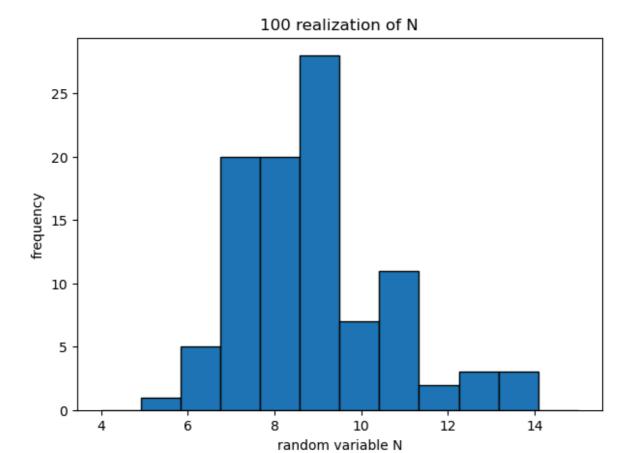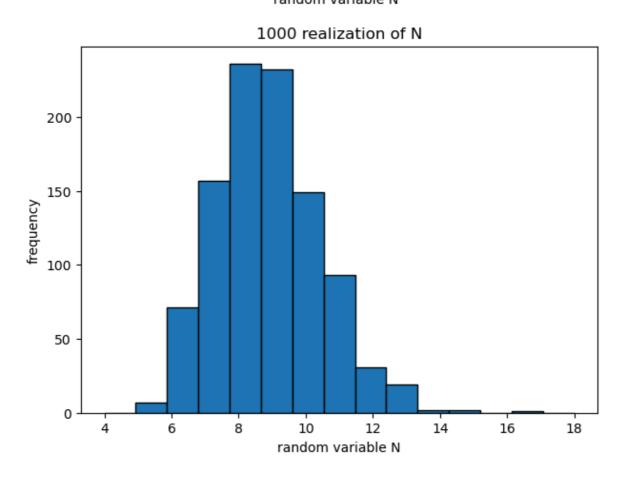# Q6

In [6]:
```python
import numpy as np
import matplotlib.pyplot as plt
import random
#get a N
def a_random_variable(sum_limit):
    #N the number of random
    N = 0
    #record current sum of random
    sum_of_random = 0
    #as long as it's not >4, add another random number
    while sum_of_random <= sum_limit:
        sum_of_random += random.random()
        N += 1
    return N

#get more N
def more_random_variable(n_variable, sum_limit):
    #sum of all N(to calculate the expectatioin)
    sum_all_variable = 0
    #record all N
    list_N = []
    for i in range(n_variable):
        N = a_random_variable(sum_limit)
        list_N.append(N)
        sum_all_variable += N
    #record the min and max of N(to the range of x of histogram)
    max_N=max(list_N)
    min_N=min(list_N)

    #draw histograms
    plt.figure(figsize=(7,5))
    hist_range = max_N - min_N + 3
    plt.hist(list_N, bins = hist_range, range=(min_N - 1, max_N + 1), edgecolor
    plt.title("%d realization of N" %(n_variable))
    plt.xlabel("random variable N")
    plt.ylabel("frequency")

    #expectation
    expectation_N = sum_all_variable/n_variable
    print("the expectation of %d random variable is :E[N] = %f" %(n_variable, ex


n_variable = [100, 1000, 10000]
for i in n_variable:
    more_random_variable(i, 4)
```

```
the expectation of 100 random variable is :E[N] = 8.830000
the expectation of 1000 random variable is :E[N] = 8.743000
the expectation of 10000 random variable is :E[N] = 8.669800
```

100 realization of N

1000 realization of N

10000 realization of N