homework2

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Excerse 6

Basic Plot

```r
#*********R CODE START************
library(spBayes)
library(classInt)
library(geoR)
library(MBA)
library(fields)
library(RColorBrewer)
url <- "https://www.counterpointstat.com/uploads/1/1/9/3/119383887/myscallops.txt"
myscallops <- read.table(url,header = T)

coords <- as.matrix(myscallops[,c("lat","long")])

strata <- myscallops$strata
lgcatch<- myscallops$lgcatch

plot(coords, pch=1, cex=sqrt(strata)/100, col="darkgreen", xlab="Lat", ylab="Long")
leg.vals <- round(quantile(strata),0)
legend("topleft", pch=1, legend=leg.vals, col="darkgreen",
       pt.cex=sqrt(leg.vals)/1000, bty="n", title="strata")
```
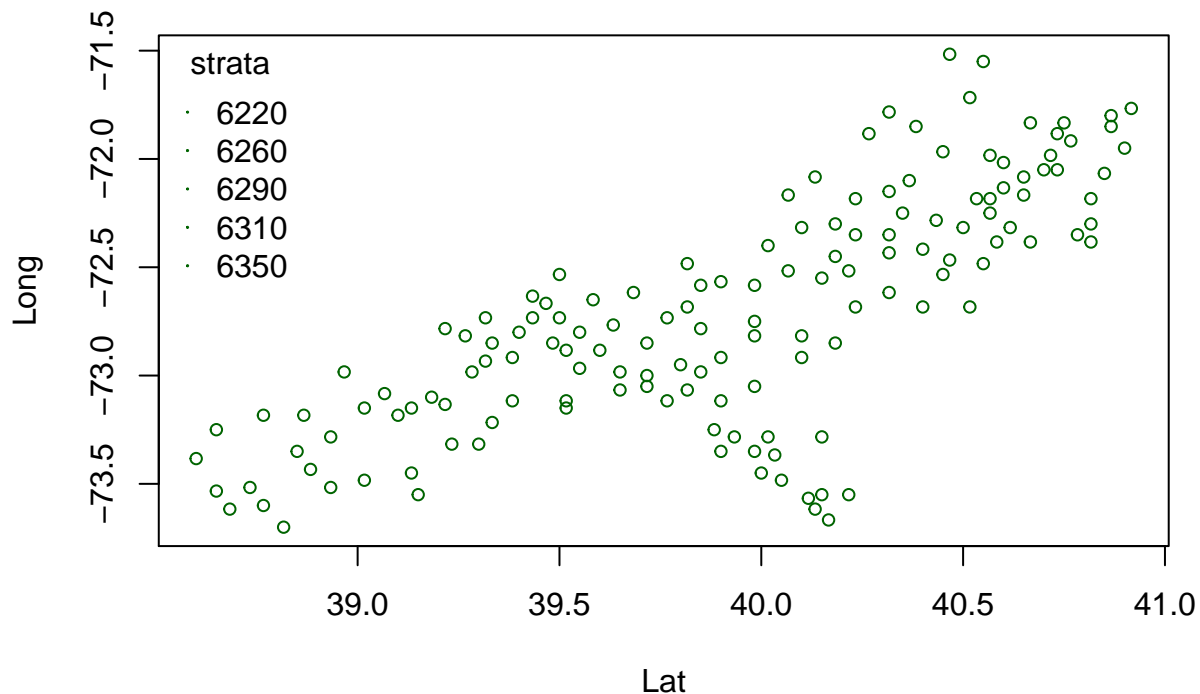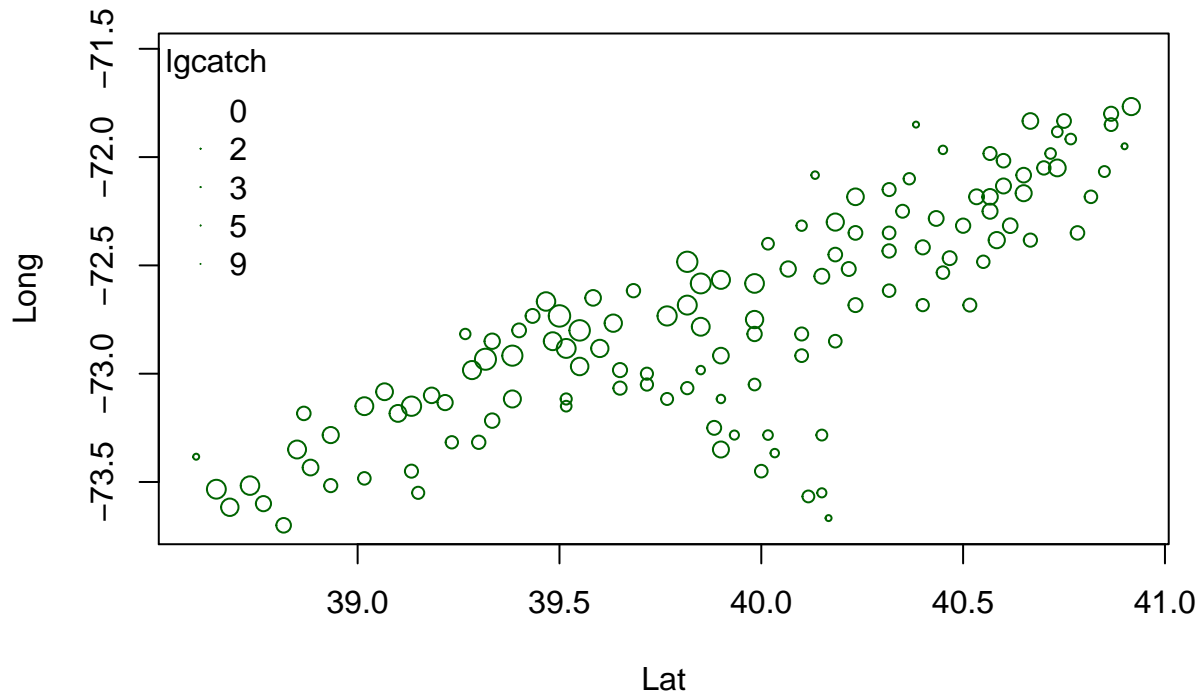


```r
plot(coords, pch=1, cex=sqrt(lgcatch)/2, col="darkgreen", xlab="Lat", ylab="Long")
leg.vals <- round(quantile(lgcatch),0)
```

```
legend("topleft", pch=1, legend=leg.vals, col="darkgreen",
       pt.cex=sqrt(leg.vals)/1000, bty="n", title="lgcatch")
