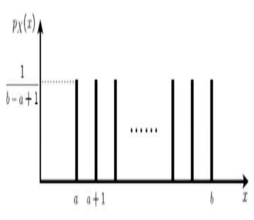
Distribution Cheat Sheet

DISCRETE UNIFORM DISTRIBUTION: U{a,b}or unif{a,b}

Domain/Sample space:
$x \in \{a, a+1, \dots, b\}$

Parameters:
a,b$\in \mathbb{Z}$ *with* $b \geq a$ *or* $\boldsymbol{n = b - a + 1}$

Graph:



PMF:
$P[X = x] = \frac{1}{b-a+1}$ *or* $\frac{1}{n}$ *where* $n = b - a + 1$

CDF:
$$F[X] = \begin{cases} 0 & for\ x < a \\ \frac{x-a+1}{b-a+1}\ or\ \frac{x-a+1}{n} & for\ a \leq x < b \\ 1 & for\ x \geq b \end{cases}$$

Mean E[X]:
$E[X] = \frac{a+b}{2}$

Variance V[X]:
$V[X] = \frac{(b-a+1)^2 - 1}{12}$ *or* $\frac{(n^2-1)}{12}$ *where* $n = b - a + 1$

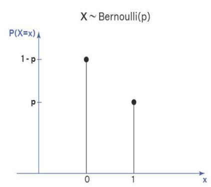
MGF(Moment Generating Function):
$M_X(t) = \frac{e^{at} - e^{(b+1)t}}{n(1-e^t)}$

BERNOLLI DISTRIBUTION: Ber{p}
e.g:Tossing a coin once

Domain/Sample space:
X:Occurence of success
$x \in \{0,1\}$

Parameters:
$\boldsymbol{0 \leq p \leq 1}$

Graph:



PMF:
$$P[X = x] = \begin{cases} q = 1 - p & if\ x = 0 \\ p & if\ x = 1 \end{cases}$$
DIFFERENT FORMS:
$f(x,p) = p^x * (1-p)^{1-x}$
$f(x,p) = px + (1-p)(1-x)$

CDF:
$$F[X] = \begin{cases} 0 & if\ x < 0 \\ q = 1 - p & if\ 0 \leq x < 1 \\ 1 & if\ x = 1 \end{cases}$$

Mean E[X]:
$E[X] = p$

Variance V[X]:
$V[X] = p(1-p)$

MGF(Moment Generating Function):
$M_X(t) = q + pe^t$

Higher Moments and Cumulants:
$E[X^k] = p$
$E\left[\left(X - E(X)\right)^k\right] = \mu_k = (1-p)(-p)^k + p(1-p)^k$
where $k \in \mathbb{N}$

Relation with other distributions:
If $X_1, X_2, \dots, X_n \sim Bernolli(p)\ then, \sum_{i=1}^n X_i \sim B(n,p)$

Transformations:
- If $X_1, X_2, \dots, X_n \sim Bernoulli(p)\ then, \sum_{i=1}^n X_i \sim B(n,p)$
- If $X_1 \sim Bernoulli(p)\ then, X_1 + a \sim Bernoulli(p)$
  here the vlaues of X_1 *changes from* $0,1$ *to* $a, a+1$ *where*
  $P[X_1 = a] = 1 - p$ *and* $P[X_1 = a + 1] = p$

MLE:

$L_n(x_1, x_2, \dots, x_n, p) = p^{\sum_{i=1}^n X_i} (1-p)^{n - \sum_{i=1}^n X_i}$
$\widehat{p_{MLE}} = \sum_{i=1}^{n} X_i / n$

