

Analysis of Credit Card Approval:  
A Case Study of African American Adults Living in Metropolitan Areas.

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## Analysis of Credit Card Approval

When comes access to credit, this is an essential tool to be able to perform certain tasks and operations within one's life. Most adults depend on credit, to start a business, buy a car, to buy a home among others. Before we can delve deep into the topic of discussion, first and foremost, let's take a glimpse into the history of credit cards and how we can use it in the world we are living in today.

Steele (2022) gives a breakdown of the history of credit cards. As listed below.

- Circa 1800s: Merchants used credit coins and charge plates to extend credit to local farmers and ranchers until they collected profits from harvests.
- 1964: Charge cards were launched by banker John Biggins with the Charg-It card, used in a two-block radius of his bank in New York City. Customer purchases were forwarded to his bank and merchants were reimbursed later in what was known as the "closed-loop system."
- 1950: The Diners Club Card debuted when Frank McNamara forgot his wallet and couldn't pay for a business dinner. He proposed the idea of a small cardboard card, which members could use like a charge card and pay the bill in full every month.
- 1958: American Express launched its first credit card made of cardboard, followed shortly by the first plastic credit card in 1959.

Thus, as from 1958, marked the beginning of what we have today as our credit cards. Credit cards come with the FICO credit score, where the score is determined by various factors such as how you utilize the credit awarded and the duration taken until repayment is made. If there is a missed payment, then there will be interest accrued. The FICO score plays a fundamental role in today's life as (Matthews II, 2021) puts it on a 30-year, \$200,000 mortgage with a FICO credit score between 700 and 759, one could expect to receive a 2.56% interest rate. But a person with a credit score between 660 and 679 could end up paying an additional \$14,914.

As much as this may sound attractive on paper, it has been reported that there hasn't been fairness in the availability of credit/ credit cards based on race. My data will provide ample results to back these findings.

My dataset contains 691 individuals of different ethnicities, social statuses, and ages. The dataset contains the names of those approved and not approved to have a credit card. I decided to only take the ones approved so that they can bring to light my hypothesis. Out of 691 individuals on the dataset, only 304 were approved to attain a credit card. Making it to be almost half of the surveyed population. Using my Statistics library, I was able to determine that the mean age for approval of credit was 34 years old, with a 13-standard deviation, and the most common age to receive the approval was 23 years old. Concluding that a lot of young people are applying to get credit cards. This can be viewed in the screenshot; I have attached below.

[illegible]

On the third sheet, I decided to take only individuals that identified as black and I was able to determine that among the 304 approved, 87 were African Americans. I decided to apply Binomial Distribution to determine the probability that 20 African American individuals are likely to get approval to get credit. The Binomial Distribution formula is given by:

Where P denotes the probability of success and Q denotes the probability of failure.

3	0.086871
4	0.147887
5	0.18956
6	0.189826
7	0.152073
8	0.098986
9	0.052866
10	0.023294
11	0.008482
12	0.002548
13	0.000628
14	0.000126
15	2.02E-05
16	2.52E-06
17	2.38E-07
18	1.59E-08
19	6.69E-10
20	1.34E-11
21	

Chart Title

Index	Value
1	0.000000
2	0.035000
3	0.085000
4	0.145000
5	0.185000
6	0.185000
7	0.150000
8	0.095000
9	0.050000
10	0.020000
11	0.005000
12	0.001000
13	0.000000
14	0.000000
15	0.000000
16	0.000000
17	0.000000
18	0.000000
19	0.000000
20	0.000000

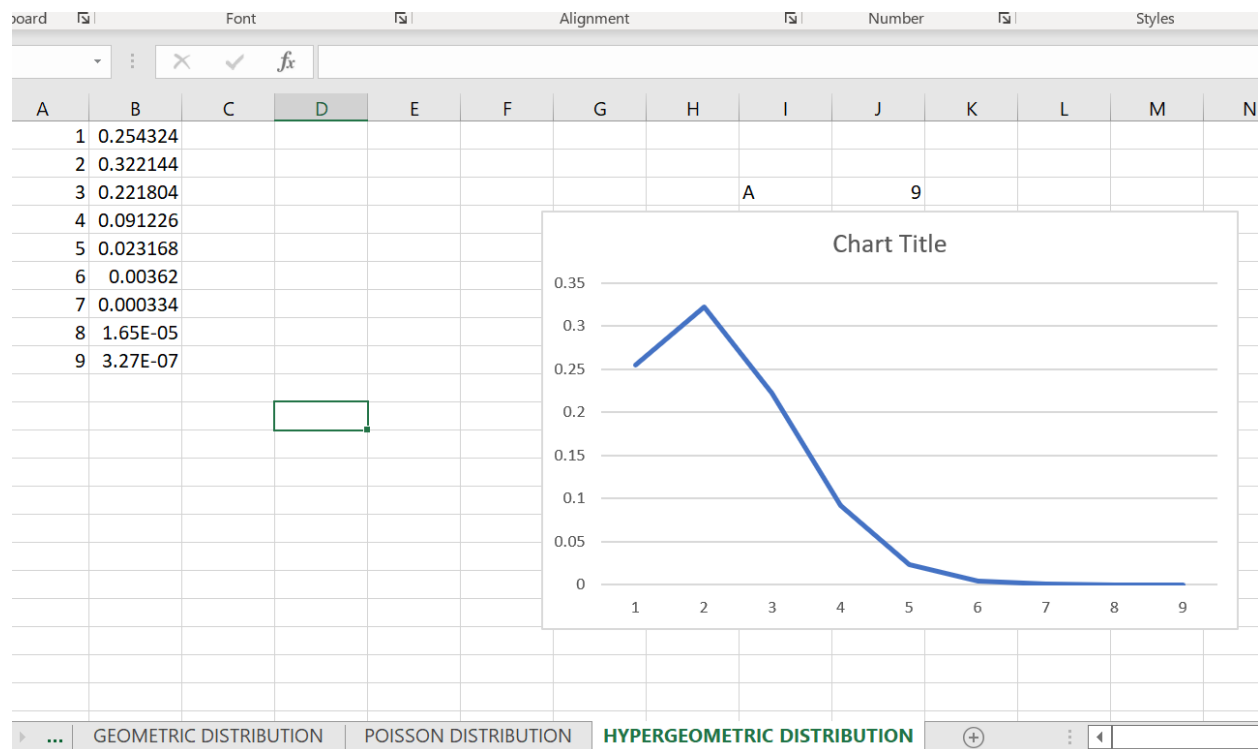
The math behind it is, I took my sample data as 20 to represent the number of trials, then I got the probability for the possible outcome of success, which is 0.285, which is the sample data we have. Then I graphed my values and as you can see, it would take approximately 5 to 6 attempts for adult black Americans to be approved for credit.

