Comparing the HT estimator and the ratio estimator

Here is some R code that should help you do HW assignment 6. You should read the details of assignment 6 in the syllabus carefully before looking at this code.

The only code you will have to change is the last few lines after the line set.seed(2004). Of course you will have to consider various designs. It will probably be helpful to look at other functions of popx as possible designs.

```
> getans<-function(est,stnderr,truetot)
+ {
+   err<-abs(est-truetot)
+   lwbd<-est -1.96*stnderr
+   upbd<-est + 1.96*stnderr
+   if(lwbd <= truetot & truetot <= upbd) { cov<-1}
+   else {cov<-0}
+   ans<-c(est,err,lwbd,upbd - lwbd,cov)
+   return(ans)
+ }
> srstot<-function(smp,popy)
+ {
+   n<-length(smp)
+   N<-length(popy)
+   fpc<-1-n/N
+   ysmp<-popy[smp]
+   est<-N*mean(ysmp)
+   stnderr<-N*sqrt((fpc/n)*var(ysmp))
+   ans<-getans(est,stnderr,sum(popy))
+   return(ans)
+ }
> ratiotot<-function(smp,popy,popx)
+ {
+          n <- length(smp)
+          N<-length(popx)
+          ff<-n/N
+          ysamp<-popy[smp]
+          xsamp<-popx[smp]
+          tx<-sum(popx)
+          trtot<-sum(popy)
+          rhat <- sum(ysamp)/sum(xsamp)
+          est <- rhat * tx
+          dum1<-(N*N*(1-ff))/(n*(n-1))
+          vartot <- dum1*sum((ysamp-rhat*xsamp)^2)
+          stnderr<-sqrt(vartot)
+           ans<-getans(est,stnderr,sum(popy))
+          return(ans)
```

```
+ }
> httot<-function(smp,popy,designwts)
+ {
+    wts<-designwts[smp]
+    est<-sum(wts*popy[smp])
+    n<-length(smp)
+    dum<-sum((n*wts*popy[smp] - est)^2)
+    stnderr<-sqrt((1/(n*(n-1))*dum))
+    ans<-getans(est,stnderr,sum(popy))
+    return(ans)
+ }
> compar3est<-function(popy,popx,design,n)
+ {
+    designwts<-sum(design)/(n*design)
+    smp<-sample(1:length(popy),n,replace=FALSE,prob=design)
+    anssrs<-srstot(smp,popy)
+    ansHT<-httot(smp,popy,designwts)
+    ansratio<-ratiotot(smp,popy,popx)
+    ans<-rbind(anssrs,ansHT,ansratio)
+    return(ans)
+ }
> compar3estlp<-function(popy,popx,design,n,R)
+ {
+    ans<-matrix(0,3,5)
+    for(i in 1:R){
+       ans<-ans + compar3est(popy,popx,design,n)
+    }
+    ans<-round(ans/R,digits=3)
+    return(ans)
+ }
> set.seed(2004)
> popx<-rlnorm(500,10,.4)
> popy<-rnorm(500,0.1*popx,3*sqrt(popx))
> sum(popy)

[1] 1232136

> cor(popx,popy)

[1] 0.9203

> n<-50
> R<-500
> design<-popx
> compar3estlp(popy,popx,design,n,R)

            [,1]       [,2]      [,3]      [,4]  [,5]
anssrs   1439359 207313.61 1268065 342586.8 0.328
```

```
ansHT     1232135   24660.52 1168937 126397.3 0.966
ansratio 1239790   22754.39 1176851 125878.2 0.970

> design<-rep(1,length(popy))
> compar3estlp(popy,popx,design,n,R)

            [,1]      [,2]     [,3]      [,4] [,5]
anssrs   1234516 63158.28 1083825 301382.6 0.942
ansHT    1234516 63158.28 1075674 317685.1 0.952
ansratio 1232362 24560.78 1172819 119085.1 0.946
```