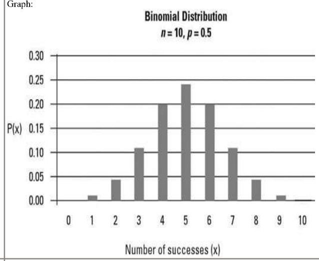
Confidence Interval:
$\hat{p} = \overline{X_n}$
- Conservative bound
  $\left[\hat{p} - \frac{q_{\frac{\alpha}{2}}}{2\sqrt{n}}, \hat{p} + \frac{q_{\frac{\alpha}{2}}}{2\sqrt{n}}\right]$
- Plug in
  $\left[\hat{p} - \frac{q_{\frac{\alpha}{2}}\sqrt{\hat{p}(1-\hat{p})}}{\sqrt{n}}, \hat{p} + \frac{q_{\frac{\alpha}{2}}\sqrt{\hat{p}(1-\hat{p})}}{\sqrt{n}}\right]$

BINOMIAL DISTRIBUTION:B(n,p)
e.g:Tossing a coin n number of times

Domain/Sample space:
X:No of success
$x \in \{0, 1, \dots n\}$

Parameters:
n$\in \{0,1,\dots,\}$,p$\in [0,1]$

Graph:



PMF:
$P[X = x] = \binom{n}{x} p^x (1-p)^n - x$
or
$P[X = x] = \binom{n}{x} p^x q^n - x$
where $q = 1 - p$

Mean E[X]:
$E[X] = np$

Variance V[X]:
$V[X] = np(1-p) = npq$

MGF(Moment Generating Function):
$M_X(t) = (q + pe^t)^n$

Relation with other distributions:
- When n=1 the binomial distribution is Bernoulli distribution with parameter p i.e: X~B(1,p) is just X~Bernolli(p)
- As n approaches to ∞ and p remains fixed the distribution of X~B(n,p) turns to normal distribution i.e.
  $\frac{X - np}{\sqrt{np(1-p)}} \overset{n \to \infty}{\sim} N(0,1)$
- As n approaches to ∞ and p approaches to 0 with the product np held fixed the binomial distribution is Poisson distribution with parameter $\lambda = np$ i.e:
  X~B(n,p) $\underset{np = \lambda}{\overset{n \to \infty,\ p \to 0}{\sim}}$ $Pois(\lambda)$

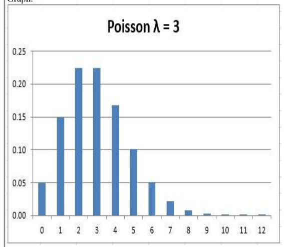
Transformations:
If X~B(n,p) and Y ~B(m,p) are independent binomial variables with same probability p then X+Y~B(n+m,p)

POISSON DISTRIBUTION:Pois(λ)
e.g:A meteorite hitting the earth (rare events)

Domain/Sample space:
$x \in \{0, 1, \dots\}$*(natural numbers starting from zero)*

Parameters:
$\lambda \in (0, \infty)$

Graph:



PMF:
$P[X = x] = \frac{\lambda^x e^{-\lambda}}{x!}$

Mean E[X]:
$E[X] = \lambda$

Variance V[X]:
$V[X] = \lambda$

MGF(Moment Generating Function):
$M_X(t) = e^{\lambda(e^t - 1)}$

Relation with other distributions:
- X~B(n,p) $\underset{np = \lambda}{\overset{n \to \infty,\ p \to 0}{\sim}}$ $Pois(\lambda)$
  The Poisson distribution is limiting case to Binomial distribution as $n \to \infty, p \to 0$ *and* np *is constant*
- If $X_1, X_2, \dots, X_n$ are independent Poisson r.v. with paramters $\lambda_1, \lambda_2, \dots, \lambda_n$ *then given* $\sum_{j=1}^n X_j = k$
  ,it follows that
  $X_i | \sum_{j=1}^{n} X_j = k \sim B(n = k, p = \frac{\lambda_i}{\sum_{j=1}^n \lambda_j})$
- For sufficiently large values of λ
  X~Pois(λ) $\overset{\lambda \to \infty}{\sim}$ $N(\lambda, \lambda)$

Transformations:
If forX_i~Poi(λ_i) i=1,2,..n are independent then $\sum_{i=1}^n X_i$~Poi($\sum_{i=1}^n \lambda_i$)

MLE:

