Dungeons & Dragons Data Report

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Introduction and Data

Dungeons and Dragons is a tabletop role playing game where several players and a dungeon master work together to tell a story through gameplay. In this story, players will create their own characters that fit the setting of the campaign and their own vision. Some will even create several characters, myself included, for a single campaign. In this report, we'll be focusing on two aspects of character creation: class and race.

In Dungeons and Dragons, there are a variety of races and classes for players to choose from. They may want to be a human paladin, a tiefling warlock, or perhaps an elf ranger. The data set I've chosen for this research paper is information about the most popular races and classes in the game.

The most popular races and classes in 'Dungeons & Dragons'

Class and race combinations per 100,000 characters that players created on D&D Beyond from Aug. 15 to Sept. 15, 2017

	CLASS												
RACE	FIGHTER	ROGUE	WIZARD	BARBARIAN	CLERIC	RANGER	PALADIN	WARLOCK	MONK	BARD	SORCERER	DRUID	TOTAL
HUMAN	4,888	2,542	2,568	1,435	2,339	1,715	2,326	1,714	1,946	1,454	1,324	996	25,248
ELF	1,242	2,257	2,744	336	921	3,076	492	755	1,349	651	841	1,779	16,443
HALF-ELF	646	1,325	611	153	628	891	817	1,401	399	1,808	1,258	516	10,454
DWARF	2,009	362	395	1,323	2,199	415	971	286	405	394	264	484	9,507
DRAGONBORN	1,335	325	346	875	510	355	1,688	584	457	371	1,031	309	8,185
TIEFLING	379	798	516	198	353	272	473	2,188	309	806	1,062	281	7,634
GENASI	580	495	558	388	459	420	322	415	750	352	648	584	5,971
HALFLING	339	1,797	257	306	308	440	207	296	551	801	310	302	5,916
HALF-ORC	976	233	143	1,709	272	245	427	212	284	199	126	215	5,039
GNOME	257	600	1,360	227	304	238	151	311	196	400	257	332	4,634
GOLIATH	865	139	109	1,729	192	187	389	136	326	144	114	190	4,522
AARAKOCRA	273	362	181	313	249	572	149	203	835	279	177	275	3,868
AASIMAR	116	71	67	70	274	60	429	210	87	144	174	65	1,767
TOTAL	13,906	11,307	9,855	9,063	9,009	8,887	8,840	8,711	7,892	7,804	7,587	6,328	

As you can see, it's quite a bit of information. This picture specifically was taken from https://fivethirtyeight.com/features/is-your-dd-character-rare/, though the data was collected by DnD Beyond, a website that facilitates playing DnD online through character creation, homebrew, book purchases, and more.

Looking at the chart, you can use the MN rule to see that with 13 races and 12 classes, there are 156 different combinations players can choose from. Normally, companies strive for an equal amount of popularity for every combination, but you can clearly see that there is a clear favorite and several combinations left in the dust.

The Most Popular Combination

For example, let's take a look at the most popular combination in the game, the human fighter. It's quite the stereotype in the DnD community that anyone who plays a human fighter is basic because of how common it is. In fact, if you play as a human, people already assume that you'll be a fighter as well. If we look at the conditional probability here, we can see that this stereotype is not unfounded.

You may calculate this with the following formula:

$p(A|B) = p(A \cap B) / P(B)$

So, the chance of being a fighter is 13.906%, and the chance of being both a human and a fighter is 4.888%. Plugging it into the equation, you see that if you are a human, the chance of you being a fighter is about 35%.

But why is this the case? Well, after doing some research there are a few reasons for this. First of all, fighter is generally an extremely basic class. There's no spell casting involved, and their general action in combat is to swing a sword or mace and do nothing else, at least ealy on. Therefore, it's an extremely beginner friendly class and is more likely to be picked by those who are new to the hobby. However, how do we explain its connection to the human race? Well for starters, obviously anyone who plays DnD is also a human. We have a natural tendency to want to stick to what we know, so of course there's a natural tendency to start off as a human. It would be difficult for someone to pick up DnD after never playing a ttrpg, only to somehow role play as a dragonborn. Essentially, my theory of why humans and fighters are closely linked is that they're the most beginner friendly choices and are perfect for learning the game.

