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STAT F300 Statistics, Dr. Short
Worksheet 11, Due Monday, February 13, 4:15pm

1. Every day you practice juggling in your too-small cabin for 30 minutes. You don't get better or worse over time, and you've discovered after many years that the probability you'll smash something valuable (an antique Flintstones mug) during a juggling session is 0.12. We consider 30 days worth of juggling sessions. (The sessions are independent.)

(a) Find the expected number of Flintstones mugs that will be broken in 30 days of juggling sessions. Interpret this number.

$A =$ a mug being broken, n = 30

$$\begin{aligned}\mathbb{E}(A) &= 30(0.12)\\ &= \boxed{3.6}\end{aligned}$$

Over the course of 30 days of juggling, it's expected that you will drop and break an average of 3.6 mugs.

(b) Find the variance and standard deviation of the number of broken mugs.

$\text{var}(A)$:

$$\begin{aligned}\text{var}(A) &= nA(1-A)\\ &= 30 \cdot 0.12(1-0.12)\\ &= 30 \cdot 0.12(0.88)\\ &= \boxed{3.168}\end{aligned}$$

$\text{sd}(A)$:

$$\begin{aligned}\text{sd}(A) &= \sqrt{\text{var}(A)}\\ &= \sqrt{2.808}\\ &= \boxed{1.6756}\end{aligned}$$

(c) What is the probability that at least 3 mugs will end up broken?

$$\begin{aligned}P(3 \leq A) &= \text{dbinom(3, 30,0 .12)}\\ &= \boxed{0.65}\end{aligned}$$

(d) If it costs \$30 to replace a Flintstones mug, and you must replace the ones you've broken (to maintain peace in the household), and it costs \$1 to polish the unbroken mugs, what is the expected cost of 30 days of juggling sessions? What is the standard deviation?

Expected Cost (C):

$$\begin{aligned} C &= 30(30 \cdot (A) + 1 \cdot (1 - A)) \\ \mathbb{E}(C) &= 30(30 \cdot \mathbb{E}(A) + 1 \cdot (1 - \mathbb{E}(A))) \\ &= 30(30(0.12) + 0.88) \\ &= 30(4.48) \\ &= \boxed{\$134.40} \end{aligned}$$

sd(C):

$$\begin{aligned} \text{sd}(C) &= \sqrt{\text{var}(C)} \\ \text{var}(C) &= \end{aligned}$$