Discrete Probability Distributions

Uniform Discrete Distribution

German Tank Problem

Discrete Probability Distributions

Poisson Distribution

Prussian Calvary Deaths by Horse Kicks

Ladislaus Bortikewicz was a statistician who was tasked with investigating the number of soldiers in the Prussian army accidentally killed by horse kicks.

Prussian hussars at the Battle of Leipzig, 1813

From the study of 14 corps over a 20-year period, he obtained the data shown.

24 Zweites Kapitel. § 12.

	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
G	—	2	2	1	—	—	1	1	—	3	—	2	1	—	—	1	—	1	—	1
I	—	—	—	2	—	3	—	2	—	—	—	1	1	1	—	2	—	3	1	—
II	—	—	—	2	—	2	—	—	1	1	—	—	2	1	1	—	—	2	—	—
III	—	—	—	1	1	1	2	—	2	—	—	—	1	—	1	2	1	—	—	—
IV	—	1	—	1	1	1	1	—	—	—	—	1	—	—	—	—	1	1	—	—
V	—	—	—	—	2	1	—	—	1	—	—	1	—	1	1	1	1	1	1	—
VI	—	—	1	—	2	—	—	1	2	—	1	1	3	1	1	1	—	3	—	—
VII	1	—	1	—	—	—	1	—	1	1	—	—	2	—	—	2	1	—	2	—
VIII	1	—	—	—	1	—	—	1	—	—	—	—	1	—	—	—	1	1	—	1
IX	—	—	—	—	—	2	1	1	1	—	2	1	1	—	1	2	—	1	—	—
X	—	—	1	1	—	1	—	2	—	2	—	—	—	—	2	1	3	—	1	1
XI	—	—	—	—	2	4	—	1	3	—	1	1	1	1	2	1	3	1	3	1
XIV	1	1	2	1	1	3	—	4	—	1	—	3	2	1	—	2	1	1	—	—
XV	—	1	—	—	—	—	—	1	—	1	1	—	—	—	2	2	—	—	—	—

Source: Ladislaus von Bortkiewicz, *Das Gesetz der kleinen Zahlen* [The law of small numbers] (Leipzig, Germany: B.G. Teubner, 1898).
4. Beispiel: Die durch Schlag eines Pferdes im preussischen Heere Getöteten.

Poisson Distribution:

Estimate the occurrence of a specified event that happens in a specified time or space

Events random and independent

Probability event occurs is constant

From the study of 14 corps over a 20-year period, he obtained the data shown.

24 Zweites Kapitel. § 12.

	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
G	—	2	2	1	—	—	1	1	—	3	—	2	1	—	—	1	—	1	—	1
I	—	—	—	2	—	3	—	2	—	—	—	1	1	1	—	2	—	3	1	—
II	—	—	—	2	—	2	—	—	1	1	—	—	2	1	1	—	—	2	—	—
III	—	—	—	1	1	1	2	—	2	—	—	—	1	—	1	2	1	—	—	—
IV	—	1	—	1	1	1	1	—	—	—	—	1	—	—	—	—	1	1	—	—
V	—	—	—	—	2	1	—	—	1	—	—	1	—	1	1	1	1	1	1	—
VI	—	—	1	—	2	—	—	1	2	—	1	1	3	1	1	1	—	3	—	—
VII	1	—	1	—	—	—	1	—	1	1	—	—	2	—	—	2	1	—	2	—
VIII	1	—	—	—	1	—	—	1	—	—	—	—	1	—	—	—	1	1	—	1
IX	—	—	—	—	—	2	1	1	1	—	2	1	1	—	1	2	—	1	—	—
X	—	—	1	1	—	1	—	2	—	2	—	—	—	—	2	1	3	—	1	1
XI	—	—	—	—	2	4	—	1	3	—	1	1	1	1	2	1	3	1	3	1
XIV	1	1	2	1	1	3	—	4	—	1	—	3	2	1	—	2	1	1	—	—
XV	—	1	—	—	—	—	—	1	—	1	1	—	—	—	2	2	—	—	—	—

Source: Ladislaus von Bortkiewicz, *Das Gesetz der kleinen Zahlen* [The law of small numbers] (Leipzig, Germany: B.G. Teubner, 1898).
4. Beispiel: Die durch Schlag eines Pferdes im preussischen Heere Getöteten.

