B: Poisson Distribution, Estimates

Why is this a Poisson distribution?

- Independent events (unless there's a gang)
- Bikes occupy physical space, two bikes cannot pass the same spot in the same instant
- Has a ratio of expected number of events per time unit

Calculating Lambda

$$\hat{\lambda} = \frac{X}{t}$$

```
lambda = 78 / 30
```

```
lambda = 2.6000
```

$$Var(X) = \lambda t$$

```
variance = lambda * 30
```

```
variance = 78
```

```
%variance = total;
```

$$\hat{\sigma} = \sqrt{Var(X)} = \sqrt{\lambda t}$$

```
standard_deviation = sqrt(variance)
```

```
standard_deviation = 8.8318
```

$$\hat{\mu} = \hat{\lambda} \cdot t = \frac{X}{t} \cdot t = X$$

```
forventning = 78
```

```
forventning = 78
```

$$P(X = x) = \frac{(\lambda t)^x}{x!} e^{-\lambda t}$$

$$P(X > \mu + \sigma) = 1 - P(X \leq \mu + \sigma)$$

```
P = @(x) exp(-78)*78^x / factorial(x)
```

```
P = function_handle with value:
    @(x)exp(-78)*78^x/factorial(x)
```

```
standard_deviation + forventning
```

```
ans = 86.8318
```

```
limit = round(forventning + standard_deviation, 0, "decimals")
```

```
limit = 87
```

```
p = 1;
for i=0:limit - 1
    p = p - P(i);
end
sprintf('The probability is %f', p)
```

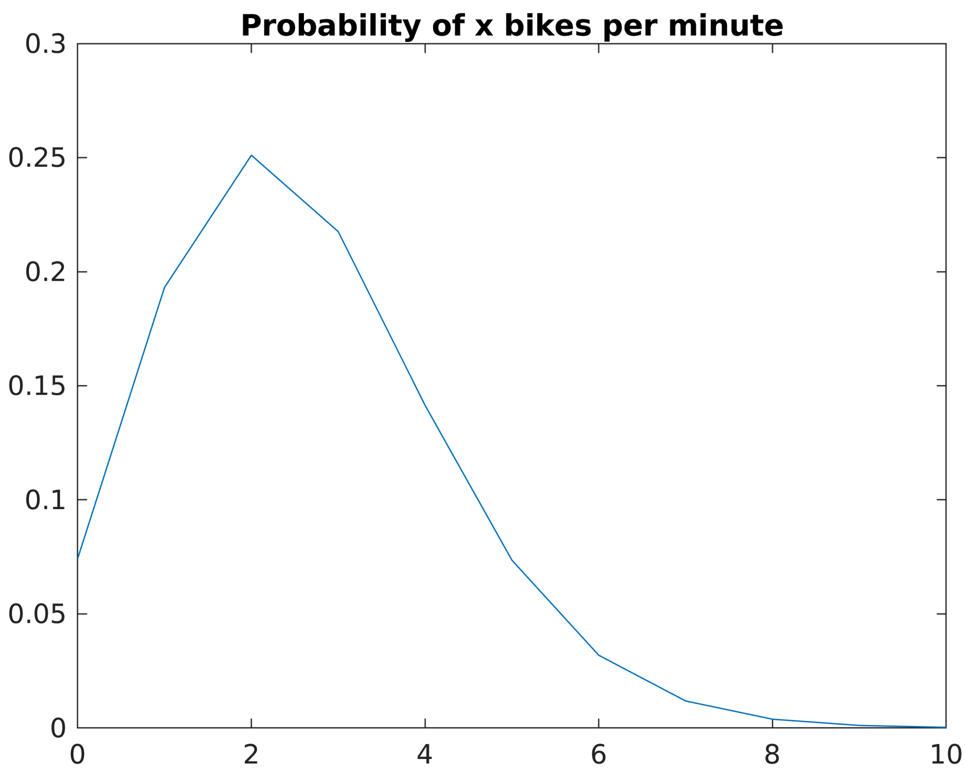
```
ans =
'The probability is 0.167454'
```

Graphs

With t = 1 minute

– lower reliability

```
x = 0:10;
plot(x, poisspdf(x,lambda))
title('Probability of x bikes per minute')
```



With t = 30 minutes

– which matches the circumstances of our original data

$\hat{\lambda} \cdot t = \frac{x}{t} \cdot t = x$

```
x = 50:110;
plot(x, poisspdf(x,78))
```

```
title('Probability of x bikes per 30 minutes')
```