# HW08 - Binomial

Stat 131A, Spring 2019

**General Instructions**

- Write your narrative and code in an `Rmd` (R markdown) file.
- Name this file as `hw08-first-last.Rmd`, where `first` and `last` are your first and last names (e.g. `hw08-gaston-sanchez.Rmd`).
- Please do not use code chunk options such as: `echo = FALSE`, `eval = FALSE`, `results = 'hide'`. All chunks must be visible and evaluated.
- Submit your Rmd and html files to bCourses.

---

**1)** A husband's year-end bonus will be:

- \$0 with probability 0.3
- \$1000 with probability 0.5
- \$2000 with probability 0.2

His wife's bonus will be:

- \$1000 with probability 0.7
- \$2000 with probability 0.3

Let $S$ be the sum of their bonuses, and assume that the bonus of the husband is independent from the bonus of the wife. Find $E(S)$ and $Var(S)$.

**2)** Donald is taking a statistics course. He intends to rely on luck to pass the next quiz. The quiz consists of 10 multiple-choice questions. Each question has 5 possible answers, only one of which is correct. Donald plans to guess the answer to each question.

a. What is the probability that Donald gets no answers correct?

b. What is the probability that Donald gets half of the answers correct?

c. Find the probability that Donald fails the quiz. A mark is considered a failure if it is less than 60%.

d. Plot the probability distribution of the number $k$ of correct answers ($k = 0, 1, \ldots, 10$).

**3)** Silicon chips are tested at the completion of the fabrication process. Chips either pass or fail the inspection, and if they fail they are destroyed. The probability that a chip fails an inspection is 0.02.

a. What is the probability that for a manufacturing run of 300, only 5 will fail the inspection?

b. What is the probability that for a manufacturing run of 300, at most 7 chips will fail the inspection?

c. What is the probability that for a manufacturing run of 300, at least 10 chips will fail the inspection?

**4)** Seven decks of 52 playing cards are shuffled and the top card on each deck is turned up.

a. What is the probability all seven are face cards (King, Queen, and Jack)?

b. What is the probability all seven are face cards of the same suit (all hearts, diamonds, spades, or clubs)?

c. What is the probability of exactly four face cards among the seven cards turned up?

**5)** A satellite is powered by three solar cells. The probability that any one of these cells will fail is 0.15, and the cells operate independently. Find the least number of cells the satellite should have so that the expected value of the number of working cells is no smaller than 3.

**6)** A regional community is trying to ensure that their local water supply has fluoride added to it, as a medical officer found that a large number of children aged between eight and twelve have at least one filling in their teeth. In order to push their cause, the community representatives have asked a local dentist to check the teeth of one hundred 8-12-year-old children from the community. Let $X$ be the random variable for the number of 8-12-year-old children who have at least one filling in their teeth. Find the value of $p$, correct to 3 decimal places, if $P(X \leq 90) \approx 0.95$.

**7)** Consider tossing a fair coin.

a. You win a dollar if there are more than 60% heads. Which is better: 10 tosses or 100? Explain.

b. As in (a), but you win the dollar if there are more than 40% heads.

c. As in (a), but you win the dollar if there are between 40% and 60% heads.

d. As in (a), but you win the dollar if there are exactly 50% heads.

**8)** One hundred draws are going to be made at random with replacement from the box

```
[0   2   3   4   6   9]
```

True or false and explain:

a. The expected value for the sum of the draws is 400.

b. The expected value for the sum of the draws is 400, give or take 30 or so.

c. The sum of the draws will be 400.

d. The sum of the draws will be around 400, give or take 30 or so.