

Complete the following tasks. You need to show work for full credit, and you may use RStudio to finish the calculations. Some answers have been provided. Assemble your work into one PDF document and upload the PDF back into our CatCourses page.

1. For the first time, mixed doubles curling was an event at the Winter Olympics. Below are the number of ends won by siblings Becca and Matt Hamilton during the round-robin stage.¹ Find the mean and median number of ends won.²

4, 4, 5, 10, 9, 1, 4

2. Please help the Department of the Interior compute the average and median number of wildfires in the year 2018 in the western region of the United States using the following table of data.³⁴

| State | Arizona | California | Idaho | Nevada | Oregon | Washington |
|-----------|---------|------------|-------|--------|--------|------------|
| Wildfires | 2000 | 8054 | 1132 | 649 | 2019 | 1743 |

3. The data below are a sample of Covid-19 vaccination rates (number of people fully vaccinated per 100 persons).⁵ Compute the mean and median of the sample rates.⁶

| state | CA | TX | FL | NY | IL | PA |
|------------------|------|------|------|------|------|------|
| vaccination rate | 5.33 | 5.12 | 6.95 | 6.45 | 4.67 | 5.19 |

4. **Combinations** Here we will work with the “choose operator” $\binom{n}{k} = \frac{n!}{k!(n-k)!}$

- (a) Compute $\binom{32}{3}$
- (b) Recite what we do when the calculations include “0!”
- (c) **Symmetry** Show that $\binom{n}{n-k} = \binom{n}{k}$

¹https://en.wikipedia.org/wiki/Curling_at_the_2018_Winter_Olympics_%E2%80%93_Mixed_doubles_tournament

²This was an exam question during the Spring 2018 semester.

³Source: <https://www.iii.org/table-archive/23284>

⁴This question was a task during the Fall 2019 final exam and was based on work by a group of students: Roger Barreto-Ramos, Daniel Rendon, Natalie Tejeda Cordon, and Angel Mai

⁵Source: Our World in Data, https://github.com/owid/covid-19-data/blob/master/public/data/vaccinations/us_state_vaccinations.csv, accessed 2021-02-23

⁶This was an exam question during the Spring 2021 semester.

5. **Patterns** For the calculations in this problem, you may simply use a calculator.

- (a) Compute $\binom{0}{0}$
 - (b) Compute $\binom{1}{0}, \binom{1}{1}$
 - (c) Compute $\binom{2}{0}, \binom{2}{1}, \binom{2}{2}$
 - (d) Compute $\binom{3}{0}, \binom{3}{1}, \binom{3}{2}, \binom{3}{3}$
 - (e) Compute $\binom{4}{0}, \binom{4}{1}, \binom{4}{2}, \binom{4}{3}, \binom{4}{4}$
 - (f) What is the pattern? What are the calculations above forming?
 - (g) Use that observation to briefly describe why $\sum_{k=0}^n \binom{n}{k} = 2^n$
6. Each day in Bio 18, Derek leaves a stack of paper packets near the entry door for students to obtain. Eighty-one percent of students grab a packet before being seated. If we observe a random selection of nine students, what is the probability that exactly two students sit first before grabbing a packet.
7. According to the New York Times, eleven percent of parents helped their college children write an essay. If I collect seven essays, that is the probability that at most two of those submissions had parental assistance?⁷
8. Suppose that at a famous aquarium, a docent found that 35 percent of elementary school children know the difference between dolphins and porpoises. If a docent has a tour group that has 9 elementary school children, what is the probability that at least two of the children know the difference between dolphins and porpoises?
9. In a fantasy world, there is a region called Durotar, where about 68 percent of the denizens are orcs. If we happen upon a group of 7 denizens, what is the probability that the number of orcs is at least 2 and less than 5.⁸

⁷Source: <https://www.nytimes.com/2019/03/13/upshot/parenting-new-norms-grown-children-extremes.html>

⁸This was an exam question during the Spring 2021 semester.

Here are some of answers. Note that numbers may slightly vary depending on when and where the rounding took place.

1. mean: 5.2857 ends, median: 4 ends
2. mean: 2599.5 wildfires, median: 1871.5 wildfires
3. $\bar{x} \approx 5.6183$, median = 5.26 fully vaccinated (per 100 persons)
4. (a) 4960
 (b)
 (c)
- 5.
6. 0.2973
7. 0.9669
8. 0.8789
9. 0.3932