

MATH 498 HW1

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```
library(fda)
```

```
## Warning: package 'fda' was built under R version 4.1.3
```

```
## Loading required package: splines
```

```
## Loading required package: fds
```

```
## Warning: package 'fds' was built under R version 4.1.3
```

```
## Loading required package: rainbow
```

```
## Warning: package 'rainbow' was built under R version 4.1.3
```

```
## Loading required package: MASS
```

```
## Loading required package: pcaPP
```

```
## Warning: package 'pcaPP' was built under R version 4.1.3
```

```
## Loading required package: RCurl
```

```
## Warning: package 'RCurl' was built under R version 4.1.3
```

```
## Loading required package: deSolve
```

```
## Warning: package 'deSolve' was built under R version 4.1.3
```

```
##
```

```
## Attaching package: 'fda'
```

```
## The following object is masked from 'package:graphics':
```

```
##
```

```
##      matplot
```

1.1 Assume that the median value does not have the maximum depth. Let b be the value with the maximum depth. a is the median yet lays exactly between fifty percent of the data. a is therefore deeper than b . This produces a contradiction so a must equal b . 2.1 Consider the values directly above and below the deepest value. Call them

$$z_{p-1}$$

and

$$z_{p+1}$$

. Now consider the log transformation.

$$\log(z_{p-1}) < \log(y_p) < \log(y_{p+1})$$

. This demonstrates that under this transformation the deepest value remains the deepest value. 2.2 Consider the functions

$$z_{p-1}$$

and

$$z_{p+1}$$

. For each of these functions if

$$y_{p-1} < y_p < y_{p+1}$$

then

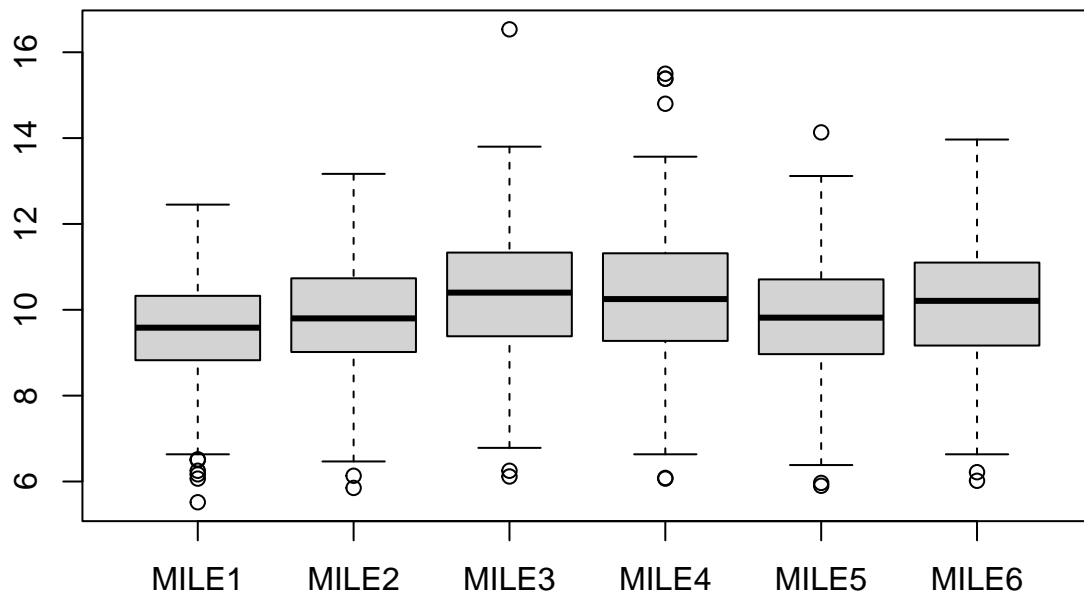
$$z_{p-1} < z_p < z_{p+1}$$

. So the depth of $z_{\{i\}}$ = the depth of $y_{\{i\}}$.

```
load("C:/Users/Drewr/Documents/School/MATH498/HW1/BB10K.rda")
split<- as.matrix(BB10K[,4 + 1:6])
split <- t( split)
indM<- BB10K$DIV == "M30"
indF<- BB10K$DIV == "F30"
split30F<- split[,indF]
timeF30<- BB10K$TIME[indF]
split30M<- split[,indM]
```

3.1 Split30F is functional based on times, the split, and the mile. You can tell it's a function because each data point has neighbors and a unique vertical position. 3.2 There is missing data to the function. 3.3

```
boxplot(t(split30F))
```



There are outliers based on the classic boxplot criteria. 3.4

```
fbplot(t(split30F))
```

```
## Warning in FUN(newX[, i], ...): no non-missing arguments to max; returning -Inf
## Warning in FUN(newX[, i], ...): no non-missing arguments to max; returning -Inf
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```

