ST2334
R commands to find probabilities and quantiles for some common distributions
Reference: http://127.0.0.1:31680/library/stats/html/Distributions.html
This document is for students who want to use R to find probabilities and quantiles

X ~ Binomial(n,p), where x is the number of successes, n is the number of trials and p is the probability of a success.
To find Pr(X <= x), R command: pbinom(x,n,p,lower=T)
Example: To find Pr(X <= 5) with n=10 and p=0.4, 'pbinom(5,10,0.4,lower=T)' gives 0.8337614 .

To find Pr(X = x), R command: dbinom(x,n,p)
Example: To find Pr(X = 5) with n=10 and p=0.4, 'dbinom(5,10,0.4)' gives 0.2006581 .

To find Pr(X > x), R command: pbinom(x,n,p,lower=F)
Example: To find Pr(X > 5) with n=10 and p=0.4, 'pbinom(5,10,0.4,lower=F)' gives 0.1662386 .

To find x such that Pr(X <= x) = a, R command: qbinom(a,n,p,lower=T), where n is the number of trials and p is the probability of a success.
Example: Find x such that x satisfies Pr(X <= x) >= 0.05. 'qbinom(0.05,10,0.4,lower=T)' gives 2 which means that Pr(X <= 2 ) >= 0.05.
Note: Since Binomial is a discrete distribution, we could not find an x-value such that Pr(X <= x) = 0.05.
x=2 is the smallest value for x such that Pr(X <= 2) is at least 5%
That is, Pr(X <= 2 ) = 0.1672898 and Pr(X <= 1 ) = 0.0463574 .

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X ~ Negative Binomial(k,p), where X is the number of trials, k is the number of successes and p is the probability of a success
To find Pr(X <= x), R command: pnbinom(x-k,k,p,lower=T), where x-k and k are the number of failures and the number of successes in x trials respectively.
Example: To find Pr(X <= 6) with k=4 and p=0.55, 'pnbinom(2,4,0.55)' gives 0.4415177 .

To find Pr(X = x), R command: dnbinom(x-k,k,p),where x-k = number of failures in x trials.
Example: To find Pr(X = 6) with k=4 and p=0.55, 'dnbinom(2,4,0.55)' gives 0.1853002

To find Pr(X>x), R commands: pnbinom(x-k,k,p,lower=F), where x-k = number of failures in x trials.
Example: To find Pr(X > 6) with k=4 and p=0.55, 'pnbinom(2,4,p,lower=F)' gives 0.5584823 .

To find x such that Pr(X <= x)=a, R command: qnbinom(a,k,p,lower=T), where a = probability, k = number of successes, p = probability of a success
Example: To find x such that Pr(X <= x) = 0.25 with k=4 and p=0.55,
'qnbinom(0.25,4,0.55,lower=T)' gives 1 which means that Pr(X <= 1 + 4 ) = Pr(X <= 5 ) >= 0.25
Note: Since Negative Binomial is a discrete distribution, we could not find an x-value such that Pr(X <= x) = 0.25.
x = 5 is the smallest value for x such that Pr(X <= x) is at least 0.25
That is, Pr(X <= 5 ) = 0.2562175 and Pr(X <= 4 ) = 0.09150625 .

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X ~ Poisson(lambda), where X is the number of successes, lambda is the mean, E(X).
To find Pr(X <= x), R command: ppois(x,lambda,lower=T), where x = number of successes, lambda is the mean and lower=T gives the lower tail probability
Example: To find Pr(X <= 6) with lambda=8, 'ppois(6,8)' gives 0.3133743

To find Pr(X = x), R command: dpois(x,lambda), where x = number of successes and lambda is the mean
Example: To find Pr(X = 6) with lambda=8, 'dpois(6,8)' gives 0.1221382

To find Pr(X > x), R commands: ppois(x,lambda,lower=F), where x = number of successes and lambda is the mean
Example: To find Pr(X > 6) with lambda=8, 'ppois(6,8,lower=F)' gives 0.6866257

To find x such that Pr(X <= x) = a, R command: qpois(a,lambda,lower=T), where a = probability, x = number of successes, lambda = E(X)
Example: To find x such that Pr(X <= x) = 0.25 with lambda=8, ' qpois(0.25,8,lower=T)' gives 6 which means that Pr(X <= 6 ) >= 0.25
Note: Since Poisson is a discrete distribution, we could not find an x-value such that Pr(X <= x) = 0.25.
x = 6 is the smallest value for x such that Pr(X <= x) is at least 0.25 .
That is, Pr(X <= 6 ) = 0.3133743 and Pr(X <= 5 ) = 0.1912361 .

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X ~ Exponential(alpha), where X is the time to occur, alpha = 1/mean = 1/E(X).
To find Pr(X <= x), R command: pexp(x,alpha,lower=T), where X is the time to occur, alpha = 1/mean and lower=T gives the lower tail probability
Example: To find Pr(X <= 8) with alpha = 1/5 or mean = 5, 'pexp(8,1/5)' gives 0.7981035

To find the pdf f_X(x), R command: dexp(x,alpha), where X is the time to occur and alpha = 1/mean.
Example: To find the pdf f_X(8) with alpha = 1/5 or mean = 5, 'dexp(8,1/5)' gives 0.0403793

To find Pr(X > x), R commands: 1-pexp(x,alpha,lower=F), where x = the time to occur and alpha = 1/mean
Example: To find Pr(X > 8) with alpha = 1/5 or mean = 5, 'pexp(8,1/5,lower=F)' gives 0.2018965