X = Number of deaths	Number of corps with X deaths in a given year	Number of soldier deaths
0	144	0
1	91	91
2	32	64
3	11	33
4	2	8
5	0	0

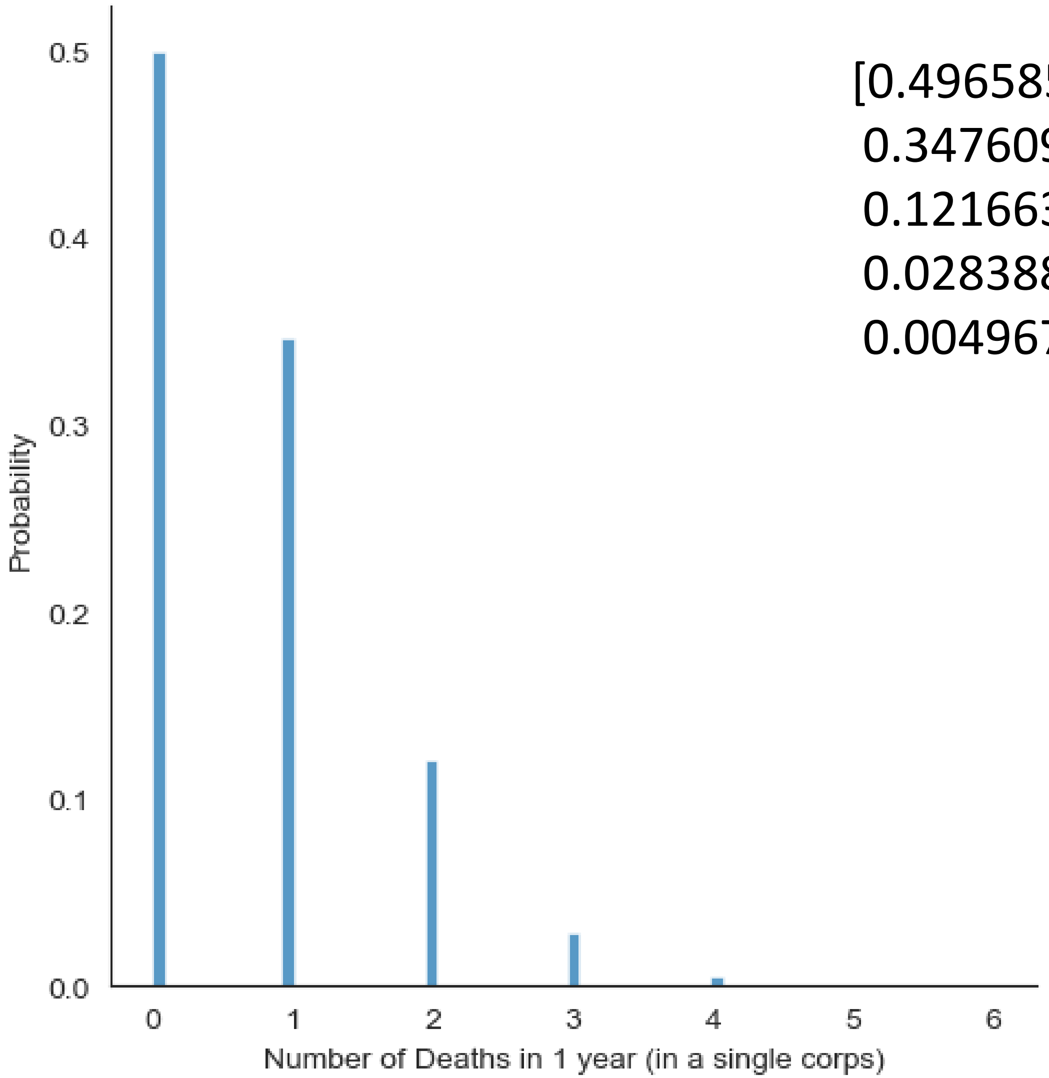
Total # of soldier deaths = 196

Number of observations (sum of number of corprs with X deaths in a year or 20 years *14 corps) = 280

Rate (lamda=deaths/observations) = 0.70

X~Poisson(0.70)

Probability predicted from a Poisson Distribution



[0.4965853
0.34760971
0.1216634
0.02838813
0.00496792]

X~Poisson(0.70)

X = Number of deaths	Number of corps with X deathsin given year predicted: P(X=k)*280	Actual Number of corps with X deaths in a given year
0	139.04	144
1	97.33	91
2	34.07	64
3	7.95	33
4	1.39	8