

MITOCW | MIT15_071S17_Session_8.4.04_300k

In the previous video, we introduced the concept of price-per-click and click-through-rate.

Once we know both of these quantities, we can calculate the average price per display.

This is simply the average amount that an advertiser pays when a user is shown their ad.

We can compute this by multiplying the price-per-click with the click-through-rate.

Let's go through an example to see how this works.

Suppose we have 10 users who search for "best LTE network".

Google decides to display Verizon's ad to all of them.

We know that the click-through-rate for Verizon and for the "best LTE network" query is 0.2, so only two users click on the ad.

Verizon must now pay the price-per-click for each of these users.

Since there were two clicks and each click costs \$25, Verizon must pay a total of \$50 to Google.

If we consider how much Verizon paid to Google on average, per user, or equivalently how much Verizon paid per display of the ad, we just divide the total amount of \$50 for the 10 users who saw the ad.

Doing this, we see that the average price per display was \$5.

We could have obtained this amount in a simpler way.

In particular, as we defined in the previous slide, this turns out to be exactly the same as the price-per-click multiplied by the click-through-rate.

For our data then, to obtain the average price per display we simply need to multiply the price-per-click table and the click-through-rate tables together.

The last piece of data that we need before we can define our problem is we need to know how popular the queries are.

Obviously, Google does not control how many times a search query will be searched because the users are the ones who submit the queries.

However, Google does have an estimate of the number of times, on average, the query will be requested over a

given day.

For the example that we have been building so far, let's suppose that we expect to see "4G LTE" 140 times, "largest LTE" 80 times, and "best LTE network" 80 times, as well.

We're now ready to start modeling this problem.

The problem that we will consider is this.

How many times should Google display each ad for each query, so as to maximize their total revenue?

In the next video, we will formulate this as a linear optimization problem.