```


Create a color palette for subsequent plots.

```
col.br <- colorRampPalette(c("blue", "cyan", "yellow", "red"))
col.pal <- col.br(5)

fixed <- classIntervals(strata, n = 4, style = "fixed",
                        fixedBreaks = c(0,6260, 62290, 6310, max(strata) + 1))
fixed.col <- findColours(fixed, col.pal)
plot(coords, col = fixed.col, pch = 19, cex = 0.5,
     main = "strata classes", xlab = "Lat", ylab = "Long")
legend("topleft", fill = attr(fixed.col, "palette"),
       legend = c("strata1", "strata2", "strata3", "strata4"),
       bty = "n")
```

strata classes
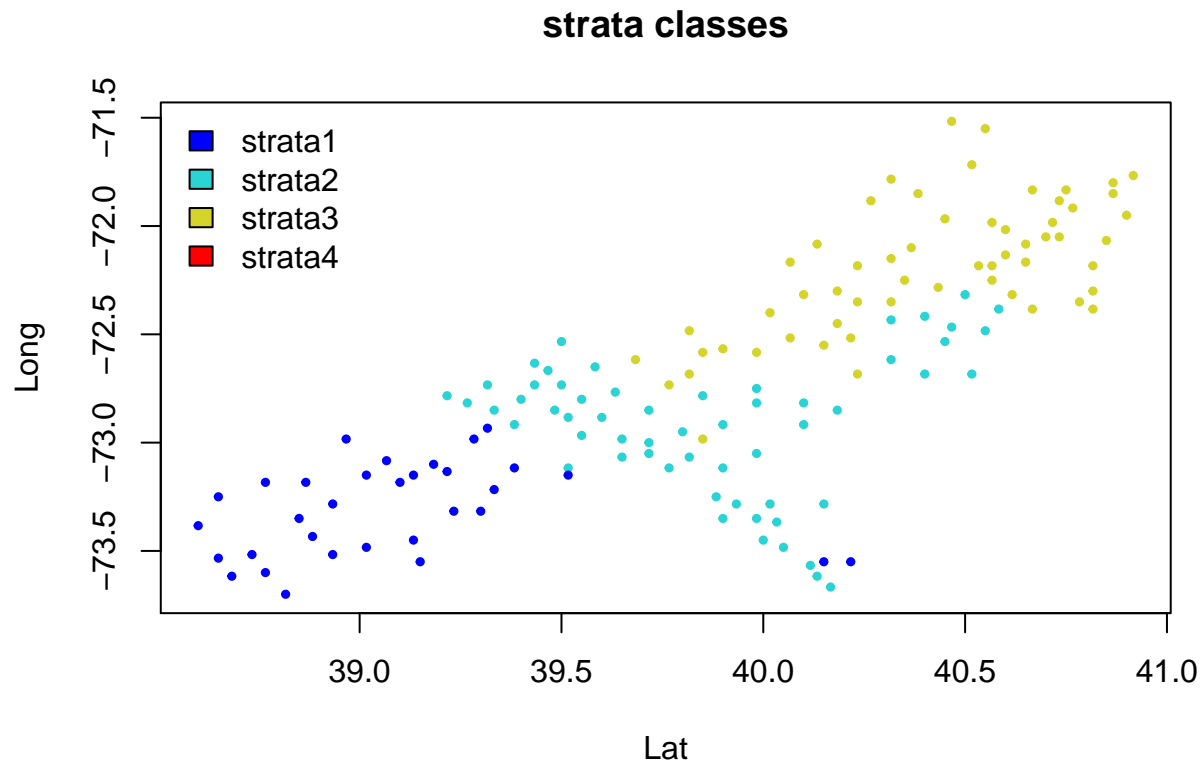
**Surface**

```
## MBA and fields libraries for creating surface interpolation plots
x.res <- 148
y.res <- 148
surf <- mba.surf(cbind(coords, strata),
                 no.X = x.res, no.Y = y.res,
                 h = 5, m = 2, extend = FALSE)$xyz.est
image.plot(surf, xaxs = "r",
           yaxs = "r", xlab = "lat",
           ylab = "long", col = col.br(25))
contour(surf, add=T)
```
