Volume

1

Stockton University

Probability & Applied Statistics

Valorant Champions Meets Statistics

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Introduction

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Introduction

For the final project, I decided to choose a very popular game that came out over a year ago. The game is called Valorant and is a competitive first-person shooter that uses team tactics. If you have never played the game before, a good example to get a feel for what the game is like is basically CS: GO and Overwatch mashed up into one game, as it incorporates gunplay along with what are known as “Agents”, or different selectable characters with varying abilities and a limit to one of each per team. The objective for the attacking team is to plant the “spike”, also known as the “bomb” on one of two of the defending team’s bomb sites, with a switching of sides at 12 rounds in.

The game is played until the first team reaches 13 rounds won, with a win-by-two stipulation. Last year there was a huge professional tournament, known as the Valorant Champions Tour, where the top players from around the world come together to show off their skills and play towards a cash prize of $200,000 going to the first-place team.

For the project topic, I chose to follow all the players of the final ten remaining teams in the Valorant Champion Tour 2021: Stage 2 Masters tournament. After learning about so many types of probability distributions and statistical techniques over the course I want to apply them to the stats of the all the players of the last ten remaining teams. In this final report I will be going through chapter by chapter explaining the important concepts we learned and displaying an example that I can apply to my data.

Chapter

1

Chapter 1

In chapter one we start to look at the basics into statistics. The chapter goes over these three main techniques which is the mean, variance, and standard deviation. Finding the mean of a collection of data is when you add up all the numbers in your data set and divide by the number of items in your list. The mean could also be represented in a formula that is . So, one of the questions that could be asked is from the data that was collected what is the average amount of kills that each player had. According to the calculations that were made in excel the average amount of kills is 122.04 kills. Next the chapter goes into variance and standard deviation. The mathematical formula for the variance is . Also, for the standard deviation the textbook listed the formula as . Now standard deviation and variance go hand in hand when you are calculating the values. This is because while you are calculating the standard deviation you come across solving for the variance. When you are solving for the standard deviation first you must calculate the mean. Once you have the mean you take each value in the data set and subtract it from the mean. Next you must take every value and square it. Then you sum up all of those values and divide by the number of items in the list subtracted by one. Now after you calculate this you actually have the variance. The last step to getting the standard deviation is taking the square root of the variance. Let’s use the set of kills from the data set to find the variance and standard deviation. Luckily excel comes with a variance and standard deviation function. So, after performing the calculation you can find that the variance of the total amount of kills is 4102.7184. Since we have the variance, we can take the square root of that number to find the standard deviation which was 64.0524. Chapter one is a very important chapter that teaches you basic concepts and techniques that you will eventually have to use again later in the semester.



Chapter

2

Chapter 2

In chapter two it introduces us to the concepts of sets. The first concept that is introduced is three terms the union, intersection, and compliment. Union can be denoted as . This notation means the union of the two sets. You could also think of it as the combination of sets A and B but only one of a repeats. Let’s have a set where it contains the maximum kills on a single map. In this large set it will contain two subsets of team Sentinels and Fnatic. So let set A be team Sentinels which would be [33,31,23,20,23]. Set B will be team Fnatic that set would contain the values [34,26,21,24,23]. Now that we have both sets created, we can perform some operation on them. So, the union of set A and B is going to be [34,33,31,26,23,20,21,24]. The next term is the intersection which can be shown as . Essentially the intersection of two sets is only the common values of the sets nothing more. Now we can use the sets created above to sinuate the intersection of both sets which would be [23]. This is because the number 23 is the only number that both sets have in common with each other. The last term is the compliment of the set which can be denoted as . Compliment is a very easy concept to understand as an example let’s say you had a set that had all the values from one to five in it. Set A has the value [1,3,5] the complement of set A is the remaining values from the set that are not in set A. So, the answer to the example is [2,4] which would be the compliment of set A.



During this next section of chapter two is when we start to go over some new statistical techniques that are used to solve problems. These concepts are permutation and combination. Permutation is an arrangement of all or part of a group of objects in terms of the order in which they are arranged. In the textbook they wrote out the formula for permutation as . We can use the data set to display a permutation problem. Let’s say you took one game and you wanted to know the permutation of the top three players. Since there are 10 players in a game that would be your n. Your r value would be the number you are looking for which in this case would be 3. After calculation the total amount of permutation of the top three players is 720 ways the leaderboards can be ordered. Now the next formula is the combination formula. This formula takes in the same values n, and r and tries to find the total amount of combinations. The combination formula can be donated as . Let’s take the permutation example and use it to find the total amount of combinations you can order the top three players. Your n would be 10 and your r would be 3 just like the example. After running the calculations there is 120 different ways you can order the top three players in one single match. Unfortunately, some of the other topics in chapter 2 could not be used from the data set. I tired to do more research to find comparable data to use but sadly I did not find anything that would work or make sense.



