

## Math 155 - Day #26 Expected Values - Beanboozled

Suppose you have a bucket containing 200 Jelly Beans. 150 of them are typical, delicious Jelly Beans. While the other 50 are Beanboozled (awful tasting) Jelly Beans. If you get a cup of 5 random jelly beans, find the probability of getting 0, 1, 2, ..., 5 Beanboozled Beans.

$$P(0 \text{ Beanboozled}) = \frac{50 C_0 \times 150 C_5}{200 C_5} = \frac{1 \times 591600030}{2535650040} \approx 23.3\%$$

$$P(1 \text{ Beanboozled}) = \frac{50 C_1 \times 150 C_4}{200 C_5} = \frac{50 \times 20260275}{2535650040} \approx 40.0\%$$

$$P(2 \text{ Beanboozled}) = \frac{\overbrace{50 C_2}^{2 \text{ BB}} \times \overbrace{150 C_3}^{3 \text{ regular}}}{\underbrace{200 C_5}_{\text{any 5 from 200}}} = \frac{1225 \times 551300}{2535650040} \approx 26.6\%$$

$$P(3 \text{ Beanboozled}) = \frac{50 C_3 \times 150 C_2}{200 C_5} = \frac{19600 \times 11175}{2535650040} \approx 8.6\%$$

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$$P(4 \text{ Beanboozled}) = \frac{{}^{50}C_4 \times {}^{150}C_1}{{}^{200}C_5} = \frac{230300 \times 150}{2535650040} \approx 1.4\%$$

$$P(5 \text{ Beanboozled}) = \frac{{}^{50}C_5 \times {}^{150}C_0}{{}^{200}C_5} = \frac{2118760 \times 1}{2535650040} \approx .08\%$$

What is the probability that you get at least 1 Beanboozled Jelly Bean?

$$P(\text{at least } 1) = 1 - P(0) = 1 - \frac{591600030}{2535650040} = \frac{1944050010}{2535650040} \approx 76.7\%$$

What is the expected value on the number of Beanboozled Jelly Beans you would get in a cup of 5?

$$E \approx 0 \times .233 + 1 \times .4 + 2 \times .266 + 3 \times .086 + 4 \times .014 + 5 \times .0008 \approx 1.25$$