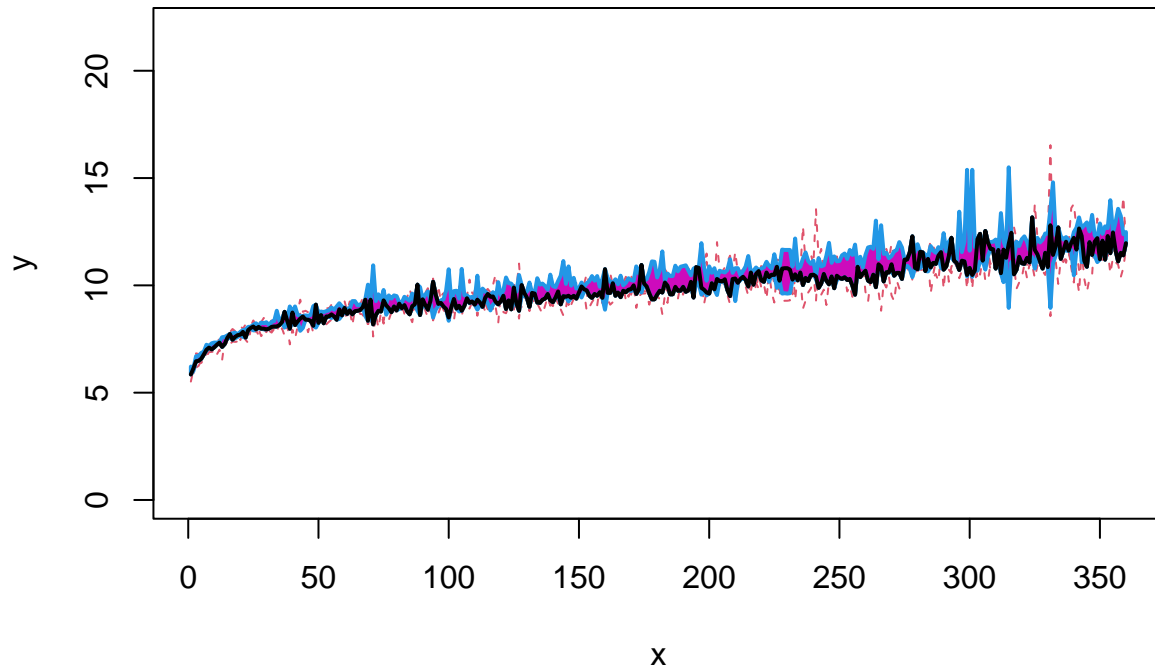

[illegible]

[illegible]

[illegible]

[illegible]

```
## Warning in FUN(newX[, i], ...): no non-missing arguments to min; returning Inf
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```



```
## $depth
##      MILE1      MILE2      MILE3      MILE4      MILE5      MILE6
## 0.4730093 0.6116667 0.5242593 0.5975463 0.5653704 0.5670370
##
## $outpoint
## [1] 1 2 3 4 5 6
##
## $medcurve
## MILE2
##      2
```

There are outliers based on the functional boxplot. This gives some insight into how the function actually

looks as well as the median function. 4.1

```
split30FCentered <- scale(split30F, center=TRUE, scale=FALSE)
fbplot(t(split30FCentered))
```

[illegible]

[illegible]

[illegible]

[illegible]

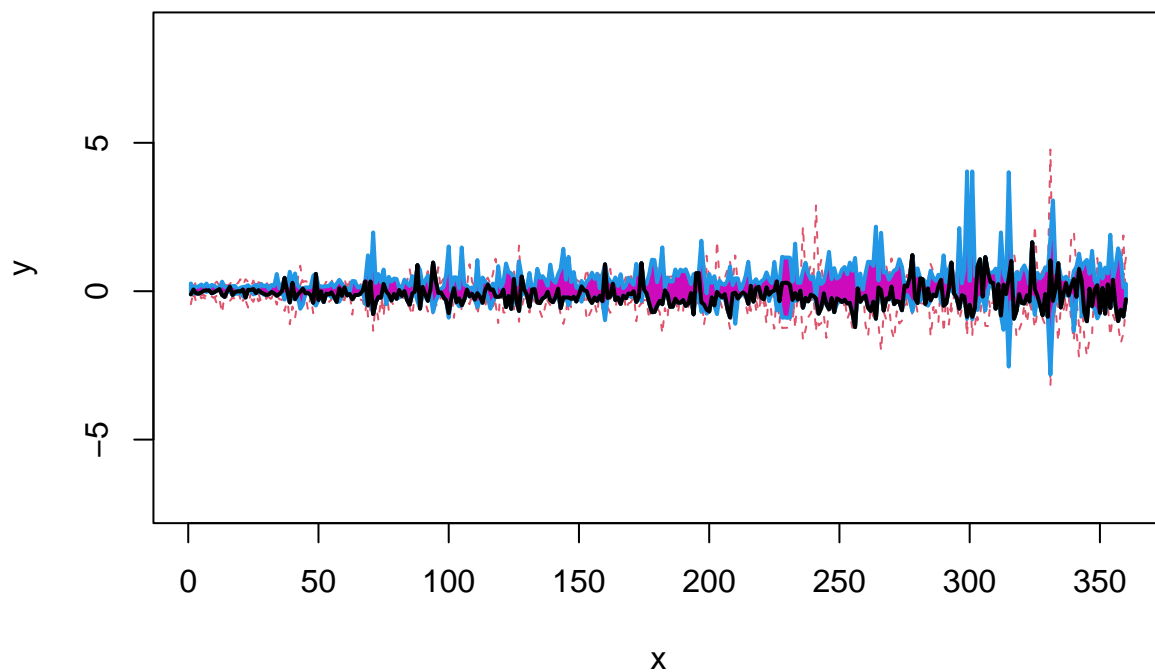
[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



```
## $depth
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## $medcurve
## MILE2
##      2
```

There is not a relationship between depth and runners split times. For outliers there is.