CS 261 - Data Structure **Spring 2017**

HomeWork 2

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Problem 1 **Solution:**

$$
\begin{aligned}
Pr &= \binom{n}{s-1}(\frac{1}{N})^{s-1}(\frac{N-1}{N})^{N-s} \\
&\leq \frac{n(n-1)(n-2)...(n-s+1)}{(s-1)!} * (\frac{1}{N})^{s-1} \\
&\leq \frac{n^{s-1}}{N^{s-1} * (s-1)!} \\
&= \frac{\alpha^{s-1}}{(s-1)!}
\end{aligned}
$$

Problem 2 **Solution:**

a the probabilty of a pair entries has same key is $(N/2)^{-2}$.

Thus the the probabilty of a triple entries has same key is $(N/2)^{-4}$.

The numer of all possible triple is $\binom{n}{3} = \frac{n(n-1)(n-2)}{6}$.

Hence $E = (N/2)^{-2} * \binom{n}{3} = \frac{8n(n-1)(n-2)}{3N^4}$.

b

$Pr[R > t] \leq E[R]/t$ with t = 1

$$
\begin{aligned}
&\rightarrow Pr[R > t] \leq \frac{8n(n-1)(n-2)}{3N^4} \\
&\leq \frac{8n^3}{3N^4} \\
&\leq \frac{8}{3}\alpha^4\frac{1}{n} \\
&= O(\frac{1}{n})
\end{aligned}
$$

Problem 3 **Solution:**

```
def CheckSingle(Input):
  dic = {}
  for item in Input:
    if dic.has_key(item):
      dic[item] += 1
    else:
      dic[item] = 1
```

```
ans = []
for key in dic:
  if dic[key] == 1:
    ans.append(key)
return ans
```

Problem 4 **Solution:**

Cuckoo. Because, using Cuckoo, looking up time is $O(1)$. For two of other algorithm, the worst time could be O(n).