MFE 409; Risk HW7

Aliaksei Kanstantsinau

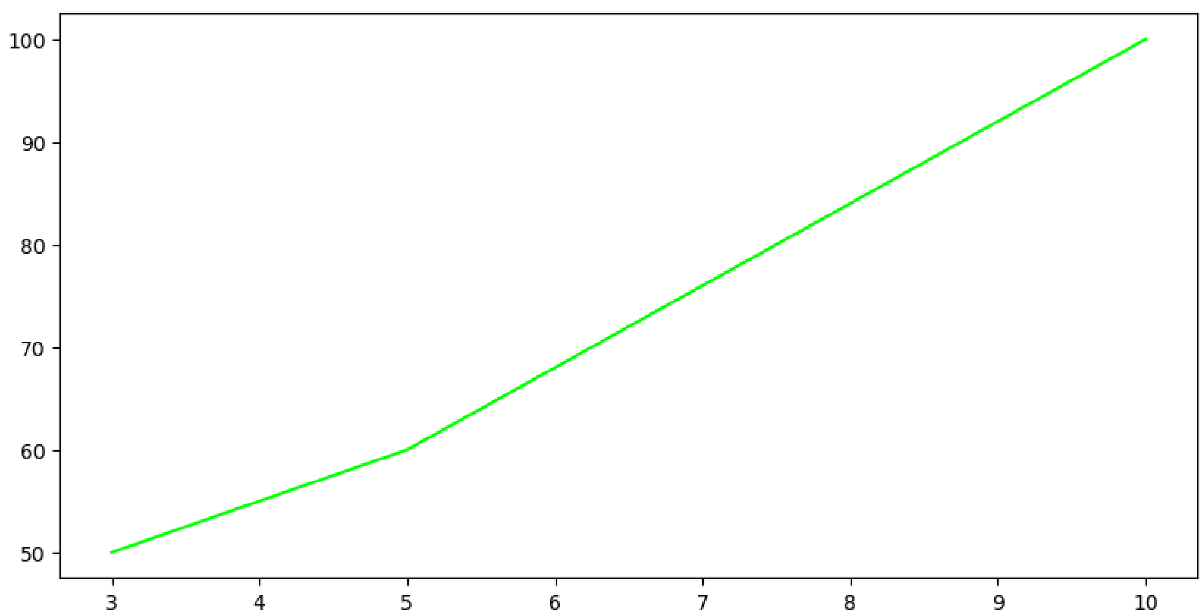
In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

Problem 1.

(a) Recover the hazard rate curve from the slide “Bootstrapping Default Probabilities from CDS” (slide 17) of the notes. $$CDS Spread(T) = (1 – R)\frac{\int_{T}^{0}\lambda(\tau)e^{-\int_{0}^{\tau}r(u) + \lambda(u)du}d\tau}{\int_{T}^{0}e^{-\int_{0}^{\tau}r(u) + \lambda(u)du}d\tau}$$

(b) Use this hazard rate curve to price a 6-year bond on the same company which pays 2% coupon every 6 month and has face value $100.

In [4]:
```
# plot slide values
maturities = [3, 5, 10]
cds_spreads = [50, 60, 100]
plt.figure(figsize=(10,5))
plt.plot(maturities, cds_spreads, color='lime')
plt.show()
```



In [5]:
```
# interpolate to get 6
maturity = 6
spread_estimate = np.interp(maturity, maturities, cds_spreads)
print(spread_estimate)
```

```
68.0
```

In [6]:
```
# set bond parameters: face value, coupon, years to maturity, spread, risk-f
fv = 100
c = 0.02
yearstm = 6
cds_spread = 68
rf = 0
```

In [8]:
```
total_periods = yearstm * 2
# cds in semiannual decimal
cds_spread = (cds_spread / 10000) / 2
# semiannual rf
semiannual_rf = rf / 2
# semiannual discount rate
semiannual_dr = semiannual_rf + cds_spread
# semiannual coupon
semiannual_c = fv * c
# coupons pv
c_pv = sum([semiannual_c / (1 + semiannual_dr)**t for t in range(1, total_pe
# fv pv
fv_pv = fv / (1 + semiannual_dr)**total_periods
# get bond price
bond_price = c_pv + fv_pv
print(bond_price)
```

```
119.48666491517415
```

Problem 2.

Explain the patterns you see in the table on the slide “Comparing Hazard Rates” (slide 19) of the notes.

- It is clear that as bond rating goes down, historical hazard rate and hazard rate from bonds increases. As far as the ratio goes, it makes sense that lower the bond rating is more likely it is to default, therefore hazard rate ratio gets closer to 1.

In [ ]:
```

```