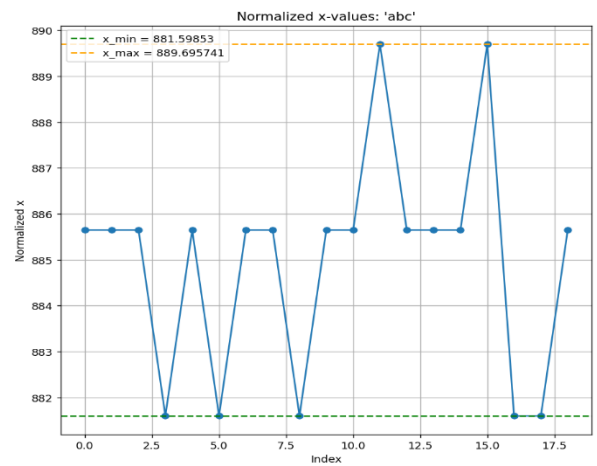## Password 2: Password123

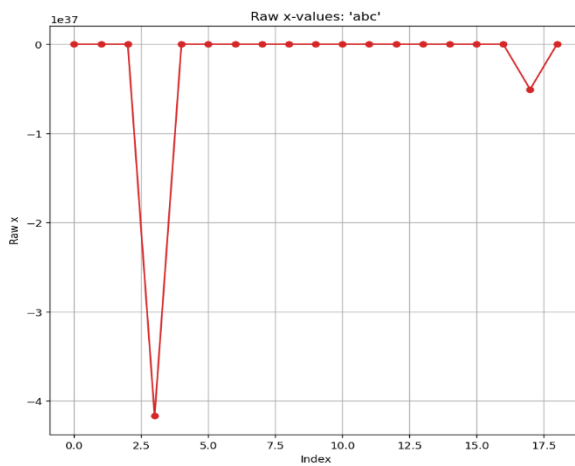## Password 3: 12345678

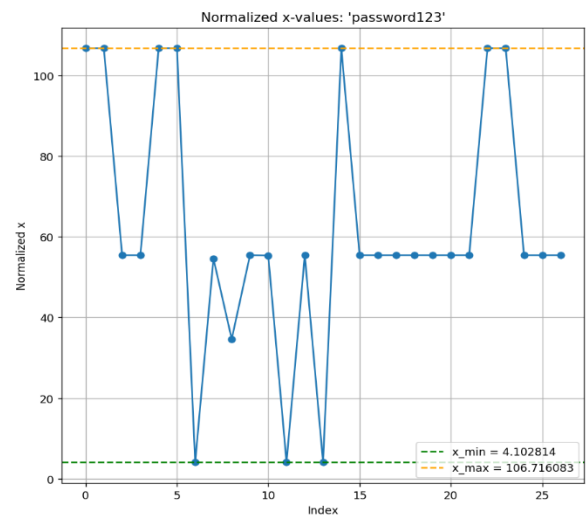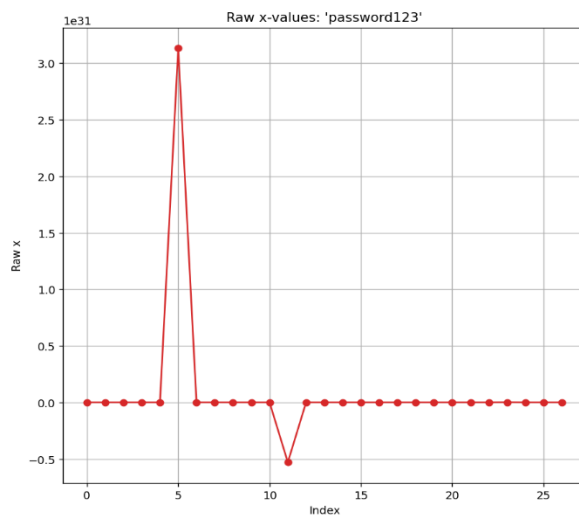## Password 4: AbC4%L98/?78/IiKkLaDfBn3I0o

4. Tanh based Normalization

```python
def tanh_normalization(xs):
    scale = 1e10   # Can tune this as needed
    squashed = np.tanh(xs / scale)
    tanh_min = np.min(squashed)
    tanh_max = np.max(squashed)
    if abs(tanh_max - tanh_min) < 1e-6:
        tanh_max = tanh_min + 1.0
    normed = (squashed - tanh_min) / (tanh_max - tanh_min)
    return x_min + normed * (x_max - x_min)
```
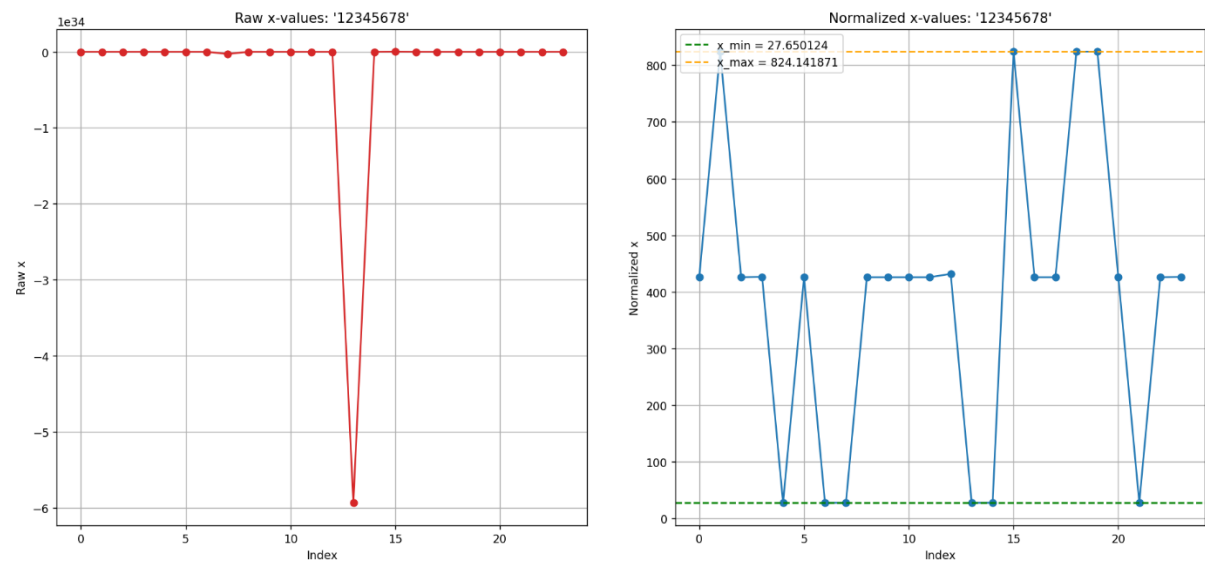
Password 1: abc

Password 2: Password123

Password 3: 12345678

Password 4: AbC4%L98/?78/IiKkLaDfBn3I0o