To find x such that Pr(X <= x) = a, R command: qexp(a,alpha,lower=T), where a = probability, x = the time to occur and alpha = 1/mean
Example: To find x such that Pr(X <= x) = 0.05 with alpha = 1/5 or mean = 5, 'qexp(0.05,1/5,lower=T)' gives 0.2564665 which means that Pr(X <= 0.2564665 ) = 0.05

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X ~ Normal(mu,sigma^2), where mu=E(X), sigma^2=Var(X).
To find Pr(X <= x), R command: pnonrm(x,mu,sigma,lower=T), where E(X)=mu, Var(X)=sigma^2.
Example: To find Pr(X <= 45) with mu=50 and sigma=10, 'pnorm(45,50,10,lower=T)' gives 0.3085375

To find the pdf f_X(x), R command: dnorm(x,mu,sigma),where X ~ N(mu,sigma^2).
Example: To find the pdf f_X(45) with mu=50 and sigma=10, 'dnorm(45,50,10)' gives 0.03520653

To find Pr(X > x), R command: pnorm(x,mu,sigma,lower=F), where X ~ N(mu,sigma^2).
Example: To find Pr(X > 45) with mu=50 and sigma=10, 'pnorm(45,50,10,lower=F)' gives 0.6914625

To find x such that Pr(X <= x) = a, R command: qnorm(a,mu,sigma,lower=T), where a = probability, X ~ N(mu,sigma^2).
Example: To find x such that Pr(X <= x) = 0.05 with X ~ N(50,10^2).
'qnorm(0.05,50,10,lower=T)' gives 33.55146 which means that Pr(X <= 33.55146 ) = 0.05
Example: To find z_(0.05) such that Pr(Z >= z_(0.05)) = 0.05 with Z ~ N(0,1),
'qnorm(0.05,0,1,lower=F)' gives 1.644854 .

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X ~ t(v), where v is the degrees of freedom.
To find Pr(X <= x), R command: pt(x,v,lower=T), where v is the degrees of freedom.
Example: To find Pr(X <= 1.5) with v=10, 'pt(1.5,10,lower=T)' gives 0.9177463 .

To find the pdf f_X(x), R command: dt(x,v),where X ~ t(10).
Example: To find the pdf f_X(1.5) with v=10, 'dt(1.5,10)' gives 0.1274448 .

To find Pr(X>x), R commands: 1-pt(x,v,lower=T), where X ~ t(v).
Example: To find Pr(X > 1.5) with v=10, 'pt(1.5,10,lower=F)' gives 0.08225366 .

To find x such that Pr(X <= x) = a, R command: qt(a,v,lower=T), where a = probability, X ~ t(v).
Example: To find x such that Pr(X <= x) = 0.05 with X ~ t(10). 'qt(0.05,10,lower=T)' gives -1.812461 which means that Pr(X <= -1.812461 ) = 0.05.
Example: To find t_(0.05,10) such that Pr(T >= t_(0.05,10)) = 0.05 with T ~ t(10),
'qt(0.05,10,lower=F)' gives 1.812461 .

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X ~ chisq(v), where v is the degrees of freedom.
To find Pr(X <= x), R command: pchisq(x,v,lower=T), where v is the degrees of freedom.
Example: To find Pr(X <= 12) with v=10, 'pchisq(12,10,lower=T)' gives 0.7149435

To find the pdf f_X(x), R command: dchisq(x,v),where X ~ chisq(v).

Example: To find the pdf f_X(12) with v=10, 'dchisq(12,10)' gives 0.06692631

To find Pr(X > x), R commands: pchisq(x,v,lower=F), where X ~ chisq(v).
Example: To find Pr(X > 12) with v=10, 'pchisq(12,10,lower=F)' gives 0.2850565

To find x such that Pr(X <= x) = a, R command: qchisq(a,v,lower=T), where a = probability, X ~ chisq(v).
Example: To find x such that Pr(X <= x) = 0.05 with X ~ chisq(10). 'qchisq(0.05,10,lower=T)' gives 3.940299 which means that Pr(X <= 3.940299 ) = 0.05
Example: To find chisq_(0.05,10) such that Pr(W >= chisq_(0.05,10)) = 0.05 with W ~ chisq(10), 'qchisq(0.05,10,lower=F)' gives 18.30704 .

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X ~ F(v1,v2), where v1 and v2 are the degrees of freedom.
To find Pr(X <= x), R command: pf(x,v1,v2,lower=T), where v1 and v2 are the degrees of freedom.
Example: To find Pr(X <= 3) with v1=12, v2=10, 'pf(3,12,10,lower=T)' gives 0.9542993

To find the pdf f_X(x), R command: df(x,v1,v2),where X ~ F(12,10).
Example: To find the pdf f_X(3) with v1=12, v2=10, 'df(3,12,10)' gives 0.046852

To find Pr(X > x), R commands: pf(x,v1,v2,lower=F), where X ~ F(v1,v2).
Example: To find Pr(X > 3) with v1=12, v2=10, 'pf(3,12,10,lower=F)' gives 0.04570066

To find x such that Pr(X <= x) = a, R command: qf(a,v1,v2,lower=T), where a = probability, X ~ F(v1,v2).
Example: To find x such that Pr(X <= x) = 0.05 with X ~ F(12,10). 'qf(0.05,12,10,lower=T)' gives 0.3631891 which means that Pr(X <= 0.3631891 ) = 0.05
Example: To find f_(0.05,12,10) such that Pr(F >= f_(0.05,12,10)) = 0.05 with F ~ F(12,10), 'qf(0.05,12,10,lower=F)' gives 2.912977 .