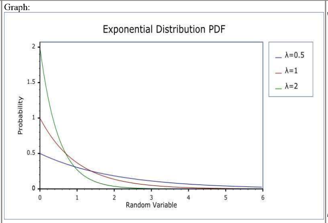
$L_n(x_1, x_2, \dots, x_n, \lambda) = \lambda^{\sum_{i=1}^n X_i} e^{-n\lambda} / \prod_{i=1}^{n} x_i!$
$\widehat{\lambda_{MLE}} = \sum_{i=1}^{n} X_i / n$

EXPONENTIAL DISTRIBUTION:Exp(λ)
e.g:Interarrival time between customers

Domain/Sample space:
X:Interarrival time (Most common example)
$x \in [0, \infty)$

Parameters:
$\lambda > 0$

Graph:



PDF:
$f(x) = \lambda e^{-\lambda x}$

CDF:
$$F[X] = \begin{cases} 0 & for\ x < 0 \\ 1 - e^{-\lambda x} & for\ x \in [0, \infty) \end{cases}$$

Mean E[X]:
$E[X] = \frac{1}{\lambda}$

Variance V[X]:
$V[X] = \frac{1}{\lambda^2}$

MGF(Moment Generating Function):
$M_X(t) = \frac{\lambda}{\lambda - t}$

Higher Moments and Cumulants:
$E[X^k] = \frac{k!}{\lambda^k}$ *where* $k \in \mathbb{N}$

Relation with other distributions:
- If $\lambda = \frac{1}{2}$ *then* $X \sim \chi_2^2$ i.e. X has chi square with 2 degrees of freedom.

Transformations:
Sum of independent exponential r.v. is not exponential r.v.

MLE:

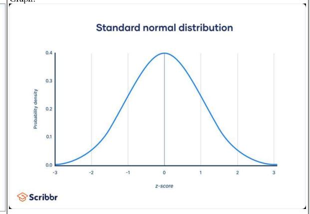
$L_n(x_1, x_2, \dots, x_n, \lambda) = \lambda^n e^{-\lambda \sum_{i=1}^n x_i}$
$\widehat{\lambda_{MLE}} = n / \sum_{i=1}^{n} X_i$

NORMAL DISTRIBUTION:N(μ, σ^2)

Domain/Sample space:
$x \in \mathbb{R}$

Parameters:
$\mu \in \mathbb{R}, \sigma^2 > 0$

Graph:



PDF:
$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$

CDF:
$\Phi(z) = P[Z \leq z] = P[-Z \geq -z] = 1 - \Phi(-z)$
$\Phi(1.644854) = 0.95$
$\Phi(1.959964) = 0.975$
$\Phi(1.281552) = 0.90$

Mean E[X]:
$E[X] = \mu$

Variance V[X]:
$V[X] = \sigma^2$

MGF(Moment Generating Function):
$M_X(t) = e^{\left(\mu t + \frac{\sigma^2 t^2}{2}\right)}$

Higher Moments and Cumulants:
$$E[(X-\mu)^k] = \begin{cases} 0\ if\ k\ is\ odd \\ \sigma^2(p-1)!!\ in\ k\ is\ even \\ \\ up\ here\ the\ !!\ stands\ for \\ double\ factorial \end{cases}$$
where $k \in \mathbb{N}$

Relation with other distributions:
- The binomial distribution B(n,p) is approximately normal with mean np and variance np(1-p) for large n and for p not too close to 0 or 1.
- The Poisson distribution with parameterλ is approximately normal with mean λ and varianceλ,for large values of λ.
- The chi-squared distribution $\chi^2(k)$is approximately normal with mean k and variance 2k , for large k.
- The Student's t-distribution t(v) is approximately normal with mean 0 and variance 1 when v is large.

