**MODERN COLLEGE OF ARTS,SCI. & COMM. PUNE-05.**

**(Autonomous)**

**DEPARTMENT OF STATISTICS.**

M.Sc.( I )- ST-15

EXPT.NO. 11

**TITLE : CIRCULAR SYSTEMATIC SAMPLING**

**1. The following are the data in population related to the number of seedlings in every**

**individual foot of sawn bed for 78 feet length.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **26** | **16** | | **27** | | **37** | | **04** | | **36** | | **20** | | **21** |
| **28** | **9** | | **20** | | **14** | | **05** | | **20** | | **21** | | **26** |
| **11** | **22** | | **25** | | **14** | | **11** | | **43** | | **15** | | **16** |
| **16** | **26** | | **39** | | **24** | | **09** | | **27** | | **14** | | **18** |
| **07** | **17** | | **24** | | **18** | | **25** | | **20** | | **13** | | **11** |
| **22** | **39** | | **25** | | **17** | | **16** | | **21** | | **09** | | **19** |
| **44** | **21** | | **18** | | **14** | | **13** | | **18** | | **25** | | **27** |
| **26** | **14** | | **44** | | **38** | | **22** | | **19** | | **17** | | **29** |
| **31** | | **40** | | **55** | | **36** | | **18** | | **24** | | **07** | | |
| **26** | | **30** | | **39** | | **29** | | **06** | | **30** | | **30** | | |

1. **a) A circular systematic sample of size 8 is to be drawn from the above population. Compute the variance of the sample mean for circular systematic sampling. Compare this variance with that of mean of sample of size 8 drawn using SRSWOR.**
2. **2.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Population** | **Cultivated area** | **S.No.** | **Population** | **Cultivated area** |
| **1** | **226** | **678** | **26** | **1007** | **680** |
| **2** | **670** | **663** | **27** | **1567** | **970** |
| **3** | **4505** | **1290** | **28** | **5271** | **1850** |
| **4** | **1732** | **1170** | **29** | **659** | **340** |
| **5** | **2874** | **1390** | **30** | **3209** | **2450** |
| **6** | **2282** | **1110** | **31** | **2902** | **1760** |
| **7** | **793** | **760** | **32** | **2955** | **2120** |
| **8** | **895** | **730** | **33** | **1746** | **1220** |
| **9** | **1157** | **950** | **34** | **1045** | **860** |
| **10** | **3201** | **1700** | **35** | **666** | **620** |
| **11** | **1117** | **909** | **36** | **904** | **760** |
| **12** | **1236** | **1169** | **37** | **773** | **502** |
| **13** | **5201** | **1840** | **38** | **1040** | **532** |
| **14** | **848** | **660** | **39** | **760** | **438** |
| **15** | **1238** | **1140** | **40** | **2084** | **633** |
| **16** | **1917** | **1360** | **41** | **828** | **277** |
| **17** | **1800** | **1509** | **42** | **4877** | **1640** |
| **18** | **2335** | **1810** | **43** | **911** | **424** |
| **19** | **4396** | **2240** | **44** | **1205** | **822** |
| **20** | **1607** | **1225** | **45** | **1139** | **555** |
| **21** | **2071** | **1250** | **46** | **4064** | **347** |
| **22** | **2155** | **1690** | **47** | **1114** | **744** |
| **23** | **7780** | **3200** | **48** | **547** | **372** |
| **24** | **2746** | **1744** | **49** | **1178** | **644** |
| **25** | **2549** | **2400** | **50** | **1159** | **732** |

1. **(i) Draw five circular systematic samples of size 5 each, from rearranged frame.**
2. **(ii) From each of the five samples, estimate the total cultivated area in the tehsil using the figures**

**for cultivated area for the selected villages as given table**

1. (iii) Obtain a single combined estimate from the five sample estimates .Also calculate the standard error of this combined estimator.

