

620-374 Sampling

Lab task week 2

1. Generate a sequence of 100 random numbers with a periodic mean using

```
x <- runif(100, -1, 1) + sin((1:100)*2*pi/10)
```

Using a 1/10 systematic sample, verify that $S^2_{\text{wsy}} < S^2$. Then sort x and show that $S^2_{\text{wsy}} > S^2$.

Hint: put x into a 10x10 array row-wise using

```
matrix(x, 10, 10, byrow=T).
```

2. Obtain the file lab2data.txt from the web site. It contains 300 values split into two strata. Load the file using

```
x <- read.csv("lab2data.txt")
x1 <- x[x$stratum == 1, 2]
x2 <- x[x$stratum == 2, 2]
```

Using these values

a) Calculate S^2 , μ and for each stratum S_h^2 and μ_h .

b) Verify the sum of squares formula (total SS = within group SS + between group SS):

$$(N-1)S^2 = \sum_{h=1}^L (N_h - 1)S_h^2 + \sum_{h=1}^L N_h (\mu_h - \mu)^2$$

c) For $n = 30$ calculate $\text{Var}(\hat{\mu}_{\text{SRS}})$, $\text{Var}_{\text{prop}}(\hat{\mu}_{\text{st}})$ and $\text{Var}_{\text{opt}}(\hat{\mu}_{\text{st}})$.

d) For $n = 30$ generate a simple random sample, a proportional sample and an optimal sample and for each calculate $\hat{\mu}$ and $\hat{\text{Var}}(\hat{\mu})$. Compare with your answers from (c).