Transformations:
If forX_i~N(μ_i, σ_i^2) i=1,2,..n are independent then $\sum_{i=1}^n X_i$~N($\sum_{i=1}^n \mu_i, \sum_{i=1}^n \sigma_i^2$)
If forX_i~N(μ, σ^2) i=1,2,..n are independent then $\sum_{i=1}^n X_i$~N($n\mu, n\sigma^2$)
If forX_i~N(μ, σ^2) i=1,2,..n are independent then $\sum_{i=1}^n \frac{X_i}{n} = \bar{X}$~N($\mu, \sigma^2/n$)

MLE:
$L_n(x_1, x_2, \dots, x_n, \mu, \sigma^2) = \frac{1}{(\sigma\sqrt{2\pi})^n} e^{\frac{\sum_{i=1}^n -(x-\mu)^2}{2\sigma^2}}$
$\widehat{\mu_{MLE}} = \sum_{i=1}^{n} X_i / n$
$\widehat{\sigma^2_{MLE}} = \sum_{i=1}^{n} (X_i - \bar{X})^2 / n$

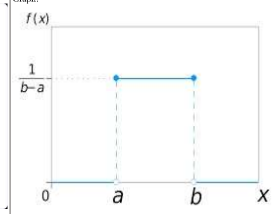
Confidence Interval for mean μ:
$\hat{\mu} = \overline{X_n}$
- Plug in(asymtoically):
  $\left[\hat{\mu} - \frac{q_{\frac{\alpha}{2}} * \sigma}{\sqrt{n}}, \hat{\mu} + \frac{q_{\frac{\alpha}{2}} * \sigma}{\sqrt{n}}\right]$

UNIFORM DISTRIBUTION:U[a,b]

Domain/Sample space:
$x \in [a, b]$

Parameters:
a,b$\in \mathbb{R}, b > a$

Graph:



PDF:
$f(x) = \frac{1}{b-a}$

CDF:
$$F[X] = \begin{cases} 0 & for\ x < a \\ \frac{x-a}{b-a} & for\ a \leq x < b \\ 1 & for\ x \geq b \end{cases}$$

Mean E[X]:
$E[X] = \frac{a+b}{2}$

Variance V[X]:
$V[X] = \frac{(b-a)^2}{12}$

MGF(Moment Generating Function):
$M_X(t) = \frac{e^{bt} - e^{at}}{t(b-a)}$

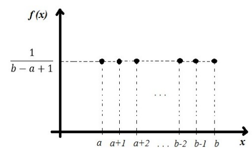
Higher Moments and Cumulants:
$E[X^k] = \frac{b^{k+1} - a^{k+1}}{(k+1)(b-a)}$ *where* $k \in \mathbb{N}$

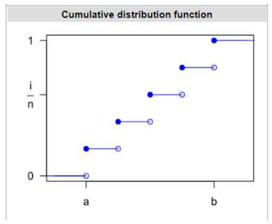
MLE:
$\boldsymbol{X_i \sim U(0, b)\ then}$:
$L_n(x_1, x_2, \dots, x_n, \boldsymbol{b}) = \frac{1}{b^n} \prod_{i=1}^{n} (\max(x_i \leq b))$
$\widehat{b_{MLE}} = X_{(n)}$*where* $X_{(n)}$ *is the nth order statistic*

Uniform Distribution(Discrete and Continous):

- **Discrete Uniform Distribution:**

Notation	U{a,b} or unif{a,b}
Sample space/Domain	$x \in \{a, a+1, \ldots, b\}$
Paramters	**a,b**$\in \mathbb{Z}$ $with\ b \ge a$
PDF	$P[X=x] = \frac{1}{b-a+1}$ or $\frac{1}{n}$ $where\ n = b-a+1$
CDF	$F[X] = \begin{cases} 0 & for\ x < a \\ \frac{x-a+1}{b-a+1}\ or\ \frac{x-a+1}{n} & for\ a \le x < b \\ 1 & for\ x \ge b \end{cases}$
Mean E[X]	$E[X] = \frac{a+b}{2}$
Variance V[X]	$V[X] = \frac{(b-a+1)^2-1}{12}$ or $\frac{(n^2-1)}{12}$ $where\ n = b-a+1$
MGF $M_X(t)$	$M_X(t) = \frac{e^{at}-e^{(b+1)t}}{n(1-e^t)}$