Chapter

3

Chapter 3

In chapter three this section of the textbook starts to go into the many different distributions that are associated with statistics. The first distribution the textbook goes over is the binomial distribution. In the textbook they wrote out the binomial distribution formula as . Binomial distribution is used to find the probability of an event occurring in a fixed number of trails. For this example, let’s look at a induvial players stats in this example we will use TenZ. In this problem we are going to see the probability of TenZ getting a head shot in the first three rounds he plays. First, we need to calculate the total combination our n value is going to be set to 13 for the total amount of rounds in one match, and our r value will be 3 since we are only interested in the first 3 rounds he plays. Our p will be the probability he hits a head shot which is 20 percent and our q will be the compliment which is 80 percent. So, the total combination of 13 pick 3 is 286. Next, we need to solve for p and q. Once we plug in the rest of the values and multiply it by all of them it turns out that he has a 24.56% chance of getting a head shot in the first three rounds he plays.



The next distribution that the textbook goes over is the geometric distribution. In the textbook the formula is written out as . Where in this case we are only worried the first time a successful trial occurs. In this problem we will continue to look at only TenZ’s stats and use his clutch percentage to see how soon during a game he can clutch a round for his team. Our p will be set to .11 and q will be .89. Next, y value will be set to the number of rounds he wants to look at which will be 6. Once we have all of our values, we can simply plug it into the formula. The results are pretty shocking the answer that was outputted 0.0614. This means that in the first 6 rounds of a game TenZ has a 6.14% chance of clutching the round.



Another distribution the textbook goes over is the hypergeometric distribution. This is used for finding the probability of the amount of success in a specific number of trials without replacement. The textbook denoted the hypergeometric distribution as . We can actually use the data set to simulate a hypergeometric problem. Let’s figure out the probability if you select three players that those three players have a kill death ratio over 1.0. To start this problem, we need to set our variables. Our N will be set to 50 since there are 50 players total and n will be set to 10 for the number of teams in the data set. Next our r will be set to 24 which is the number of players that came out with a 1.0 or over kill death ratio. Last the y variable will be set to 3 since that is the number we are searching for. Once we set our variables up, we can put it into our calculator to see the output. The results for this answer really shocked me the result came out to be 0.1306. Which is 13.06% so randomly choosing 3 players out of the 50 you have a 13.06% chance of picking a player that has over a 1.0 kill death ratio.



Later in the chapter the textbook goes over another type of distribution which is the Poisson distribution. The Poisson distribution is a discrete frequency distribution that expresses the likelihood of a set of independent occurrences occurring at a specific moment. The formula can be written out as .Unfortunately I found it difficult to add a Poisson distribution question. But I will still explain how to solve a problem. First you are going to need two values. Lambda is required and Lambda is equal to the mean or expected as some people call it. Next you will need a y value you will be able to identify the y value because it will be provided in the problem. But usually, it will be a rate of time. Once you have those two values plug it into the formula above on a calculator then you will have solved for the Poisson distribution.



The last distribution this chapter goes over is Tchebysheff’s theorem. This theorem is used to find the lowest fraction of observations falling within a specified number of standard deviations from the mean is estimated. In the textbook this formula is written out two ways and . For this example, we will use every player combat score. First, we need the to get the mean and standard deviation of this column. In order to easily get those, answer I used excels built in functions to give me the mean and standard deviation of the combat score column. The mean came out to be 198.152 and the standard deviation came out to be 34.259. Next, we must take the upper and lower bound and subtract the mean from both of them. If they equal the same number, then you can use your upper bound and divide it by your standard deviation top get your k value then you can plug it in to the equation above to get the correct answer. The upper bound is set to 300 and the lower bound will be set to 96. Once we plug in the proper numbers to the equal the result will equal 0.88. The result means that 88% of the players that played in this part of the tournament were in the number of standard deviations from the mean of combat scores.



Chapter

4

Chapter 4

In chapter 4 with the amount of time we had in our semester we were only able to go over a few topics before we had to start preparing for our final. In this chapter we learn about two different types of functions the distribution function and density function. The formulas for these functions will be given below Distribution Function - , Density Function - .



Notice how similar these equations are but how they are written makes a huge difference on when you try to solve a specific problem. One of the last distributions which is the uniform distribution. The textbook defines the uniform distribution as . Notice how this function starts off with a little f this is how you would identify a density function. Now a distribution function will have a slight variation. First you would notice a capital letter, whenever you see it subtract your x from, you’re a value and then divide that by your b value minus you’re a value.



First, I will showcase a density function problem using my data set. In the Valorant tournament stats we can calculate the uniform distribution of the players head shot percentage between U (0.20,0.30) representing players that fall between 20 percent and 30 percent. If you follow the formula above a will, be equal to 20 and b equal to 30. The results are 1 over 10 will be the unform distribution.

Now if you want to find the distribution function of this problem it would be set up as. The probability that X is less than 22. It would be set up as P(X<=0.22) now you would do x minus a divided by b minus a. After putting the calculation into my calculator, the answer, you get is 0.2. Which means that the unform distribution would be 1 over 20 which is very interesting.

Conclusion

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Conclusion

Throughout doing the research to acquire all the results in this final report, I used to excel function, my calculator, and some of the programs that I used from previous assignments to make my life a little bit easier. Using java to calculate some of the results was very useful and a wonderful to see that the programs actually worked. The results that I acquired from doing this assignment was very interesting. Also, what makes this project a more pleasant experience is that I am using data from a topic that I am genuinely interested in. This project demonstrated to me how much knowledge I have accumulated throughout this semester and shows that I can bring the skills I learned in this course and apply it to real-world situations. Ultimately, I am happy with what I have accomplished this semester and are interested by the clashing world of programming and statistics.