cheg304 homework4 question3

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PUBLISHED
February 28, 2025

The pdf for our exponential random variable is

$$f(x) = \frac{1}{\beta}\exp\left(\frac{-x}{\beta}\right)$$

so the statement that there's a 60% chance that there are more than 30 days between tornado warnings looks like this in math

$$\int_{30}^{\infty} f(x)\,dx = 0.60$$

and this integral may be used to get our value of β

$$\begin{aligned}
\int_{30}^{\infty} f(x)\,dx &= \int_{30}^{\infty} \frac{1}{\beta}\exp\left(\frac{-x}{\beta}\right)dx \\
&= \left[-\exp\left(\frac{-x}{\beta}\right)\right]_{30}^{\infty} \\
&= \left[\exp\left(\frac{-x}{\beta}\right)\right]_{\infty}^{30} \\
&= \exp\left(\frac{-30}{\beta}\right) \\
0.60 &= \exp\left(\frac{-30}{\beta}\right) \\
\ln(0.60) &= \frac{-30}{\beta} \\
\beta &= \frac{-30}{\ln(0.60)}
\end{aligned}$$

as per our textbook, β is the expected value of this distribution.

```
import numpy as np
beta = -30 / np.log(.60)
print(f'beta: {beta:.2f}')
```

```
beta: 58.73
```

now since β is our expected number of days between events, if we just convert β into years and evaluate $\frac{1}{\beta}$ our result will have the units of events per year

```
beta /= 365
inv_beta = 1/beta
print(f'expected events per year: {inv_beta:.2f}')
```

```
expected events per year: 6.22
```