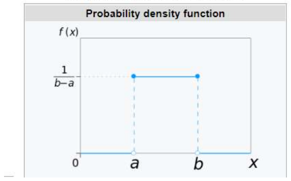
Using R to generate Discrete Uniform Distribution:(Rpackages needed:purrr,extraDistr)

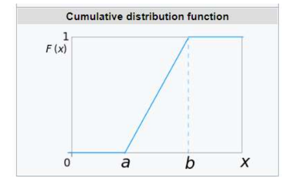
To generate a r.v. following Discrete Uniform Distribution use:	**rdunif(n**=no. of data points you wanna generate,**min**=a,**max**=b) Eg:Generate 1000 data points from unif{1,12} Code:rdunif(n=1000,min=1,max=12)
Finding Probability at certain point:	**ddunif(x**=point for which you want to calculate the probability,**min**=a,**max**=b) Eg:Calculate probability of x=2 when x follows unif{1,12}i.e. $P[X=2]$ Code:ddunif(x=2,min=1,max=12)
Finding CDF at certain point:	**pdunif(q**=point for which you want to calculate the cumulative probability,**min**=a,**max**=b) Eg:Calculate CDF at x=2 when x follows unif{1,12}i.e. $P[X \le 2]$ Code:pdunif(q=2,min=1,max=12)
Finding Quantiles for specific probabilities:	**qdunif(p**=probaility,**min**=a,**max**=b) Eg:Calculate the point at which p=0.1667 when x follows unif{1,12} *Rember the qdunif will return the value of small x for which* $P[X < x] = 0.1667$. Code:qdunif(p=0.1666667,min=1,max=12)

- **Uniform Distribution:**

Notation	U[a,b]
Sample space/Domain	$x \in [a, b]$
PDF	$f(x) = \frac{1}{b-a}$
CDF	$F[X] = \begin{cases} 0 & for\ x < a \\ \frac{x-a}{b-a} & for\ a \le x < b \\ 1 & for\ x \ge b \end{cases}$
Mean E[X]	$E[X] = \frac{a+b}{2}$
Variance V[X]	$V[X] = \frac{(b-a)^2}{12}$
MGF $M_X(t)$	$M_X(t) = \frac{e^{bt}-e^{at}}{t(b-a)}$
MLE	$\boldsymbol{X_i \sim U(0,b)}$ ***then*** **:** $L_n(x_1, x_2, \ldots, x_n, \boldsymbol{b}) = \frac{1}{b^n}\prod_{i=1}^{n}(\max(x_i \le b))$ $\widehat{b_{MLE}} = X_{(n)}$ $where\ X_{(n)}\ is\ the\ nth\ order\ statistic$

Continuous uniform distribution with parameters a and b





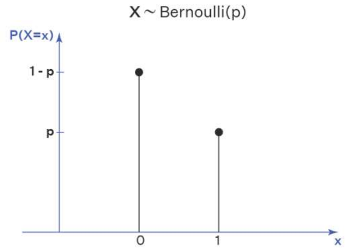
Using R to generate Discrete Uniform Distribution:

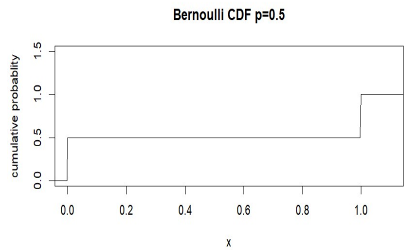
To generate a r.v. following Discrete Uniform Distribution use:	**runif(n**=no. of data points you wanna generate,**min**=a,**max**=b) Eg:Generate 1000 data points from unif[1,12] Code:runif(n=1000,min=1,max=12)
Finding Probability at certain point:	**dunif(x**=point for which you want to calculate the probability,**min**=a,**max**=b) Eg:Calculate probability of x=1 when x follows unif[1,12]i.e. $f(x=1)$ Code:dunif(x=1,min=1,max=12)
Finding CDF at certain point:	**punif(q**=point for which you want to calculate the cumulative probability,**min**=a,**max**=b) Eg:Calculate CDF at x=2 when x follows unif{1,12}i.e. $f[X \le 2]$ Code:punif(x=2,min=1,max=12)
Finding Quantiles for specific probabilities:	**qunif(p**=probaility,**min**=a,**max**=b) Eg:Calculate the point at which p=0.09090909 when x follows unif[1,12] Code:qunif(p=0.09090909,min=1,max=12)

