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Daily Coding Problem #90

Problem

This question was asked by Google.

Given an integer n and a list of integers l , write a function that randomly generates a number from 0 to $n-1$ that isn't in l (uniform).

Solution

One way we can approach this problem is by using [rejection sampling](#). First, we generate a (uniformly) random integer between 0 and $n-1$ (inclusive). Then, we check whether the random integer is found within the list l . If it is found, then generate repeat the process. If it is not found, then return that number. To make sure we can check for the presence of a number in $O(1)$ time, we can put all integers in l in a set.

Since this solution involves repeatedly generating a new random number, it could have up to infinite worst-case runtime. The initial call also incurs $O(N)$ to convert list into a set. The probability of selecting a random number depends on the ratio of numbers in l that are within the bounds 0 to $n-1$, versus the number n .

Another way we can approach this problem is by generating a random number strictly from the numbers available. We can construct the list of numbers of available by subtracting the set of integers in l from the set of integers in the range 0 to $n-1$. Then, we can simply generate a random number within 0 and the length of this new list, and return the integer at that index.

This solution takes $O(N)$ time to pre-process the list, and $O(1)$ time to generate a random integer.

```
from random import randrange

def process_list(n, l):
    all_nums_set = set()
    for i in range(n):
        all_nums_set.add(i)

    l_set = set(l)
    nums_set = all_nums_set - l_set
    return list(nums_set)

def random_number_excluding_list(n, l):
    nums_list = process_list(n, l)
    idx = randrange(0, len(nums_list))
    return nums_list[idx]

print(random_number_excluding_list(4, [1, 2, 5]))
```

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