(Some) famous named distributions

1. Bernoulli(p), $\qquad p \in [0,1]$
   Discrete distribution with support $\{0,1\}$. PMF:
   $$P(X=1)=p, \qquad P(X=0)=1-p.$$
   Common uses: indicator random variables, coin flips, outcome of a trial (success/failure)

2. Binomial(n,p), $\qquad n \geq 1,\ p \in [0,1]$
   Discrete distribution with support $\{0,1,\ldots,n\}$. PMF:
   $$P(X=k)=\binom{n}{k}p^k(1-p)^{n-k}$$
   Common uses: some of n iid Bernoulli(p) distributed random variables, number of successes among n iid trials with success probability p

3. Geometric(p), $\qquad p \in (0,1]$
   Discrete distribution with support $\{1,\ldots\}$. PMF:
   $$P(X=k)=p(1-p)^{k-1}.$$
   ($p=0$ could be included with the PMF $P(X=\infty)=1$.)
   Common uses: position of first success among and iid sequence of trials with success probability p

4. Negative binomial(r,p), $\qquad r \geq 1,\ p \in (0,1]$ Discrete distribution with support $\{r,r+1,\ldots\}$. PMF:
   $$P(X=k)=\binom{k-1}{r-1}p^r(1-p)^{k-r}$$
   Common uses: position of rth success among and iid sequence of trials with success probability p

5. Poisson(λ), $\qquad \lambda > 0$
   Discrete distribution with support $\{0,1,\ldots\}$. PMF:
   $$P(X=k)=\frac{\lambda^k}{k!}e^{-\lambda}$$
   Common uses: modeling rare events (soon: limit in distribution of binomials)

6. Uniform$[a,b]$, $\qquad a<b$ Absolutely continuous distribution with support $[a,b[$. PDF
   $$f(x)=\frac{1}{b-a}\mathbb{1}(x\in[a,b]).$$
   uniformly chosen number from the interval $[a,b]$

7. Exponential(λ), $\quad \lambda > 0$
   Absolutely continuous distribution with support $[0, \infty)$. PDF
   $$f(x) = \lambda e^{-\lambda x} \mathbb{1}(x > 0).$$
   Common uses: modeling random time lengths (later: limit in distribution of geometric)

8. Gamma(a, λ) distribution $\quad a, \lambda > 0$
   Absolutely continuous distribution with support $[0, \infty)$. PDF
   $$f(x) = e^{-\lambda x} \lambda^a \Gamma(a)^{-1} \mathbb{1}(x > 0).$$
   A generalization of exponential distribution (limit in distribution of negative binomial)

9. Cauchy distribution
   Absolutely continuous distribution with support $\mathbb{R}$. PDF
   $$f(x) = \frac{1}{\pi(1 + x^2)}$$
   Tangent of a uniformly chosen angle on $[0, 2\pi]$.

10. Normal or gaussian distribution $\mathcal{N}(\mu, \sigma^2)$ $\quad \mu \in \mathbb{R}$, $\sigma > 0$
    Absolutely continuous distribution with support $\mathbb{R}$. PDF
    $$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(\frac{1}{2\sigma^2}(x - \mu)^2\right)$$
    (Soon!) Shows up as the universal limit in distribution from iid sums (Central Limit Theorem)