Determine n, such that:
$\hat{F}(n) = .542$

1. Determine $\hat{H}(n)$
   a. Determine surrenders
   b. Determine risk sets

2. Set $\hat{F}(n)$ in terms of $\hat{H}(n)$

3. Set $\hat{F}(n) = .542$ and Solve for n.

Study on 100 policies

Year	Surrendered	riskset	Surrender / riskset
1	1	100	$\frac{1}{100}$
2	2	100	$\frac{2}{100}$
3	3	100	$\frac{3}{100}$
⋮	⋮	⋮	⋮
n	n	100	$\frac{n}{100}$

$$\hat{H}(n) = \sum_{i=1}^{n} \left(\frac{\text{Surrendered in year } i}{\text{riskset in year } i}\right)$$

$$= \frac{1}{100} + \frac{2}{100} + \frac{3}{100} + \cdots + \frac{n}{100}$$

$$= \frac{1}{100}(1 + 2 + 3 + \cdots + n)$$

Fact: $1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$

$$= \frac{1}{100}\left(\frac{n(n+1)}{2}\right)$$

$$= \frac{n(n+1)}{200}$$

$$\hat{H}(n) = \frac{n(n+1)}{200}$$

$\hat{F}(n) = 1 - \hat{S}(n)$ $\quad \hat{S}(n) = e^{-\hat{H}(n)}$

$$\hat{F}(n) = 1 - e^{-\hat{H}(n)}$$

$$.542 = 1 - e^{-\frac{n(n+1)}{200}}$$

$$e^{-\frac{n(n+1)}{200}} = .458$$

$$-\frac{n(n+1)}{200} = -.780886$$

$$n(n+1) = 156.1772189$$

$$n^2 + n - 156.1772189$$

Using Quadratic Formula:

$$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$n = -13.007$ or 12.0

$n = -13$ or 12

$n = 12$