\*\*\*\*\*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | . |  |  |  |

**#Q1) Solution**

x=c(26,16,27,37,04,36,20,21,28,9,20,14,5,20,21,26,11,22,25,14,11,43,15,16,16,26,39,24,9,27,14,18,7,17,24,18,25,20,13,11,22,39,25,17,16,21,9,19,44,21,18,14,13,18,25,27,26,14,44,38,22,19,17,29,31,40,55,36,18,24,07,26,30,39,29,6,30,30)

>  N=length(x)

>  N

[1] 78

>  n=8

>  k=as.integer(N/n)

>  k

[1] 9

>  z=rep(0,n)

>  y=rep(0,N)

>  for(i in 1:length(x))

+  {

+  for(j in 1:n)

+  {

+  if((i+((j-1)\*k))<=N)

+  {

+  z[j]=x[i+(j-1)\*k]

+  }

+  if((i+((j-1)\*k))>N)

+  {

+  z[j]=x[(i+(j-1)\*k)-N]

+  }

+  }

+  y[i]=(1/((n-1)\*N))\*sum((z-mean(z))^2)

+ }

>  y

 [1] 0.4725275 0.8049451 1.2177198 4.5803571 1.9633700 1.8294414 0.2564103

 [8] 0.5521978 0.7802198 0.5421245 1.4631410 1.2598443 5.0842491 1.2847985

[15] 1.6261447 0.3031136 0.5235806 0.7635073 0.3113553 1.9393315 1.3605769

[22] 4.4008700 1.2653388 1.6437729 0.4704670 0.4679487 0.8917125 1.0989011

[29] 1.8843864 1.0034341 3.7976190 1.4503205 1.5201465 0.4972527 0.3360806

[36] 0.3917125 1.6426282 1.7030678 1.1721612 3.7326007 1.3367674 1.0512821

[43] 0.4924451 0.2708333 0.5091575 1.9120879 1.7140568 1.4935897 3.5045788

[50] 1.3111264 0.9887821 0.4924451 0.3141026 0.5620421 2.2371795 1.4432234

[57] 1.7500000 2.7433608 1.4191850 1.0565476 0.3882784 0.3653846 0.5595238

[64] 2.8679029 1.3910256 1.8745421 2.7433608 0.9294872 0.8276099 0.4027015

[71] 0.6071429 0.6151557 3.0979853 2.1261447 1.7765568 0.5448718 0.5364011

[78] 0.8498168

>  s1=var(x)

>  s2=sum(y)

>  vxbar=(((N-1)/N)\*s1)-(((n-1)/n)\*s2)

>  vxbar

[1] 11.30343

> s1;s2

[1] 106.6422

[1] 107.3961

>

**#Q2 Solution**

> d=read.table(file.choose())

> d=data.matrix(d)

> d=c(d)

> d

 [1]  678  663 1290 1170 1390 1110  760  730  950 1700  909 1169 1840  660 1140 1360

[17] 1509 1810 2240 1225 1250 1690 3200 1744 2400  680  970 1850  340 2450 1760 2120

[33] 1220  860  620  760  502  532  438  633  277 1640  424  822  555  347  744  372

[49]  644  732

> N=length(d)

> N

[1] 50

> n=5

> k=floor(N/n)

> k

[1] 10

> r=rep(0,5)

> r0=rep(0,5)

> m=matrix(rep(0,25),nrow=5,ncol=5)

> for(j in 1:5)

+ {

+   r0[j]=sample(50,1)

+   m[j,1]=d[r0[j]]

+   for(i in 2:5)

+   {

+     r[i]=r0[j]+(i\*k)

+     if(r[i]<=N)

+     {

+       r[i]=r[i]

+       m[j,i]=d[r[i]]

+     }

+     if(r[i]>N)

+     {

+       r[i]=r[i]-N

+       m[j,i]=d[r[i]]

+     }

+   }

+ }

> m

     [,1] [,2] [,3] [,4] [,5]

[1,] 1850  372  730 1810 1850

[2,] 1250  277  678  909 1250

[3,]  730 1850  532  372  730

[4,] 1360  760  347 1110 1360

[5,]  424 1840 3200 1220  424

> am=rep(0,5)

> va=rep(0,5)

> for(i in 1:5)

+ {

+   am[i]=sum(m[i,])/5

+   va[i]=var(m[i,])\*4

+ }

> am

[1] 1322.4  872.8  842.8  987.4 1421.6

> va

[1] 2048675.2  678794.8 1358148.8  754515.2 5368819.2

> va1=sum(va)

> am1=sum(am)

> cam=am1/5 # estimate of total cultivated area

> d1=am-cam

> cva=(va1+sum(d1))/5

> cse=sqrt(cva) ##standard error

> cse

[1] 1428.912

> cam

[1] 1089.4