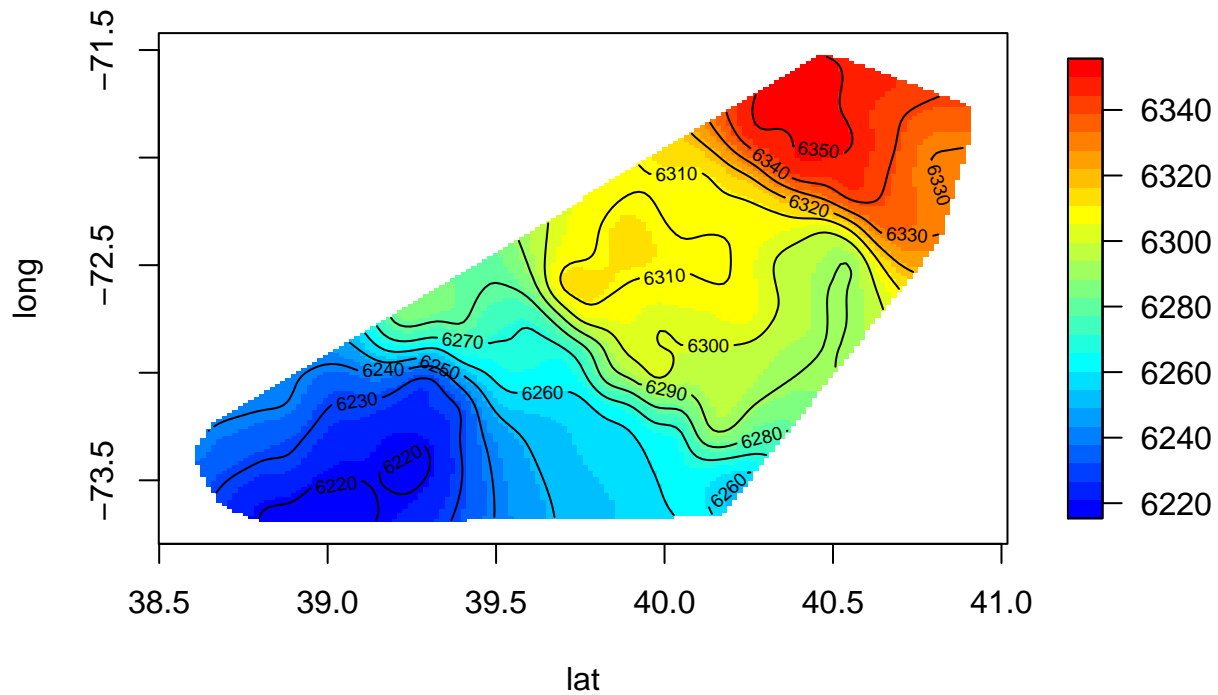
3D Plot

```r
library(rgl)
col <- rbind(0, cbind(matrix(drape.color(surf[[3]],
                                         col = col.br(25)), x.res - 1, y.res-1), 0))
surface3d(surf[[1]], surf[[2]], surf[[3]], col = abs(col))
axes3d()

title3d(main = "strata", xlab = "Lat", ylab = "Long", zlab = "Strata")
drape.plot(surf[[1]], surf[[2]], surf[[3]],
          col = col.br(150), theta = 225, phi = 50,
          border = FALSE, add.legend = FALSE,
          xlab = "Lat", ylab = "Long", zlab = "Strata")
image.plot(zlim = range(surf[[3]], na.rm = TRUE),
          legend.only = TRUE, horizontal = FALSE)
```
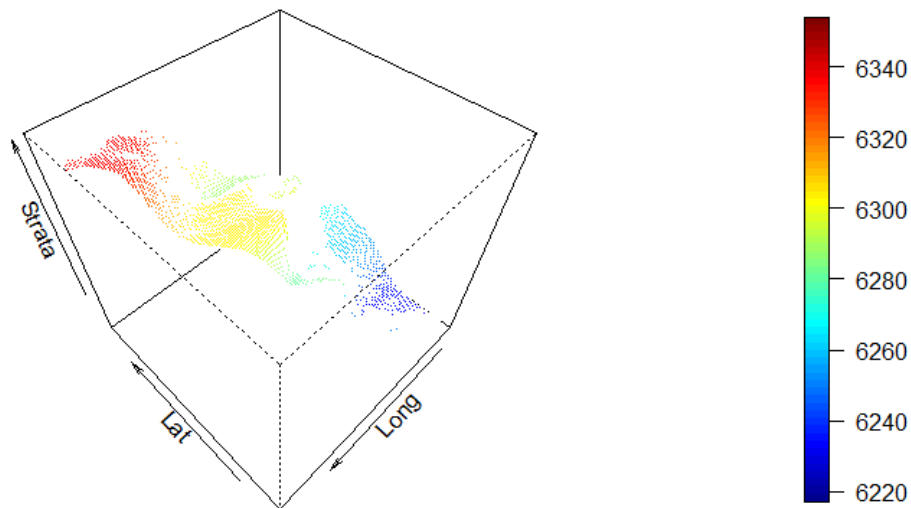
(a)

```
#*********R CODE START************
summary(myscallops)

##     strata          sample           lat             long
##  Min.   :6220   Min.   :  1.0   Min.   :38.60   Min.   :-73.70
##  1st Qu.:6260   1st Qu.:106.8   1st Qu.:39.46   1st Qu.:-73.14
##  Median :6290   Median :147.0   Median :39.98   Median :-72.74
##  Mean   :6288   Mean   :131.8   Mean   :39.91   Mean   :-72.72
##  3rd Qu.:6310   3rd Qu.:185.2   3rd Qu.:40.41   3rd Qu.:-72.31
##  Max.   :6350   Max.   :224.0   Max.   :40.92   Max.   :-71.52
##     tcatch           prerec          recruits          lgcatch
##  Min.   :   0.0   Min.   :   0.00   Min.   :   0.00   Min.   :0.000
##  1st Qu.:   8.0   1st Qu.:   1.00   1st Qu.:   5.00   1st Qu.:2.197
##  Median :  30.0   Median :   8.00   Median :  21.50   Median :3.434
##  Mean   : 274.6   Mean   : 156.55   Mean   : 118.06   Mean   :3.483
##  3rd Qu.: 115.2   3rd Qu.:  48.25   3rd Qu.:  73.75   3rd Qu.:4.756
##  Max.   :7084.0   Max.   :4487.00   Max.   :2597.00   Max.   :8.866
```

(b)

```
#*********R CODE START************


max.dist <- 0.25 * max(iDist(coords))
bins <- 50
vario.strata <- variog(coords = coords,
```
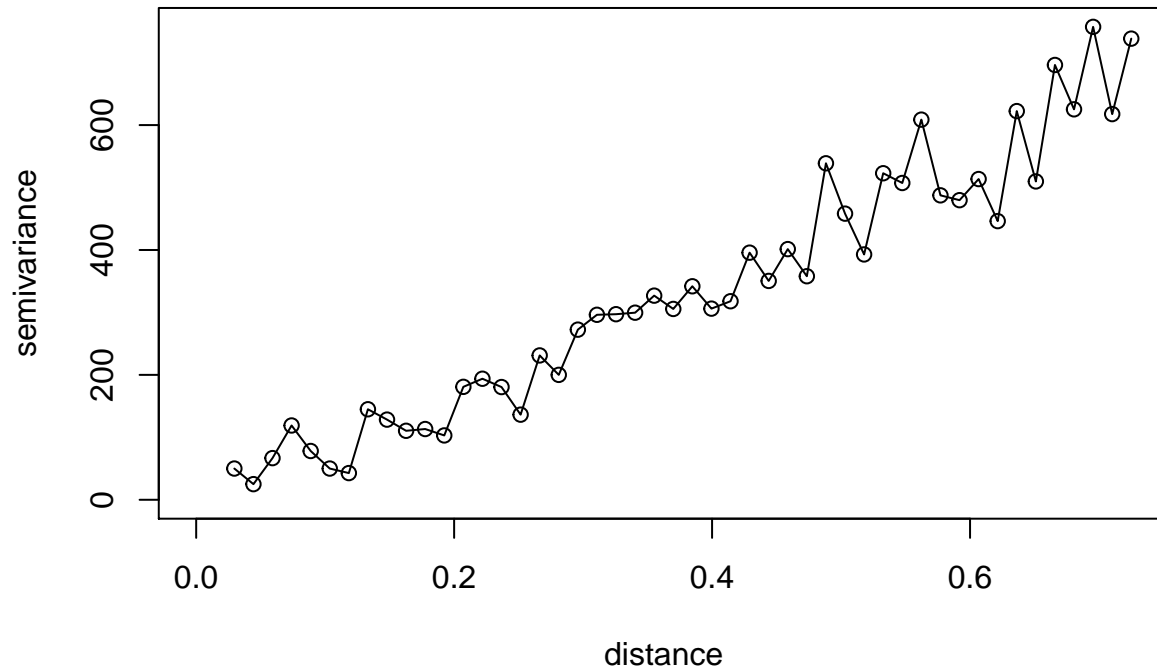
5

```
                    data = myscallops$strata,
                    uvec = (seq(0, max.dist, length = bins)))
```

variog: computing omnidirectional variogram

```
plot(vario.strata,type="o")