Bernolli & Binomial Distribution:

- **Bernolli Distribution:**

Notation	Ber{p}
Sample space/Domain	$x \in \{0,1\}$
Parameter	$\mathbf{0 \leq p \leq 1}$
PDF	$P[X = x]$ $= \begin{cases} q = 1 - p & if\ x = 0 \\ p & if\ x = 1 \end{cases}$ **DIFFERENT FORMS:** $f(x,p) = p^x * (1-p)^{1-x}$ $f(x,p) = px + (1-p)(1-x)$
CDF	$F[X] = \begin{cases} 0 & if\ x < 0 \\ q = 1 - p & if\ 0 \leq x < 1 \\ 1 & if\ x = 1 \end{cases}$
Mean E[X]	$E[X] = p$
Variance V[X]	$V[X] = p(1-p)$
MGF	$M_X(t) = q + pe^t$
MLE	$L_n(x_1, x_2, .., x_n, p) =) = p^{\sum_{i=1}^n X_i}(1-p)^{n-\sum_{i=1}^n X_i}$ $\widehat{p_{MLE}} = \sum_{i=1}^{n} X_i /n$
Confidence Interval	$\hat{p} = \overline{X_n}$ • Conservative bound $\left[\hat{p} - \frac{q_{\frac{\alpha}{2}}}{2\sqrt{n}}, \hat{p} + \frac{q_{\frac{\alpha}{2}}}{2\sqrt{n}}\right]$ • Plug in $\left[\hat{p} - \frac{q_{\frac{\alpha}{2}}\sqrt{\hat{p}(1-\hat{p})}}{\sqrt{n}}, \hat{p} + \frac{q_{\frac{\alpha}{2}}\sqrt{\hat{p}(1-\hat{p})}}{\sqrt{n}}\right]$

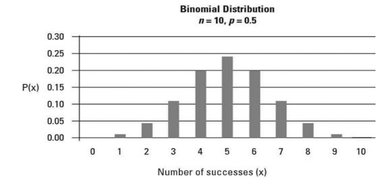


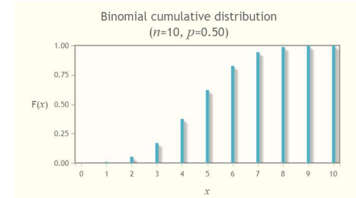


Using R to generate r.v. following bernolli Distribution:
Use the same codes as Binomial just put size=1

- **Binomial Distribution:**

Notation	B(n,p)
Sample space/Domain	$x \in \{0, 1, .. n\}$
Parameter	**n**$\in \{0,1,..,\}$,**p**$\in [0,1]$
PDF	$P[X = x] = \binom{n}{x} p^x (1-p)^n - x$ or $P[X = x] = \binom{n}{x} p^x q^n - x$ $where\ q = 1 - p$
Mean E[X]	$E[X] = np$
Variance V[X]	$V[X] = np(1-p) = npq$
MGF	$M_X(t) = (q + pe^t)^n$





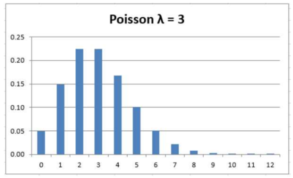
Using R to generate r.v. following bernolli Distribution:

