

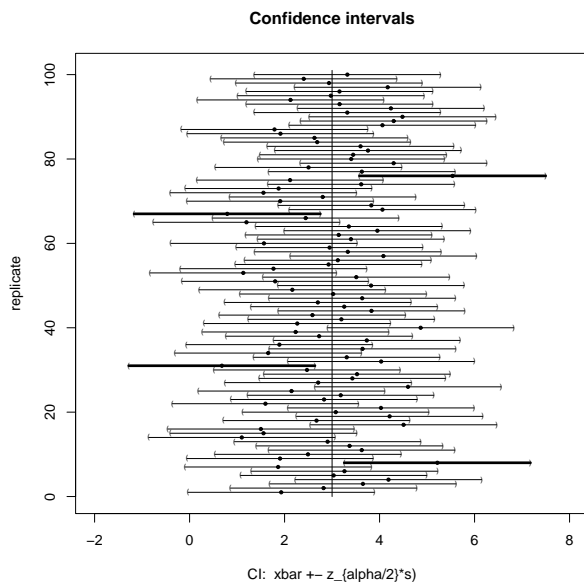
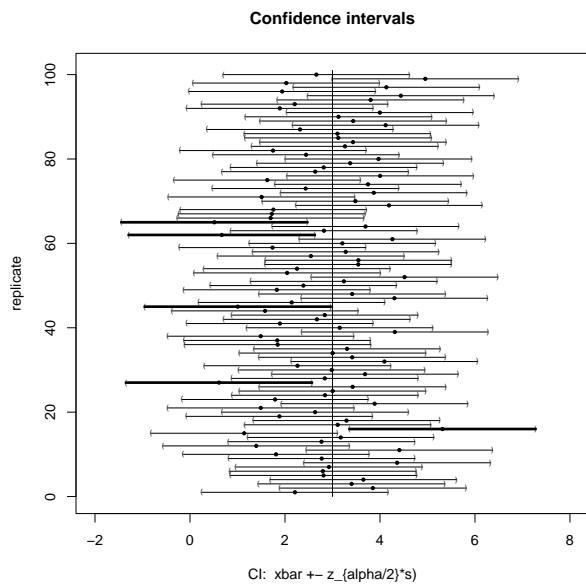
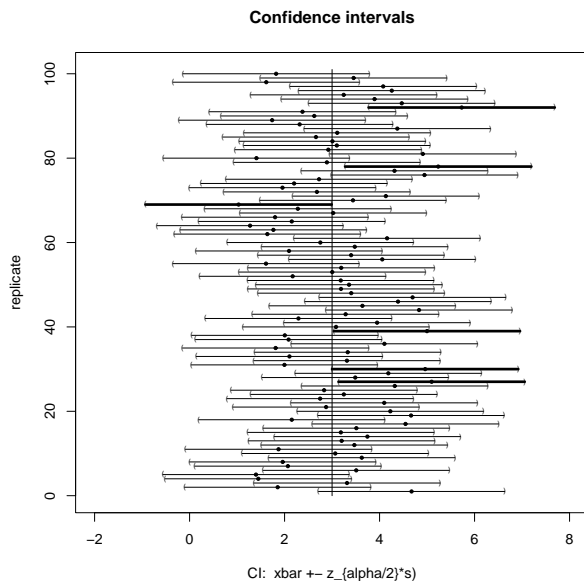
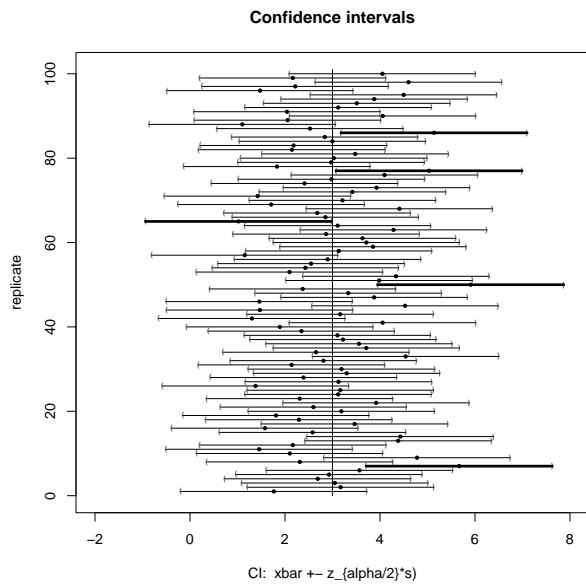
STAT 345 - Handout 7

Confidence Intervals

BASED ON SECTION: 8.1 – 8.5

The four plots below show the results of 100 confidence intervals each. Samples were drawn from the distribution of means, $\text{Normal}(\mu, \sigma^2/n)$, in this case a $\text{Normal}(3, 1)$ distribution, and a 95% confidence interval constructed from each sample for the population mean μ . In the cases when the confidence interval is correct, that is when it contains the true population mean $\mu = 3$, the interval is thin. In the cases when the confidence interval is wrong, that is when it fails to contain the true population mean $\mu = 3$, the interval is bold. Note that roughly 95 of 100 are correct and 5 of 100 are wrong. By changing the level of confidence (this is not done below), the interval length would change, changing the likelihood of drawing a correct conclusion about the location of μ .

On the back is the code producing these (random) results written in R, but it should also run in S and Splus.



```

mu=3;                # define population mean mu
sigma=1              # define population standard deviation sigma
n=100                # number of confidence intervals per plot
x=rnorm(n,mu,sigma) # draw n deviates from a normal(mu,sigma^2/n) distribution
s=rep(sigma,n)       # define a vector of sigmas to be used in constructing the intervals
z=rep(1.96,n)        # define a vector of z=1.960 values for 95% confidence
y=seq(1,n)           # y will place the intervals in the plot

plot(x,y,xlim=c(mu-5,mu+5),ylim=c(0,n+1),
     main='Confidence intervals',sub='',
     xlab='CI: xbar +- z_{alpha/2}*s',ylab='replicate',
     pch=19,cex=.5)      # plot the means
lines(c(mu,mu),c(0,n+1)) # plot the true mu=3 vertical line

for (i in 1:n)          # plot the confidence intervals
{
  if (x[i]-z[i]*s[i]>mu || x[i]+z[i]*s[i]<mu) # interval doesn't include mu -- bold
  {
    lines(c(x[i]-z[i]*s[i],x[i]+z[i]*s[i]),c(y[i],y[i]),lwd="3")
    points(x[i]-z[i]*s[i],y[i],pch='(',cex=.5)
    points(x[i]+z[i]*s[i],y[i],pch=')',cex=.5)
  }
  else # interval includes mu -- normal
  {
    lines(c(x[i]-z[i]*s[i],x[i]+z[i]*s[i]),c(y[i],y[i]),lwd="1")
    points(x[i]-z[i]*s[i],y[i],pch='(',cex=.5)
    points(x[i]+z[i]*s[i],y[i],pch=')',cex=.5)
  }
}

```