

The Probability Calculation from the end of Lecture 8/31/15

In [2]:

```
import math
```

In [5]:

```
N = 50                # determined by the lottery honchos

p = 1/N              # chance of winning, for a single bet
q = 1 - p           # chance of losing, for a single bet

# Assume that these chances remain unchanged regardless of the results of other
# bets.

n = 5                # number of bets you choose to make

P_lose_all = q**n    # chance that you lose all n bets
P_win_at_least_one = 1 - P_lose_all # chance that you win at least one of the
n bets
P_win_at_least_one
```

Out[5]:

```
0.09607920320000007
```

In [6]:

```
N = 876                                # integer greater than 1
p = 1/N                                # chance of winning, for a single bet
q = 1 - p                              # chance of losing, for a single bet

# Assume that these chances remain unchanged regardless of the results of other
# bets.

"""Gamblers' Rule:
For the chance of winning at least one bet to be around 50%,
the number of bets has to be around 2/3 of N."""

n = math.ceil((2/3)*N)                 # number of bets you choose to make

P_lose_all = q**n                      # chance that you lose all n bets
P_win_at_least_one = 1 - P_lose_all    # chance that you win at least one of the
n bets
P_win_at_least_one
```

Out[6]:

0.4867783567527024

Notes

1. In the cell above, the text inside triple quotes is a multi-line comment.
2. The Gamblers' Rule specifies $(0.66666\dots)*N$ as the number of bets. This is a pretty good estimate, considering that the gamblers had little math and certainly no calculus. If you know some calculus, you could try to show that the right proportion is about 0.693, which is the natural log of 2 correct to three decimal places. In the code above, try replacing $(2/3)$ by $\text{math.log}(2)$ and see what happens. Try it again a few times with different large values of N .