```


(c)

```
#*********R CODE START************
fit.strata<- variofit(vario.strata,cov.model="exponential",fix.nugget=FALSE, nugget=18)
```

```
## variofit: covariance model used is exponential
## variofit: weights used: npairs
## variofit: minimisation function used: optim

## Warning in variofit(vario.strata, cov.model = "exponential", fix.nugget =
## FALSE, : initial values not provided - running the default search

## variofit: searching for best initial value ... selected values:
##               sigmasq  phi     tausq kappa
## initial.value "757.26" "0.58" "18"  "0.5"
## status        "est"    "est"  "est" "fix"
## loss value: 30162508.5201582
```

```
fit.strata
```

```
## variofit: model parameters estimated by WLS (weighted least squares):
## covariance model is: exponential
## parameter estimates:
##      tausq    sigmasq        phi
##       0.00 1520154.43    1685.73
## Practical Range with cor=0.05 for asymptotic range: 5049.997
##
## variofit: minimised weighted sum of squares = 12635537
```

As we can see above$nugget=tausq=0$
$sill = tausq + sigmasq = 3439272.97$
$range = 3813.02$

Excerse 7

```
#*********R CODE START************
url_coal <- "https://www.counterpointstat.com/uploads/1/1/9/3/119383887/coal.ash.txt"
coalash <- read.table(url_coal,header = T)
```

(a)

```
#*********R CODE START************
coords_coal <- as.matrix(coalash[,c("x","y")])
coal <- coalash$coal
x.res <- 208
y.res <- 208
surf <- mba.surf(cbind(coords_coal, coal),
                 no.X = x.res, no.Y = y.res,
                 h = 5, m = 2, extend = FALSE)$xyz.est
image.plot(surf, xaxs = "r", yaxs = "r", xlab = "x", ylab = "y")
contour(surf, add=T)
```
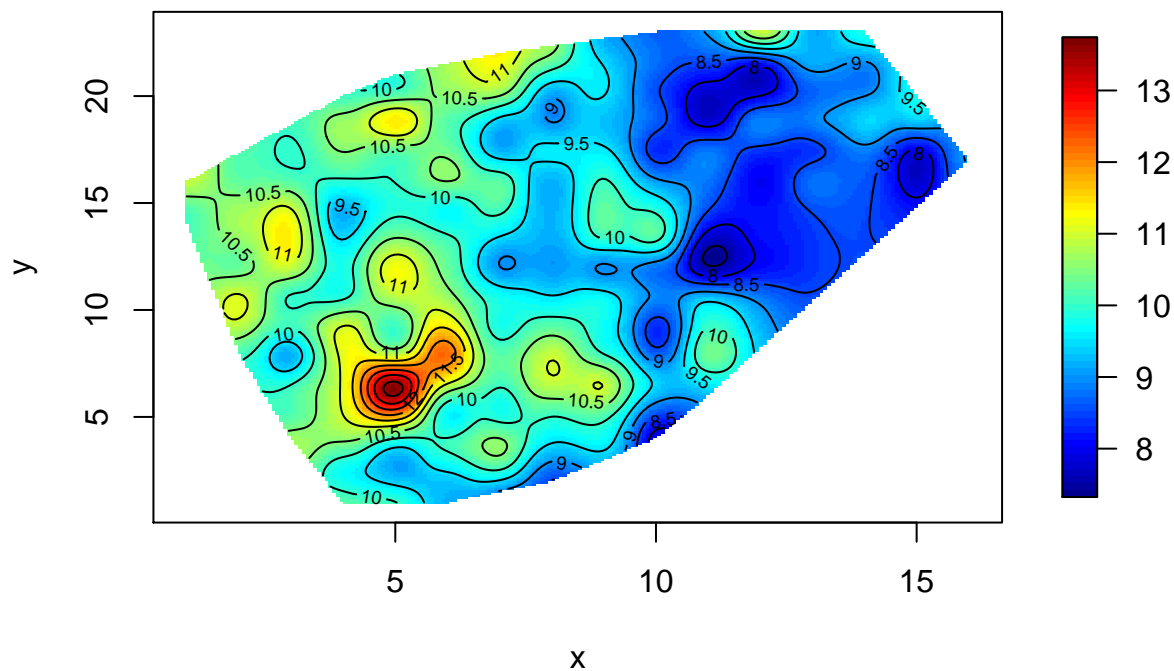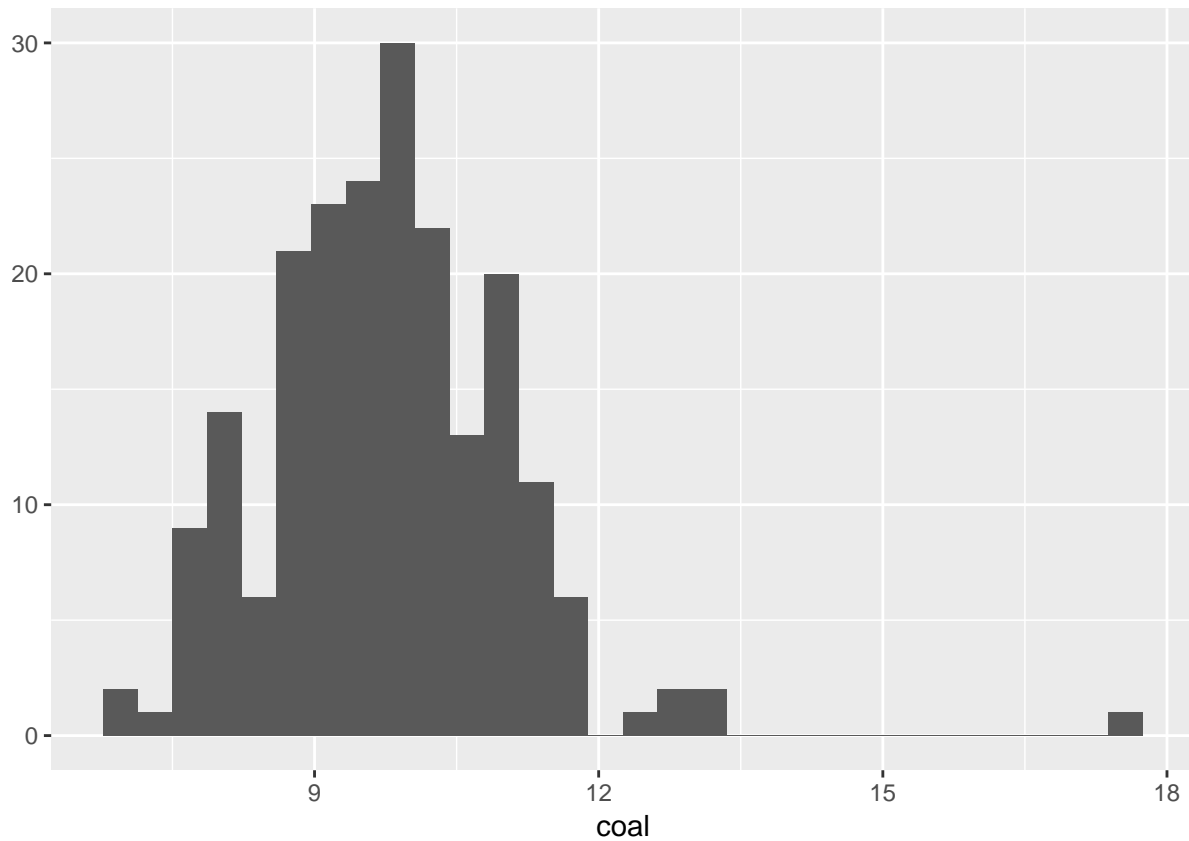

(b)

```
#*********R CODE START************
library(ggplot2)
coal <- coalash$coal
qplot(coal, geom="histogram")
```

```r
stem(coal)
```

```
## 
##   The decimal point is at the |
## 
##    7 | 00366678888999
##    8 | 00111222222235566666667888888899999999
##    9 | 000000000111112222223333333344444455555566666666777888888888899999999
