# DoorDash

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## The Problem

The pay $P$ that an employee receives for their work can be modeled as a function of their time worked in hours, $t$, and the rate they are paid, $r$ looking something like this

$$P = rt$$

When doordashing however, the rate $r$ varies between orders. For a doordasher the money $P$ a dasher makes is a sum of all the orders done in the time dashing. The pay of an order in dollars, $P_o$, is similarly modeled as a function of the order rate in dollars per hour, $r_o$, and order time in hours, $t_o$ as follows

$$P_o = r_o * t_o$$

If I am going to assume that $r_o$ varies between orders, then it would also be reasonable to assume that the graph of the frequency of different values of $r_o$ would resemble something of a bell curve. In order to maximize the pay they receive, a dasher would want to take orders with the highest pay rate and minimum wait time. The question that I hope to asnwer is what minimum value $r_o$ should a dasher to set to make the most money possible while working?

## Understanding an Order

There are really on 3 important inputs to an order and they are:

1. Pay
2. Restaurant
3. Destination

Those 3 inputs result in a few different qualities of an order, namely

1. Distance

2. Pickup Time
3. Delivery Time
4. Avg. Speed
5. Dollars / Mile

I think it's important to understand the inputs and qualities of each data point in order to enhance the analysis

## Modeling $r_o$

If the pay rate, r, is measured in dollars per hour then r will increase as dollars increases and hours decreases.

Wage rate could be calculated as:

$$r_o = \frac{dollars}{mile} * \frac{miles}{hour}$$

An additional factor to consider is the frequency of orders with optimal values of $r_o$. This is because time spent working, $t$, can be written as $t = (hours\ dashing - hours\ waiting)$ and $hours\ waiting$ certainly will increase as we wait for higher values of $r$. This makes sense as $r$ and $t$ should have an inverse relationship in the equation $P = rt$.

So, Pay could be modeled as:

$$P = \left(\frac{dollars}{mile} * \frac{miles}{hour}\right) * (hours\ dashing - hours\ waiting)$$

## Accounting for Varying Frequencies of $r_o$

Orders will come with varying rates of $r_o$. It is natural to assume that higher values of $r_o$ have lower frequencies and lower values of $r_o$ have higher frequencies. To be able to make the best selection of orders, I need to find the range of values for $r_o$ that return the highest net pay, P. In short, I do not want to spend time doing low-paying orders when I could be doing high-paying orders but I also do not want to be waiting for high-paying orders when I could be making money with low-paying orders.

Suppose there are two orders $O_1$ and $O_2$ with different values of $r_o$, and similar times to complete each order. The pay of both models could be modeled like this,

$$P_1 = (O_1) * (hours\ dashing - hours\ waiting)$$
$$P_2 = (O_2) * (hours\ dashing - hours\ waiting)$$

Higher order frequency results in less time waiting, and more time working. Assuming that order frequency takes the shape of a bell curve as a function of $r_o$ then we could say that the time spent working, t, is equal to this equation:

$$t = \left(\frac{orders}{hour}\right) * t_o$$

where $t_o$ is the time required to complete the order in hours. I should note that because everything but $r_o$ is constant in my example right now in my example, one order can be interpreted as a fixed unit of time, x hours. So the equation above can be read as x hours working / hours waiting * hours dashing

The next step is modeling frequency of orders according to values of $r_o$, and the time requirement for an order given the pickup and drop off location