

# 1 Poisson Approximation of the Binomial

- The Poisson distribution can sometimes be used to approximate the binomial distribution
- When the number of observations  $n$  is large, and the success probability  $p$  is small, the  $\text{Bin}(n, p)$  distribution approaches the Poisson distribution with the parameter given by  $m = np$ .
- This is useful since the computations involved in calculating binomial probabilities are greatly reduced.
- As a rule of thumb,  $n$  should be greater than 50 with  $p$  very small, such that  $np$  should be less than 5.
- If the value of  $p$  is very high, the definition of what constitutes a “success” or “failure” can be switched.

## 1.1 Poisson

- $M=15$  (1/2 hour or 30 minutes)
- 5 minute period  $m=2.5$
- $X$  : No of arrivals
- $P(X=0)$  when  $M = 2.5$

$$\begin{aligned}P(X = 0) &= 1 - P(X \geq 1)(\text{Complement}) \\&= 1 - 0.9179 \\&= 0.0821\end{aligned}$$