Still, there's also the chance that the event of being a human and being a fighter could be completely independent. We can check its dependence with a rule for independent random variables.

$p(x, y) = p_1(x)p_2(y)$

If the above equation is true, then the two events are independent. In this case, the chance of being a fighter is about 14%, the chance of being a human is about 25%, and the chance of being both is about 5%. However, $.14 \times .25 \neq .05$. In fact, it's not even close. Therefore, the two events must be independent.

Party Composition

While players are generally encouraged to play whatever they want, there can often be problems with party composition. For example, if you have a team of only tanks, then you'll struggle to do any damage. If you have a team of only glass cannons, you'll get killed too quickly. This is especially an issue if the campaign being run has a certain theme or setting that restricts player race.

For example, imagine that you're running a setting where you have five party members playing as descendants of the gods. The most appropriate race for this would obviously be the aasimar, since they're literally part celestial. Also, the ideal party composition for a party of five would have two frontline characters. If everyone is forced to play an aasimar, what are the

chances that two of the players will choose barbarians? This question can be answered with binomial distribution.

$$P(Y = y) = \binom{n}{y} p^y q^{n-y}$$

In this case, the chance of a success - a player picking a barbarian - would be 4%. Doing the math, the chance of getting exactly two barbarian players would be about 1.4%. This is extremely low, and goes to show how problems may arise if players aren't willing to work together and change classes for the benefit of the party.

Next, one very popular campaign idea is a low magic setting. In DnD, many DMs (dungeon masters) find spellcasting overpowered or too commonplace in their worlds. As a result, it's common for a DM to want to restrict players from choosing any classes that use magic. However, it's a bit of an issue when spellcasters are quite popular. Of the 12 classes, 8 of them cast spells. If someone wanted to run a game with five players where no spell casters are allowed, what are the chances of them finding five players who didn't want to play a spellcaster? We can use geometric distribution to figure it out.

$$p(y) = P(Y = y) = q^{y-1} p$$

However, it's worth noting that in this case, we're specifically looking at the chance of the success coming after the fifth trial. So, we'll be using a modified formula.

$$P(x > n) = (1 - p)^n$$

Looking at the graph, the percentage chance that a player would want to play a spellcaster over a martial character is just about 50%. If we consider the "success" to be the chance that someone wants to be a spellcasting class, then the chance that a player will want to play a spellcaster only after the fifth pick would be just over 3%. As you can imagine, this is an extremely small chance.

Combat Strategy

While PvP in DnD isn't super common, it can certainly happen. When it does, you'll want to be ready with the proper strategies. Like in most games, the general strategy in combat anytime you're facing off against another party of players is to focus on the squishy damage dealers or utility. You wouldn't waste all of your attacks and time taking down a tank with bulking armor and a huge shield, but you certainly would put every last bit of strength behind a blow towards a glass cannon who is destroying your allies. But what if you decided that you couldn't possibly care less about your target, and randomly chose who to down first?

Imagine you're an extremely powerful villain who can take tens of adventurers at a time, and you find yourself in front of a group of 25 angry adventurers. Using the dataset, we can conclude that the average party will have 5 fighters, 3 rogues, 3 wizards, 1 barbarian, 2 clerics, 2 rangers, 2 paladins, 2 warlocks, 2 monks, 1 bard, 1 sorcerer, and 1 druid. Of the 25 adventurers, the ones you *should* prioritize are the squishy spell casters. That would be about 10 of the adventurers. Imagine if you had the strength to kill at least 5 adventurers in one go. If you attacked people randomly without strategy, what are the chances that you down four high priority targets? Hypergeometric distribution would serve this scenario well.

$$\frac{n_A}{n_S} = \frac{\binom{r}{y} \times \binom{N-r}{n-y}}{\binom{N}{n}}$$

N = 25 total adventurers, n = 5 adventurers downed, r = 10 priority targets, and y = 4 high priority targets we want downed. Doing the math, the probability that your one powerful move randomly downs four high priority targets is only about 6%. Chances are, you're being taken down since you didn't properly plan and choose your targets wisely.

