# Stat 509: Statistics for Engineers

**Homework Assignment 2**

1. You roll two 4-sided dice. Enumerate the sample space ($\Omega$).

| | **1** | **2** | **3** | **4** |
|---|---|---|---|---|
| **1** | 2 | 3 | 4 | 5 |
| **2** | 3 | 4 | 5 | 6 |
| **3** | 4 | 5 | 6 | 7 |
| **4** | 5 | 6 | 7 | 8 |

2. Feeling lucky? I bet that at least two students in our class share a birthday (not including year). Use probability to determine if you should accept my bet or not. Assume we have 40 students in the class and you can ignore the existence of leap years (i.e., 365 days per year).

N = no shared birthdays

P(N) = 365/365 * 364/365 * 363/365 * … * 326/365

B = at least one shared birthday

P(B) = 1 – P(N)

3. You have data on two types of light bulbs (A and B) and whether the bulbs lasted the desired time length (D). Use the contingency table to answer the questions.

| | **D** | **$D^c$** |
|---|---|---|
| **A** | 53 | 4 |
| **B** | 155 | 25 |

(a) Calculate the probability that a bulb lasts the desired time length.

237 total bulbs
208 Worked desired time
P(A) = 208/237 = 87.7%

(b) Calculate the probability that a bulb lasts the desired time length and is type A.

P(B) = 53/237

(c) Calculate the probability that a bulb lasts the desired time length or is type A.

P(C) = 212/237

(d) Calculate the probability that a bulb lasts the desired time length, given that it is type A.

P(D) = 53/57

(e) Is a bulb lasting the desired time length independent of its type?

As shown in A, the bulbs are lasting the desired time length about 88% of the time.

4. You are looking at encryption used for information passed between a server and clients. The probability that information is hacked is 0.01. The probability that information is encrypted, given that it is hacked is 0.002. The probability that information is encrypted, given that it is not hacked is 0.05. What is the probability that

information is hacked, given that it is encrypted?

H = hacked
P(H) = 1%
B = backed
E = encrypted
P(B|E) = .2%
P(B|E') = 5%

P(A) = (P(B|E) * P(H))/(P(B|E) * P(H) * P(B|E') * P(H'))
= (0.002 * 0.01)/(0.002 * 0.01 * 0.05 * (1-0.01))