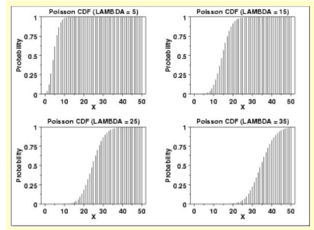
To generate a r.v. following Discrete Uniform Distribution use:	**rbinom(n**=no. of data points you wanna generate,**size**=no. of trails(n),**prob**=p) Eg:Generate 1000 data points from B(2,0.6) Code:rbinom(n=1000,size=2,prob=0.6)
Finding Probability at certain point:	**dbinom(x**=point for which you want to calculate the probability,**size**=no. of trails(n),**prob**=p) Eg:Calculate probability of x=2 when x follows B(2,0.6)i.e. $P[X = 2]$ Code:dbinom(x=1,size=2,prob=0.6)
Finding CDF at certain point:	**pbinom(q**=point for which you want to calculate the cumulative probability,**size**=no. of trails(n),**prob**=p) Eg:Calculate CDF at x=2 when x follows B(2,0.6)i.e. $P[X \leq 1]$ Code:pbinom(q=2,size=2,prob=0.6)
Finding Quantiles for specific probabilities:	**qbinom(p**=probaility,**size**=no. of trails(n),**prob**=p) Eg:Calculate the point at which cumulative probability=1 when x follows Bern(2,0.6). Code:qbinom(p=1,size=2,prob=0.6)

Poisson and Exponential Distribution

- **Poisson distribution Distribution:**

Notation	$\text{Pois}(\lambda)$
Sample space/Domain	$x \in \{0, 1, \ldots\}$
Parameter	$\lambda \in (0, \infty)$
PDF	$P[X = x] = \dfrac{\lambda^x e^{-\lambda}}{x!}$
Mean E[X]	$E[X] = \lambda$
Variance V[X]	$V[X] = \lambda$
MGF	$M_X(t) = e^{\lambda(e^t - 1)}$



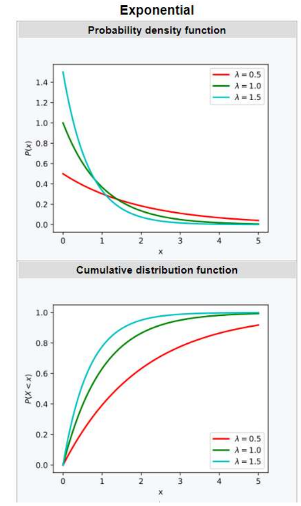


Using R to generate r.v. following bernolli Distribution:

To generate a r.v. following Discrete Uniform Distribution use:	**rpois(n**=no. of data points you wanna generate,**lambda=**λ**)** Eg:Generate 1000 data points from Pois(λ =1) Code:rpois(n=1000,lambda=1)
Finding Probability at certain point:	**dpois(x**=point for which you want to calculate the probability,**lambda=**λ**)** Eg:Calculate probability of x=2 when x follows Pois(λ =1) i.e. $P[X = 2]$ Code:dpois(x=2,lambda=1)
Finding CDF at certain point:	**ppois(q**=point for which you want to calculate the cumulative probability,**lambda=**λ) Eg:Calculate CDF at x=1 when x follows Pois(λ =1) i.e. $P[X \leq 1]$ Code:ppois(q=1,lambda=1)
Finding Quantiles for specific probabilities:	**qpois(p=**probaility,**lambda=**λ**)** Eg:Calculate the point at which cumulative probability=1 when x follows Pois(λ = 1) Code:qpois(p=0.9196986,lambda=1)

- **Exponential Distribution:**

Notation	$\text{Exp}(\lambda)$
Sample space/Domain	$x \in [0, \infty)$
Parameter	$\lambda > 0$
PDF	$f(x) = \lambda e^{-\lambda x}$
CDF	$F[X] = \begin{cases} 0 & \text{for } x < 0 \\ 1 - e^{-\lambda x} & \text{for } x \in [0, \infty) \end{cases}$
Mean E[X]	$E[X] = \dfrac{1}{\lambda}$
Variance V[X]	$V[X] = \dfrac{1}{\lambda^2}$
MGF	$M_X(t) = \dfrac{\lambda}{\lambda - t}$