Random Things to Include Chapter 4 and 5

Note: I don't think my dataset works well at all with chapter 4 and 5, so while I tried my best to make the previous problems make sense in the narrative, this won't make any sense at all.

So imagine you have a party of six players. There's five human fighters and one tiefling warlock who has disguised himself using magic. The tiefling is evil and plans on stabbing your party in the back as soon as it can. You can't tell them apart by just looking at them, so you need to pick one at a time to cast Dispel Magic on to reveal their true form. If you're choosing them randomly, what's the probability function for Y if Y is the number of the trial on which the tiefling is found?

In this case, there can only be six trials max since there's only six choices.

1. p(1) = ⅙
2. p(2) = ⅙
3. p(3) = ⅙
4. p(4) = ⅙
5. p(5) = ⅙
6. p(6) = ⅙

Essentially, each trial has an equal chance to reveal the tiefling.

Now, what if there was a relationship between orcs and druids that had a density function of:

$$f(y) = \{\frac{y^2}{8},\ 0 \le y \le 2;\ 0,\ \text{elsewhere}\}\ ?$$

What would the mean and variance of this situation be?

Well, to solve this intriguing puzzle, we need to use the equations for finding the expected and variance for continuous random variables.

$$E(Y) = \int_{-\infty}^{\infty} yf(y)dy$$

$$V(Y) = E(Y^2) - [E(Y)]^2$$

The work is as follows:

$$E(Y) = \int_0^2 y\frac{y^2}{8}dy = \frac{y^4}{32}\Big|_0^2 = \frac{1}{2}$$

$$E(Y^2) = \int_0^2 y^2\frac{y^2}{8}dy = \frac{y^5}{40}\Big|_0^2 = \frac{4}{5}$$

$$V(Y) = \frac{4}{5} - (\frac{1}{2})^2 = \frac{11}{20}$$

After surveying 100,000 adventurers, it was found that the average gold of each member was 20,000 after an abundance of dungeons filled with treasure appeared. The standard deviation was 4,000. If we wanted to figure out the interval to not exclude more than 10% of the adventurers with gold, what would that interval be? Chebyshevs's theorem would be perfect for this kind of situation.

$$P(|Y - \mu| \leq k\sigma) \geq 0.9 = 1 - \frac{1}{k^2}$$

$k = 3.162$, so the range would be $|Y - 20,000| \leq 12648.8$
In other words, the ideal range would be $7351.2 \leq 32648.8$ in order to include at least 90% of the adventurers.

Conclusion

When playing DnD, it's important to realize that everyone has fun in different ways. Some people love playing their simplistic human fighters, while some people love scouring over hundreds of spells to create awesome and sophisticated effects. Similarly, some people love making their characters as strong as possible in combat, while others couldn't care less and would rather build their characters based on what they personally like. Because of this, DnD will never be able to have an even spread of races and characters. There's no way to "balance" these options enough for each to be picked the same amount. However, it's not necessarily a bad thing. My report goes over the possible issues with having wildly popular combinations and some very unpopular ones, but one should realize that it ultimately doesn't matter. If your party is super weak, simply change your fights to be easier. If five of your players all want to play rogues, then add more stealth missions to your campaign. If you personally hate whatever choices your players want to make, then simply join another game where the players are more compatible with you. In the end, it doesn't matter if the majority of the population is interested in playing basic human fighters, as long as everyone is finding a way to have their own fun.