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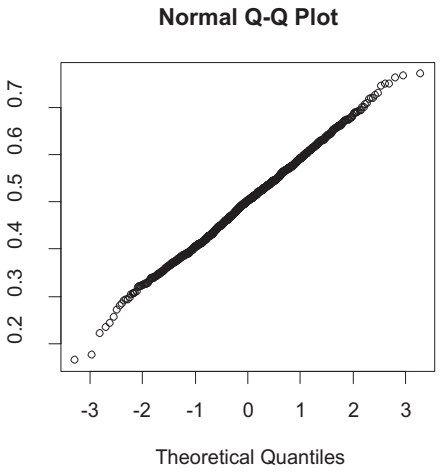
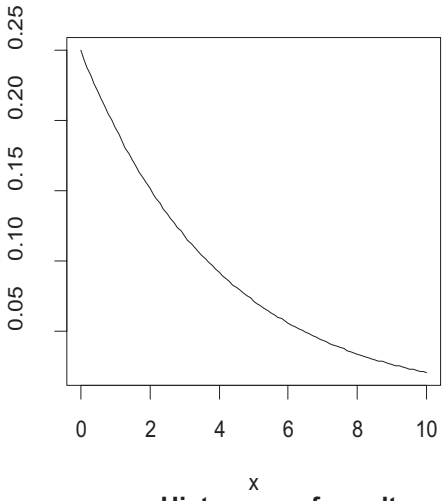
      Stat141 Oct20     Distribution of Sample Means: How do sample means behave?
> # sampling distributions of sample means
>  k=0:20     #Superior vison ex SW sec 5.2, n=20 pi=.3
> rbind(k,k/20, signif(dbinom(k,size=20,p=.3),3))
k 0.000000 1.00000 2.0000 3.0000 4.00 5.000 6.000 7.000 8.000 9.0000 10.0000
  0.000000 0.05000 0.1000 0.1500 0.20 0.250 0.300 0.350 0.400 0.4500  0.5000
  0.000798 0.00684 0.0278 0.0716 0.13 0.179 0.192 0.164 0.114 0.0654  0.0308
k 11.000 12.00000 13.00000 1.40e+01 1.50e+01 1.60e+01 1.70e+01 1.80e+01
   0.550  0.60000  0.65000 7.00e-01 7.50e-01 8.00e-01 8.50e-01 9.00e-01
   0.012  0.00386  0.00102 2.18e-04 3.74e-05 5.01e-06 5.05e-07 3.61e-08
> rbind(k,k/20, signif(dbinom(k,size=20,p=.3),4))
> pbinom(7,size=20,p=.3)- pbinom(4,s=20,p=.3)
[1] 0.534764
> # as n increases, sampling distribution narrows Table 5.5 p.155
> pbinom(14,size=40,p=.3)- pbinom(9,s=40,p=.3)
[1] 0.6115228
> pbinom(28,size=80,p=.3)- pbinom(19,s=80,p=.3)
[1] 0.7280909
> pbinom(140,size=400,p=.3)- pbinom(99,s=400,p=.3)
[1] 0.9748457

> #onto quantitative variables
> nlist = c(4,9,16,64)  #make table 5.6
> pnorm(550, 500, 120/sqrt(nlist[1])) - pnorm(450, 500, 120/sqrt(nlist[1]))
[1] 0.5953432
> pnorm(550, 500, 120/sqrt(nlist[2])) - pnorm(450, 500, 120/sqrt(nlist[2]))
[1] 0.7887005
> pnorm(550, 500, 120/sqrt(nlist[3])) - pnorm(450, 500, 120/sqrt(nlist[3]))
[1] 0.9044193
