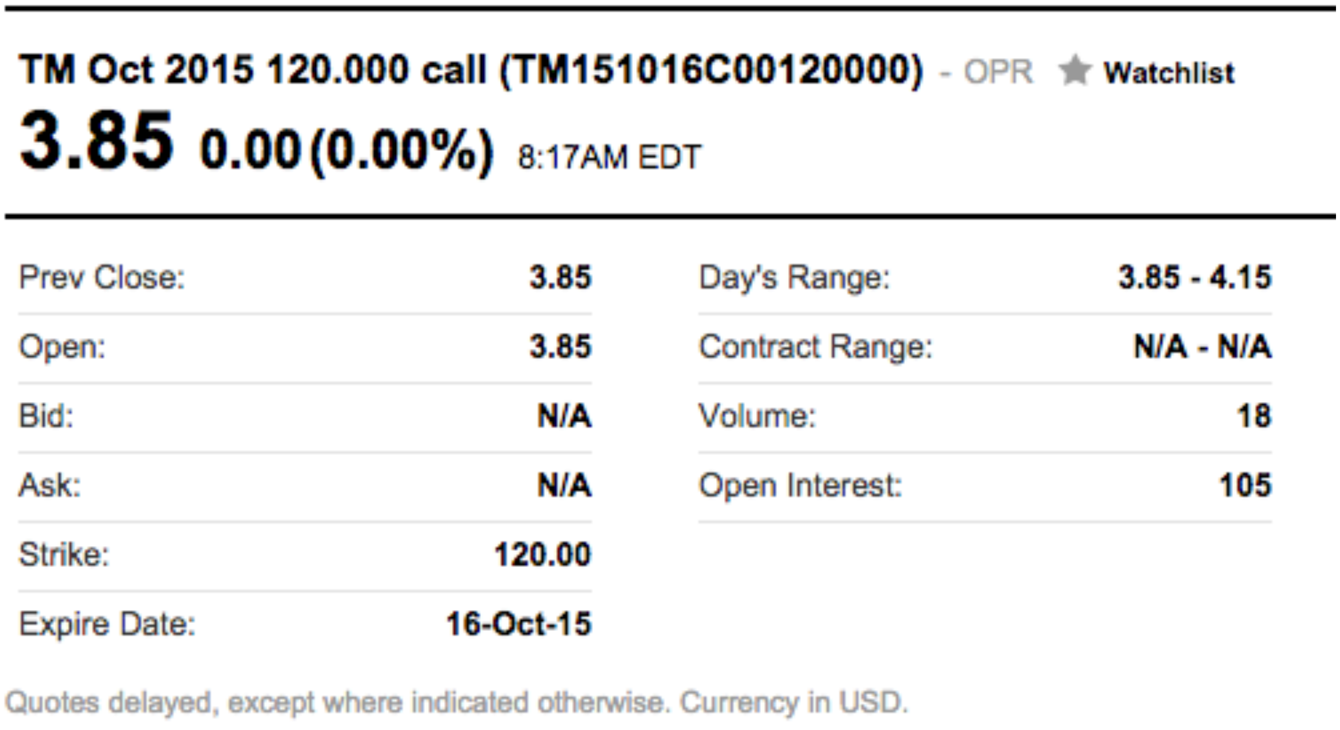
An example

Take a look at a specific call option for Toyota (TM):



TM Oct 2015 120.000 call (TM151016C00120000) - OPR ★ Watchlist

3.85 0.00 (0.00%) 8:17AM EDT

Prev Close:	3.85	Day's Range:	3.85 - 4.15
Open:	3.85	Contract Range:	N/A - N/A
Bid:	N/A	Volume:	18
Ask:	N/A	Open Interest:	105
Strike:	120.00		
Expire Date:	16-Oct-15		

Quotes delayed, except where indicated otherwise. Currency in USD.

https://finance.yahoo.com/q?s=TM151016C00120000 (https://finance.yahoo.com/q?s=TM151016C00120000)

How do we read this option box? (http://www.investopedia.com/university/options/option4.asp). It lists the *strike* price of $\$120.00$ and an expiration date of 16 October 2015. It looks like the value is around $\$3.85$ which is a good target for our simulation.

What else do we need to know? *Volatility* is missing here and can be challenging to predict. For now, we'll assume we know the the volatility for this option is 25%.

We also need the *current stock price*. At the moment it's around $\$122.00$

Toyota Motor Corporation (TM) - NYSE ★ **Watchlist**   Add to Portfolio   Like 135

122.00 ↑2.04(1.70%) Sep 16, 4:04PM EDT

Prev Close:	**119.96**	Day's Range:	**121.54 - 122.33**
Open:	**121.81**	52wk Range:	**108.40 - 145.80**
Bid:	**120.32 x 100**	Volume:	**439,615**
Ask:	**122.46 x 100**	Avg Vol (3m):	**354,368**
1y Target Est:	**149.97**	Market Cap:	**191.98B**
Beta:	**0.554096**	P/E (ttm):	**10.40**
Next Earnings Date:	**N/A**	EPS (ttm):	**11.73**
		Div & Yield:	**4.02 (3.44%)**

Quotes delayed, except where indicated otherwise. Currency in USD.

http://finance.yahoo.com/q?s=TM&fr=uh3_finance_web&uhb=uhb2 (http://finance.yahoo.com/q?s=TM&fr=uh3_finance_web&uhb=uhb2)

How do we approximate the interest rate? The US LIBOR rate (http://www.homefinance.nl/english/international-interest-rates/libor/libor-interest-rates-usd.asp) appears to be about 0.21% for a two-week rate.

We're going to make teh asset pricing a bit simpler. Recall the geometric Brownian motion:

$$S_T = S_t e^{(r-\frac{\sigma^2}{2})(T-t)+\sigma\sqrt{T-t}\epsilon}$$

```
def generate_brownian_asset_price(S, sigma, r, T):
    """
    S     : current stock
    sigma : volatility
    r     : rate
    T     : time
    """
    ret = S * np.exp((r - 0.5 * sigma**2) * T + sigma * np.sqrt(T) * np.random.randn(
))
```

Try this to see if we're close on the asset price

```
import datetime
S = 122.00
sigma = 0.25
r = 0.0021
T = (datetime.dat(2015,10,16) - datetime.date(2015,9,17)).days / 365.0
```

What does the our Browniand asset pricer give us?

Next, we'll calculating the call payout (from C_T previously). Recall that it's worth either $S_T - K$ or 0:

```
def call_payout(S_T, K):
    """
    S_T : asset price (prediction) at time T
    K   : strike price
    """
    return max(0, S_T - K)
```

Here we're not use the the *array-aware* version.

What is the payoff for your asset price (above) with the strike price?