$$p(y) = \frac{\lambda^y}{y!} e^{-\lambda}$$

Where the symbol of lambda represents the mean of the sample data

For the Hypergeometric distribution, I took a sample of 9 trials to represent 9 people of African American descent trying to apply for a credit card. Since the probability of possible outcome P is 0.286, I multiplied it by a set number of 30, to demonstrate that 9 people will be drawn for a pool of 30 eligible applicants. I displayed my findings per trial and displayed it using a line graph.

The line graph/ chart can be viewed in the figure below.

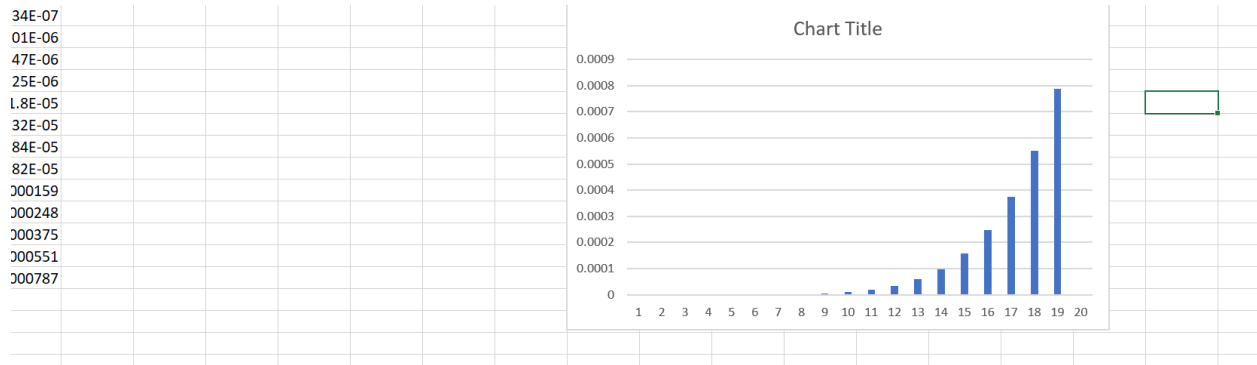


The data reveals that the more the number of applications, in terms of trials, the slimmer the chances are of attaining a credit card.

For the geometric distribution which some mathematicians term as the negation of the binomial distribution is given by the formulae:

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

I used 20 as my number of trials, and the probability of a possible outcome as 0.286, which gave me the graph attached below. Thus, from this graph, we can tell that repeated attempts are the only way to increase the chances of getting a credit card, therefore, a person of color must apply almost 20 times to have a better chance of getting a credit card from the top credit companies.



I formed the hypothesis that there is a 0.25 probability of African American males under the age of 25 getting access to credit using the probability density function. I assigned the random variable  $Y$  that has the density function  $f(y)$  and  $a < b$ , and the probability that  $Y$  falls in the interval  $[a, b]$ , which is the age range to be determined by the formula:

$$P(a \leq Y \leq b) = \int_a^b f(y)dy$$

To determine the joint density of  $Y_1$ , which denotes the proportion of males of African American descent, and  $Y_2$ , to represent the proportion of the demographic that has been approved access to credit, I applied the formula:

$$F(y_1, y_2) = \int_{-\infty}^{y_1} \int_{-\infty}^{y_2} f(t_1, t_2) dt_2 dt_1,$$

Thus I was able to conclude that only approximately 10% of applicants had their applications rejected.

In conclusion, through my analysis, application of statistics, and presentation, I can confidently ascertain that there are raging disparities in terms of access to credit cards for people of color. Hopefully, the responsible parties in the field of credit will attempt to address this challenge.

## REFERENCES

Jason Steele, The history of credit cards, 2022, <https://www.creditcards.com/statistics/history-of-credit-cards/>

Kevin L Matthew II, There's a 'credit gap' between Black and white Americans, and it's holding Black Americans back from building wealth, 2021 <https://www.businessinsider.com/personal-finance/credit-gap-black-americans-building-wealth-2021-1>