

# Example of Poisson Distribution-Wars by Year

- Number of wars beginning by year for years 1482-1939. Table of Frequency counts and proportions (458 years):

<i>wars</i>	<i>Frequency</i>	Proportion
0	242	0.5284
1	148	0.3231
2	49	0.1070
3	15	0.0328
4	4	0.0087
More	0	0

- Total Wars:  $0(242) + 1(148) + 2(49) + 3(15) + 4(4) = 307$
- Average Wars per year:  $307 \text{ wars} / 458 \text{ years} = 0.67 \text{ wars/year}$

# Using Poisson Distribution as Approximation

- Since mean of empirical (observed) distribution is 0.67, use that as mean for Poisson distribution (that is, set  $\mu = 0.67$ )

$$- p(0) = (e^{-\mu} \mu^0)/0! = e^{-0.67} = 0.5117$$

$$- p(1) = (e^{-\mu} \mu^1)/1! = e^{-0.67}(0.67) = 0.3428$$

$$- p(2) = (e^{-\mu} \mu^2)/2! = e^{-0.67}(0.67)^2/2 = 0.1149$$

$$- p(3) = (e^{-\mu} \mu^3)/3! = e^{-0.67}(0.67)^3/6 = 0.0257$$

$$- p(4) = (e^{-\mu} \mu^4)/4! = e^{-0.67}(0.67)^4/24 = 0.0043$$

$$- P(x \geq 5) = 1 - P(x \leq 4) =$$

$$1 - .5117 - .3428 - .1149 - .0257 - .0043 = 0.0006$$

# Comparison of Observed and Model Probabilities

<i>wars</i>	<i>Frequency</i>	Proportion	Model
0	242	0.5284	0.5117
1	148	0.3231	0.3428
2	49	0.1070	0.1149
3	15	0.0328	0.0257
4	4	0.0087	0.0043
More	0	0	0.0006

The model provides a good fit to the observed data.

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