STAT 391 Homework 1

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1. Problem 1- Practice with Probability

- Estimate $\theta = (\theta_0\ \theta_1\ \ldots\ \theta_4)$

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observations = 0
counter = {0:0, 1:0, 2:0, 3:0, 4:0}
for line in open(r'C:\Users\johnn\Documents\UW\SchoolWorks
\\2018Spring\STAT391\HW1\hw2-little-amazon.dat').readlines():
    line = int(line.rstrip())
    counter[line] = counter[line] + 1
    observations = observations + 1

theta = [counter[0]/observations, counter[1]/observations, \
          counter[2]/observations, counter[3]/observations,
              counter[4]/observations]
print(theta)
```

As the result, I got my θ to be

$$\theta = (0.149, 0.396, 0.049, 0.255, 0.151)$$

And the sufficient statistics are the counts for each title, which is

- A customer buys 3 books. What is the probability that he buys "War and Peace", "Harry Potter", "Probability" in this order? Assign the event that a customer buys the i^{th} book as E_i, then we are looking for

Table 1: Sufficient Statistics for Books

Book ID	Book Title	Count
0	War and Peace	149
1	Harry Potter & the Deathly Hallows	396
2	Winnie the Pooh	49
3	Get rich NOW	255
4	Probability	151

the probability that $P(E_0) \cdot P(E_1) \cdot P(E_4)$ since the book that every time that customer gets is an independent random

$$P(E_0) \cdot P(E_1) \cdot P(E_4) = 0.149 * 0.396 * 0.151 \approx 0.008910$$

And getting these three books has $2 * 3 = 6$ combinations, and we are only looking for one of those, thus

$$P = \binom{6}{1} \cdot (P(E_0) \cdot P(E_1) \cdot P(E_4)) \approx 0.001485$$

Therefore, the probability that the customer buys "War and Peace", "Harry Potter", "Probability" in this order is 0.001484934.

- A customer buys 4 books. What is the probability that she buys only non-fiction, that is, $N = 3, 4$? Denote the event that the customer buys 4 books and she buys only non-fiction as E. Then

$$P(E) = (P(E_3) + P(E_4))^4 = (0.255 + 0.151)^4 \approx 0.02717$$

- A customer buys 2 "Probability" books and 3

  fiction (i.e 0 or 1 or 2) books. What is the probability of this event?