3_3

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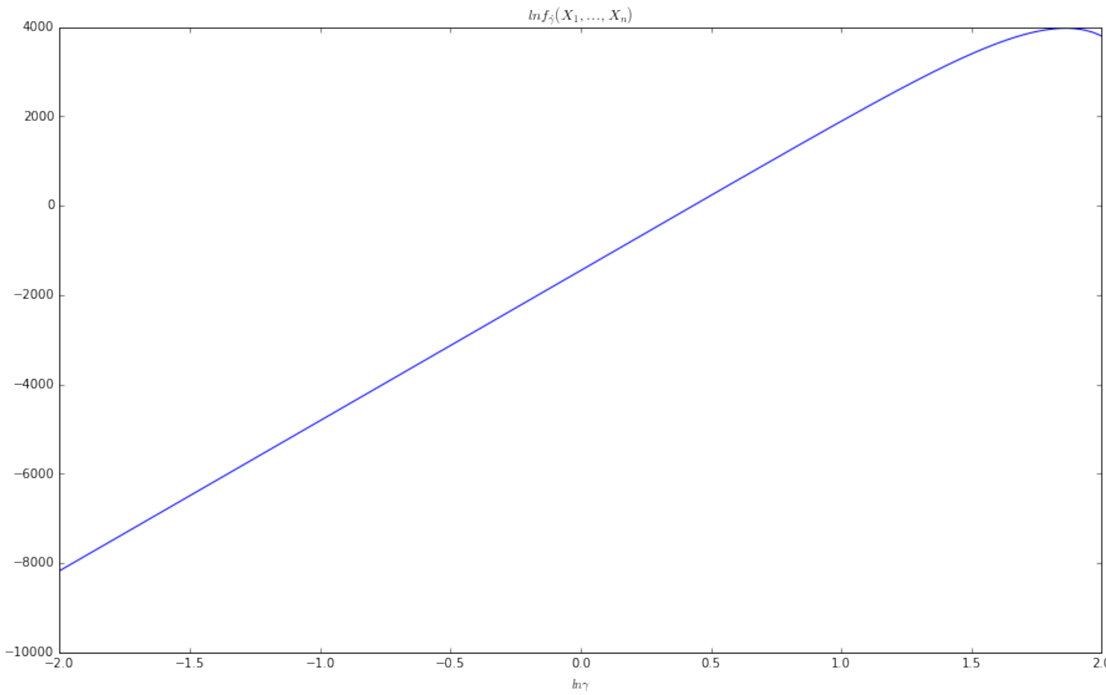
```
In [3]: __author__ = 'Security'
        import numpy as np
        import scipy.stats as stats
        %matplotlib inline
        import matplotlib.pyplot as plt
```

```
In [4]: grid = np.arange(-2, 2, 0.001)
        weibullSample = [float(line.rstrip('\n')) for line in open('Weibull.txt', 'r')]
```

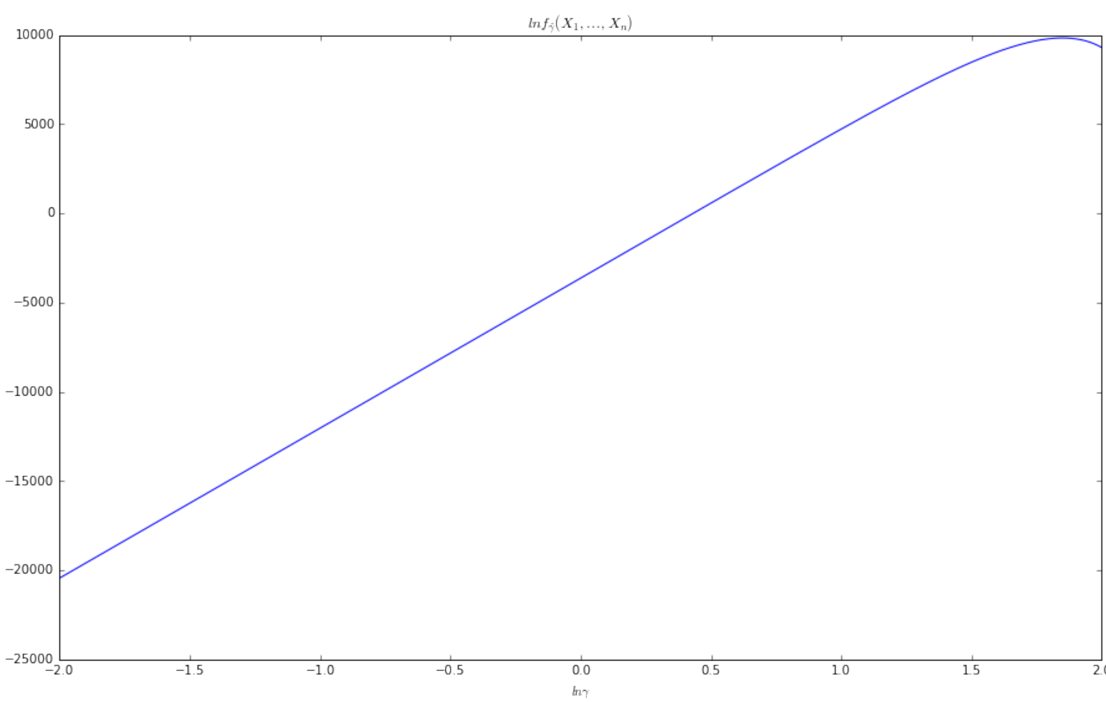
Поскольку функция распределения $F(x) = 1 - e^{-x^{\gamma}}$, то дифференцируя получим плотность распределения: $p(x) = \gamma x^{\gamma-1} e^{-x^{\gamma}}$. Тогда $lnf_{\hat{\gamma}}(X_1, \ldots, X_n) = \sum_{i=1}^{n}((\gamma-1)lnX_i - X_i^{\gamma} + ln\gamma)$

```
In [5]: def likelihoodLogFunction(gamma, sample):
            return np.sum([(gamma - 1) * np.log(x) - x**(gamma) + np.log(gamma) for x in sample])


        def likelihoodFunctionValues(sample, grid):
            return [likelihoodLogFunction(10**gamma, sample) for gamma in grid]


        def estimationForWeibullSample(sample, grid):
            return grid[np.argmax(likelihoodFunctionValues(sample, grid))]
```

```
In [6]: for sample in [weibullSample[:4 * 365], weibullSample]:
            plt.figure(figsize=(15, 9))
            plt.title(r'$lnf_{\hat{\gamma}}(X_{1}, \ldots, X_{n})$')
            plt.xlabel(r'$ln\gamma$')
            plt.plot(grid, likelihoodFunctionValues(sample, grid))
            plt.show()
            print('Estimation for first {:} years = {:}'.format(len(sample) // 365, estimationForWeibul
```



Estimation for first 4 years = 1.8609999999995748



Estimation for first 10 years = 1.848999999999576

Таким образом, оценка $\gamma = 1.8609999999995748$ за первые 4 года, и 1.848999999999576, если оценивать по данным за 10 лет

```
In [ ]:
```