> pnorm(550, 500, 120/sqrt(nlist[4])) - pnorm(450, 500, 120/sqrt(nlist[4]))
[1] 0.9991419
*********** Demonstrations of CLT, Figures on back ************************
> result = c()        #Verzani p.167
> for(i in 1:100) {
+ result[i] = mean(runif(10)) }
> summary(result)                                    > sd(result) > sqrt(1/120)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.   [1] 0.08949  [1] 0.0912871
 0.2096  0.4375  0.4956  0.4961  0.5645  0.7417
> qqnorm(result)

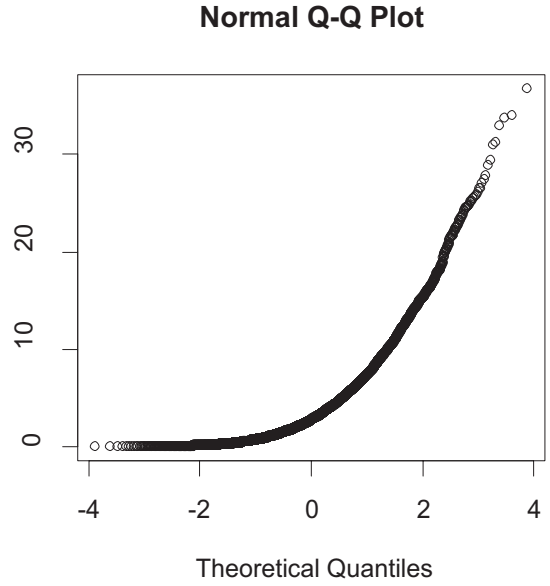
> # try strong skew, exp(1/4)
> curve(dexp(x,1/4), 0, 10)
> singlesampleexp = rexp(10000, 1/4)
> summary(singlesampleexp)
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
1.702e-04 1.138e+00 2.711e+00 3.994e+00 5.515e+00 3.675e+01
> qqnorm(singlesampleexp)
> result = c()
> for(i in 1:1000) {
+ result[i] = mean(rexp(40, 1/4)) }
> summary(result)                                     > sd(result)  > 4/sqrt(40)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    [1] 0.6304    [1] 0.63245
  2.217   3.536   3.974   3.996   4.388   6.380
> hist(result)
> qqnorm(result)
> result = c()
> for(i in 1:1000) {
+ result[i] = mean(rexp(160, 1/4)) }
> summary(result)                                       > sd(result)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.      [1] 0.32077
  3.065   3.758   3.971   3.975   4.168   5.210
> qqnorm(result)
```

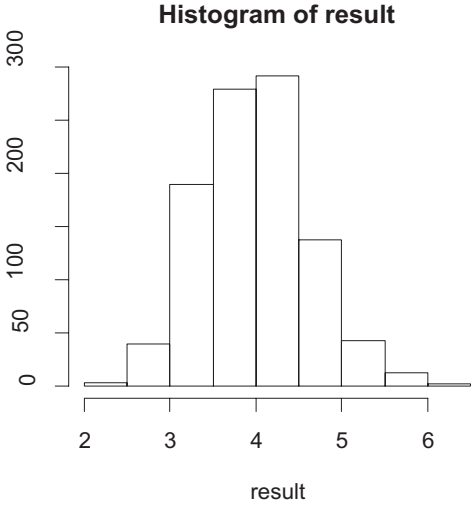


U[0,1] n=10

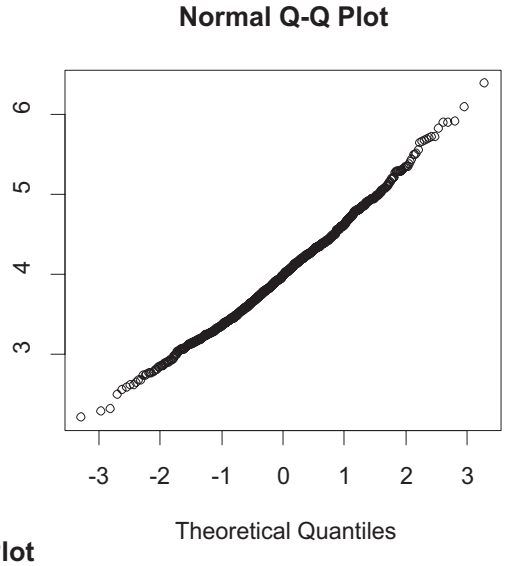


exp(1/4)





n=40



n=160