Problem 1

In [2]:

```
import random

def countNum():
    nums = dict()
    for i in range(100):
        num = random.randint(1,20)
        if num in nums:
            nums[num] = nums[num] + 1
        else:
            nums[num] = 1

    for i in nums.items():
        print(i)
countNum()
```

```
(1, 8)
(12, 5)
(16, 5)
(4, 9)
(5, 5)
(11, 5)
(9, 3)
(15, 4)
(8, 4)
(20, 6)
(10, 7)
(3, 2)
(2, 5)
(14, 5)
(7, 7)
(6, 2)
(17, 6)
(13, 6)
(18, 3)
(19, 3)
```

Problem 2

In [4]:

```
def count_values_1(dic):
    vs = dic.values()
    vs = list(vs)
    count = dict()

    for i in vs:
        if i in count:
            count[i] = count[i] + 1
        else:
            count[i] = 1

    return len(count)

def count_values_2(dic):
    vs = dic.values()
    vs = set(vs)

    return len(vs)

temp = {'red' : 1, 'green' : 1, 'blue' : 2}
print(count_values_1(temp))
print(count_values_2(temp))
```

```
2
2
```

Problem 3

In [5]:

```
def normal_to_sparse(vec):
    sps = dict()

    for i in range(0, len(vec)):
        if vec[i] == 0 : continue
        else:
            sps[i] = vec[i]

    return sps

def change_sign(dic):
    keys = dic.keys()
    for i in keys:
        dic[i] = -dic[i]
    return dic

def add_vector(dic1, dic2):
    rdic = dict()
    for i in dic1.keys():
        for j in dic2.keys():
            if(i == j):
                rdic[i] = dic1[i] + dic2[i]
    for i in dic1.keys():
        if i not in rdic:
            rdic[i] = dic1[i]
    for i in dic2.keys():
        if i not in rdic:
            rdic[i] = dic2[i]
    return rdic

def minus_vector(dic1, dic2):
    return add_vector(dic1, change_sign(dic2))



vec = [1,0,0,0,0,0,3,0,0,0]
print(normal_to_sparse(vec))
print(change_sign(normal_to_sparse(vec)))
print(add_vector({0:1, 6:3}, {1:2, 6:3}))
print(minus_vector({0:1, 6:3}, {1:2, 6:3}))
```

```
{0: 1, 6: 3}
{0: -1, 6: -3}
{6: 6, 0: 1, 1: 2}
{6: 0, 0: 1, 1: -2}
```