Chapter 12 Project

Ready Player One

An activity to demonstrate sequences and series in real life.

Electricity is the very power that runs through our lives. Without electricity, we would not have our modern way of life, and thus the study, development, and use of electricity serves as a fundamental growth point for the human race. Among all of the innovations we use on a daily basis that rely on electricity, the development of video games and video game consoles has been one of the most rapidly growing areas.

The development and construction of video games and consoles involve electricity, power, and motors as well as mathematics and sequences.

1. A fan runs inside an older video game console to prevent the system from overheating. This fan runs at 11 revolutions per second while powered on. After the console is turned off, the speed of the fan decreases by 80% per second. The number of revolutions the fan makes after the console is turned off can be modeled using a geometric series.

- **a.** Write, but do not evaluate, the expression for this scenario in sigma notation.
- **b.** Write, but do not solve, the equation for this scenario by using the sum formula of an infinite series.
- **c.** How many revolutions will the fan make after the console is turned off?

2. Older video game consoles required a physical copy (or cartridge) of the game to run. In original video game cartridges, there is a battery that is used to store saved information so that the next time you play the game, your saved data remains and you can play from where you left off. On some cartridges, this battery is rechargeable. Assume that the battery recharges 99.8% of its previous capacity every time it charges, and it initially lasted for 600 hours. The total time the battery will last can be modeled using a geometric series.

- **a.** Write, but do not evaluate, the expression for this scenario in sigma notation.
- **b.** Write, but do not solve, the equation for this scenario by using the sum formula of an infinite series.
- **c.** How many total hours will this battery last?

3. Oh, those annoying boss battles! In video games, there are sometimes points in the game where the difficulty can spike and increase dramatically to check if you have mastered the skills necessary to move on to the next level. Assume that a boss has 50 health points and will regain 10% of those health points every 5 seconds.

- **a.** Imagine you inflict damage on the boss every 5 seconds. When you cause damage, you take away 5 of the boss's health points. What is the model for the first three iterations of this process?
- **b.** Will you ever be able to beat the boss? Hypothesize why or why not and explain your answer.

4. Some video games focus on more relaxing styles of play, such as the simulation of real-life activities. Assume you are playing a relaxing farming game, where you are harvesting various types of vegetables. There are two possibilities for the quality of vegetable you harvest: you either receive a normal type of the vegetable or a golden type of the vegetable that is worth twice as much when sold. Using the formula based upon the binomial theorem, $\frac{n!}{k!(n-k)!}p^k(1-p)^{(n-k)}$, let p represent the probability of receiving a golden vegetable, n represent the total number of vegetables harvested, and k represent the number of golden vegetables you want to harvest.

a. Assume that the probability of receiving a golden vegetable is 10%. Find the probability that 3 of the next 10 vegetables that are harvested are golden vegetables. Round the percentage to the nearest hundredth.

b. Assume that the probability of receiving a golden vegetable is 10%. Find the probability that 5 of the next 10 vegetables that are harvested are golden vegetables. Round the percentage to the nearest hundredth.