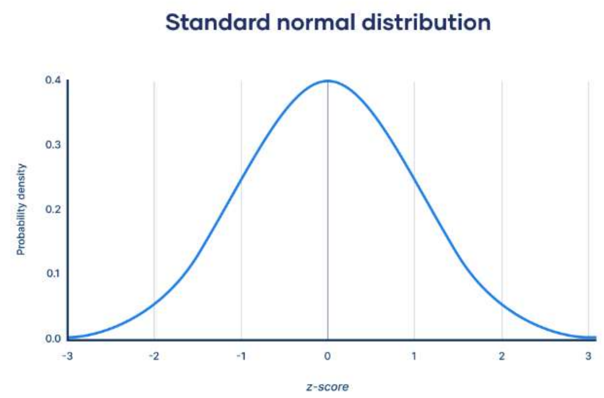
Using R to generate r.v. following bernolli Distribution:
Remember rate here is lambda(e.g:rate= customers per minutes)

To generate a r.v. following Discrete Uniform Distribution use:	**rexp(n**=no. of data points you wanna generate,**rate=**λ**)** Eg:Generate 1000 data points from Pois(λ =1) Code:rexp(n=1000,rate=1)
Finding Probability at certain point:	**dexp(x**=point for which you want to calculate the probability,**rate=**λ**)** Eg:Calculate probability of x=2 when x follows Pois(λ =1) i.e. $P[X = 2]$ Code:dexp(x=2,rate=1)
Finding CDF at certain point:	**pexp(q**=point for which you want to calculate the cumulative probability,**rate=**λ) Eg:Calculate CDF at x=1 when x follows Pois(λ =1) i.e. $P[X \leq 1]$ Code:pexp(q=1,rate=1
Finding Quantiles for specific probabilities:	**qexp(p=**probaility,**rate=**λ**)** Eg:Calculate the point at which cumulative probability=1 when x follows Pois(λ = 1) Code:qexp(p=0.9196986,rate=1)

Normal Distribution

- **Binomial Distribution:**

Notation	$N(\mu, \sigma^2)$
Sample space/Domain	$x \in \mathbb{R}$
Parameter	$\mu \in \mathbb{R}, \sigma^2 > 0$
PDF	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$
Mean E[X]	$E[X] = \mu$
Variance V[X]	$V[X] = \sigma^2$
MGF	$M_X(t) = e^{\left(\mu t + \frac{\sigma^2 t^2}{2}\right)}$
MLE:	$L_n(x_1, x_2, \ldots, x_n, \mu, \sigma^2) = \frac{1}{(\sigma\sqrt{2\pi})^n} e^{\frac{\sum_{i=1}^{n} -(x-\mu)^2}{2\sigma^2}}$



Using R to generate r.v. following bernolli Distribution:

To generate a r.v. following Discrete Uniform Distribution use:	**rnorm(n**=no. of data points you wanna generate,**mean=**μ **,sd=**σ**)** Eg:Generate 1000 data points from N(0,1) Code:rnorm(n=1000,mean=0,sd=1)
Finding Probability at certain point:	**dnorm(x**=point for which you want to calculate the probability,**mean=**μ **,sd=**σ**)** Eg:Calculate probability of x=0 when x follows N(0,1)i.e. $f[x = 0]$ Code:dnorm(x=0,mean=0,sd=1)
Finding CDF at certain point:	**pnorm(q**=point for which you want to calculate the probability,**mean=**μ **,sd=**σ**)** Eg:Calculate CDF at x=0 when x follows N(0,1)i.e. $P[X \le 0]$ Code:pnorm(q=0,mean=0,sd=1)
Finding Quantiles for specific probabilities:	**qnorm(p=**probaility**,mean=**μ **,sd=**σ**)** Eg:Calculate the point at which cumulative probability=0.5 when x follows N(0,1) Code:qnorm(p=0.5,mean=0,sd=1)