INFO 7390

# Advances in Data Sciences and Architecture Assignment 1

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Due: Sunday May 20, 2018

## Q1 (5 Points) How many people must there be before the probability that at least two people have a birthday on October 3 is greater than 1/2?

Answer1(calculate at least 2 persons on 10.3)：613

Answer2(assure 1 people has born on 10.3): 253

## Q2 (5 Points) Write python code to simulate question 1.

1.

```
>>> d=365
>>> n=1
>>> p=0
>>> while p<0.5:
        n+=1
        p=1-(pow((364/d),n)+((pow((364/d),(n-1)))*(n/d)))
        print("number",n)
        print("prob",p)


prob 0.4963317784189063
number 609
prob 0.49719493383556246
number 610
prob 0.4980571402168832
number 611
prob 0.49891839628413215
number 612
prob 0.4997787007727037
number 613
prob 0.5006380524320544
```

2.

```
>>> d,n,p=365,1,0
>>> while p<0.5:
        n+=1
        p=1-(pow((364/d),n))
        print("n",n)
        print("prob",p)
```

```
n 250
prob 0.49634888685383205
n 251
prob 0.49772875291724616
n 252
prob 0.4991048385256921
n 253
prob 0.5004771540365807
```

Q3 (5 Points) What is the probability of getting exactly 2 heads after flipping three coins?

Answer：3/8

Q4 (5 Points) Write python code to simulate question 3.

```
>>> import operator
>>> def c(n,k):
...     return  reduce(operator.mul, range(n - k + 1, n + 1)) /reduce(operator.mul, range(1, k +1))
...

>>> n,p,k=3,0.5,2
>>> prob=c(n,k)*(pow(0.5,k))*(pow(0.5,n-k))
>>> prob
0.375
>>>
```

Q5 (5 Points) Consider a six-sided die that gets a 1 with probability p = 1/6. What is the probability that you can get a 1 after rolling the die 3 times? What is the probability of getting exactly one success (a roll of 1) in three tries?

Answer1: 1/6

Answer2:75/216

Q6 (5 Points) Write python code to simulate question 5.

```
p=1/6
>>> p
0.16666666666666666
>>>


>>> prob=c(n,k)*(pow(p,k))*(pow((1-p),n-k))

>>> prob
0.3472222222222222
```

Q7 (5 Points) Suppose the MTV Video Music Awards allows users to vote for the following for “video of the year.”

i. Miley Cyrus - "Wrecking Ball" (https://www.youtube.com/watch?v=My2FRPA3Gf8 )

ii. Iggy Azalea- "Fancy" (https://www.youtube.com/watch?v=O-zpOMYRi0w )

iii. Brad Paisley - "The Ballad Of Honey Boo Boo" (https://www.youtube.com/watch?v=11Uq3iGESYM )

Of those making deliberate votes 50% would vote for Brad Paisley - "The Ballad of Honey Boo Boo," 30% for Miley Cyrus - "Wrecking Ball" and 20% for Iggy Azalea- "Fancy." However, 25% of voters are lazy and just click one of the three options with equal probability.

i. Let M be a random variable that represents the expected votes for Miley Cyrus - "Wrecking Ball"
ii. Let I be a random variable that represents the expected votes for Iggy Azalea- "Fancy"
iii. Let B be a random variable that represents the expected votes for Brad Paisley - "The Ballad Of Honey Boo Boo"

Calculate M, I and B. Show your work.

Answer： M:30.8%
I: 23.3%
B:45.8%

Q8 (5 Points) Write python code to simulate question 7.

```
>>> m,i,b=0,0,0
>>> m=.75*.3+(.25/3)
>>> m
0.3083333333333333
>>> i=.75*.2+(.25/3)
>>> i
0.23333333333333334
>>> b=.75*.5+(.25/3)
>>> b
0.4583333333333333
>>>
```

Q9 (5 Points) Suppose you're on a game show, and you're given the choice of n doors: Behind one door is a million dollars; behind all the

others, donuts. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a donut. He then says to you, "Do you want to another door?"

(1 Point) Is it to your advantage to switch your choice? Assume k of the n doors are revealed:

Answer: Yes

(2 Points) What is the probability of getting the million-dollar door if you stay?

Answer: 1/N

(2 Points) What is the probability of getting the million-dollar door if you switch to another non- revealed door?

Answer: N-1/(N*(N-K-1))

Q10 (5 Points) Write python code to simulate question 9.

```
>>> def stimulate(n,k):
        p1=(n-1)/(n*(n-k-1))
        p2=1/n
        if(p1>p2):
                print("switch win")
        elif(p1<p2):
                print("stay win")
        else:
                print("equal")

>>> stimulate(10,8)
switch win
>>> stimulate(3,1)
switch win
>>> stimulate(10000,9998)
switch win
>>>
```