##   10 | 00000000011111112222223333344444445666667777788888899999
##   11 | 000011111222222233445666789
##   12 | 578
##   13 | 11
##   14 |
##   15 |
##   16 |
##   17 | 6
```

```r
summary(coalash)
```

```
##        x                y              coal       
##  Min.   : 1.000   Min.   : 1.00   Min.   : 7.000  
##  1st Qu.: 5.000   1st Qu.: 8.00   1st Qu.: 8.960  
##  Median : 7.000   Median :13.00   Median : 9.785  
##  Mean   : 7.534   Mean   :12.91   Mean   : 9.779  
##  3rd Qu.:10.000   3rd Qu.:18.00   3rd Qu.:10.568  
##  Max.   :16.000   Max.   :23.00   Max.   :17.610  
```
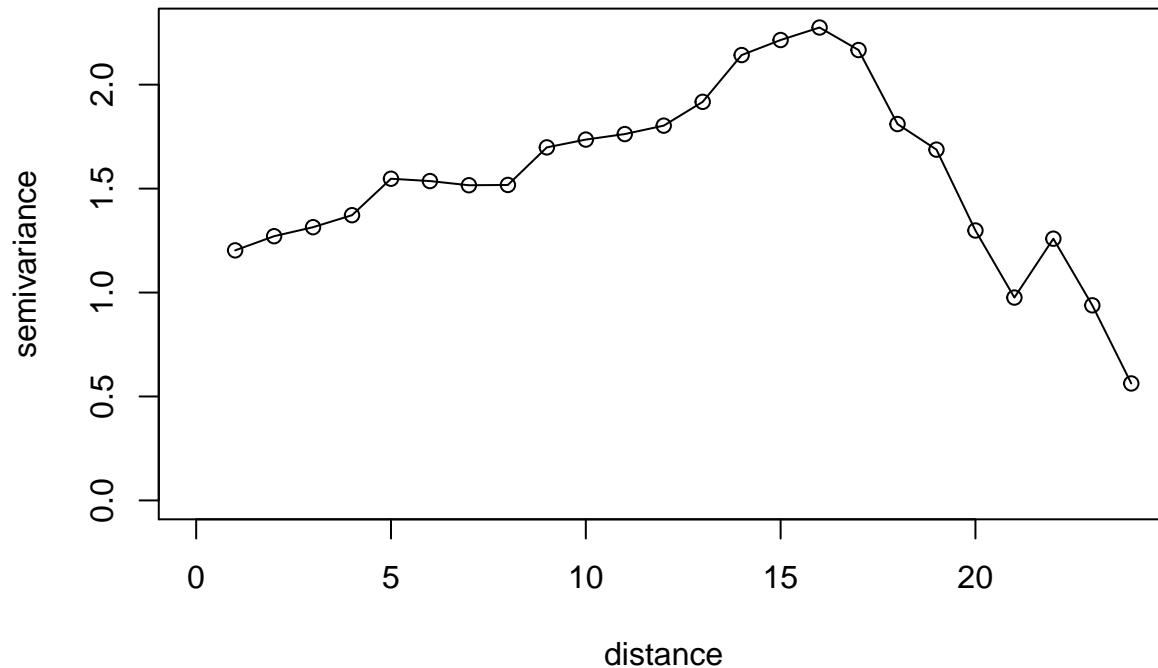
(c)

```
#*********R CODE START***********
vario.coal <- variog(coords = coords_coal,
                      data = coal, uvec = (seq(0, length = bins)))
```

variog: computing omnidirectional variogram

```
plot(vario.coal,type="o")
```


(d)

```
#*********R CODE START***********
fit.coal<- variofit(vario.coal,
                    cov.model="exponential",
                    fix.nugget=FALSE,
                    max.dist = 1/17, nugget=1.2)
```

```
## variofit: covariance model used is exponential
## variofit: weights used: npairs
## variofit: minimisation function used: optim

## Warning in variofit(vario.coal, cov.model = "exponential", fix.nugget =
## FALSE, : initial values not provided - running the default search

## variofit: searching for best initial value ... selected values:
##              sigmasq phi    tausq kappa
## initial.value "1.14"  "0"    "1.2" "0.5"
## status        "est"   "est" "est" "fix"
## loss value: 0
```

```
fit.coal
```

```
## variofit: model parameters estimated by WLS (weighted least squares):
## covariance model is: exponential
```

```
## parameter estimates:
##    tausq sigmasq      phi
##   1.2000  1.1375  0.0000
## Practical Range with cor=0.05 for asymptotic range: 0.0001159668
##
## variofit: minimised weighted sum of squares = 0
```

As we can see above, the sill corresponded to round 17 is around 2.24, which is match to the plot in (b).