

# Data wrangling

## AVOCADO

### Read and format data

Block and randomization experimental design. Three blocks and 12 subjects each

```
da <- fread('avocado_blackness.csv')
dim(da)
```

```
## [1] 50 37
```

```
head(da)
```

```
##   hue_index  Bc1  Bc6  Bc8  Bc9  Bc11  Bc12  Bt2  Bt3  Bt4  Bt5  Bt7
## 1:         0 23.71 45.27 43.63 41.31 37.85 52.14 36.47 40.1 49.59 35.40 44.60
## 2:         1 23.71 45.27 43.63 41.31 37.87 52.43 36.56 40.1 49.71 35.52 44.87
## 3:         2 23.71 45.27 43.63 41.31 37.87 52.43 36.56 40.1 49.71 35.52 44.87
## 4:         3 23.71 45.27 43.63 41.31 37.87 52.43 36.56 40.1 49.71 35.52 44.87
## 5:         4 23.71 45.27 43.63 41.31 37.87 52.43 36.56 40.1 49.71 35.52 44.87
## 6:         5 23.71 45.27 43.63 41.31 37.87 52.43 36.56 40.1 49.71 35.52 44.87
##   Bt10  Nt1  Nc2  Nt3  Nc4  Nc5  Nt6  Nc7  Nt8  Nc9  Nt10  Nc11  Nt12
## 1: 45.68 28.10 30 39.39 28.56 28.83 30.35 29.79 29.93 32.58 23.50 30.05 25.81
## 2: 45.72 28.11 30 39.39 28.56 28.83 30.36 29.79 29.94 32.58 23.51 30.09 25.81
## 3: 45.72 28.11 30 39.39 28.56 28.83 30.36 29.79 29.94 32.58 23.51 30.09 25.81
## 4: 45.72 28.11 30 39.39 28.56 28.83 30.36 29.79 29.94 32.58 23.51 30.09 25.81
## 5: 45.72 28.11 30 39.39 28.56 28.83 30.36 29.79 29.94 32.58 23.51 30.09 25.81
## 6: 45.72 28.11 30 39.39 28.56 28.83 30.36 29.79 29.94 32.58 23.51 30.09 25.81
##   Jt1  Jt4  Jt7  Jt8  Jt9  Jt11  Jc2  Jc3  Jc5  Jc6  Jc10  Jc12
## 1: 23.37 25.69 24.22 26.37 26.62 21.58 29.4 27.77 28.5 25.84 28.69 29.58
## 2: 23.38 25.69 24.22 26.38 26.62 21.59 29.4 27.77 28.5 25.84 28.69 29.58
## 3: 23.38 25.69 24.22 26.38 26.62 21.59 29.4 27.77 28.5 25.84 28.69 29.58
## 4: 23.38 25.69 24.22 26.38 26.62 21.59 29.4 27.77 28.5 25.84 28.69 29.58
## 5: 23.38 25.69 24.22 26.38 26.62 21.59 29.4 27.77 28.5 25.84 28.70 29.58
## 6: 23.38 25.70 24.22 26.38 26.62 21.59 29.4 27.77 28.5 25.84 28.70 29.58
```

```
tail(da)
```

```
##   hue_index Bc1 Bc6 Bc8 Bc9  Bc11  Bc12  Bt2 Bt3  Bt4  Bt5  Bt7  Bt10
## 1:         44 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
## 2:         45 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
## 3:         46 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
## 4:         47 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
## 5:         48 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
```

```
## 6:      49 100 100 100 100 99.97 99.61 99.76 100 99.65 99.81 99.78 99.91
##      Nt1 Nc2      Nt3      Nc4 Nc5      Nt6 Nc7      Nt8 Nc9 Nt10 Nc11 Nt12 Jt1 Jt4
## 1: 99.96 100 99.99 99.99 100 99.98 100 99.92 100 100 99.99 99.99 99.97 99.99
## 2: 99.96 100 100.00 99.99 100 99.98 100 99.93 100 100 99.99 99.99 99.97 99.99
## 3: 99.97 100 100.00 99.99 100 99.99 100 99.94 100 100 99.99 99.99 99.97 99.99
## 4: 99.97 100 100.00 99.99 100 99.99 100 99.95 100 100 99.99 99.99 99.97 99.99
## 5: 99.97 100 100.00 99.99 100 99.99 100 99.95 100 100 99.99 99.99 99.97 99.99
## 6: 99.97 100 100.00 99.99 100 99.99 100 99.95 100 100 99.99 99.99 99.97 99.99
##      Jt7      Jt8      Jt9 Jt11      Jc2      Jc3 Jc5 Jc6      Jc10 Jc12
## 1: 99.99 99.99 99.98 99.98 99.99 99.99 100 100 99.99 100
## 2: 99.99 99.99 99.99 99.98 100.00 99.99 100 100 99.99 100
## 3: 99.99 100.00 99.99 99.99 100.00 100.00 100 100 99.99 100
## 4: 100.00 100.00 99.99 99.99 100.00 100.00 100 100 100.00 100
## 5: 100.00 100.00 99.99 99.99 100.00 100.00 100 100 100.00 100
## 6: 100.00 100.00 99.99 99.99 100.00 100.00 100 100 100.00 100
```

```
colnames(da)
```

```
## [1] "hue_index" "Bc1"      "Bc6"      "Bc8"      "Bc9"      "Bc11"
## [7] "Bc12"      "Bt2"      "Bt3"      "Bt4"      "Bt5"      "Bt7"
## [13] "Bt10"      "Nt1"      "Nc2"      "Nt3"      "Nc4"      "Nc5"
## [19] "Nt6"      "Nc7"      "Nt8"      "Nc9"      "Nt10"     "Nc11"
## [25] "Nt12"      "Jt1"      "Jt4"      "Jt7"      "Jt8"      "Jt9"
## [31] "Jt11"      "Jc2"      "Jc3"      "Jc5"      "Jc6"      "Jc10"
## [37] "Jc12"
```

```
#convert wide to long extract data attribute
#and create new columns
df <- (melt(da, id.vars=c("hue_index")))
df$block <- substring(df$variable,0,1)
df$treatment <- substring(df$variable,2,2)
df$id <- substring(df$variable,3,4)
head(df)
```

```
## hue_index variable value block treatment id
## 1      0      Bc1 23.71      B      c 1
## 2      1      Bc1 23.71      B      c 1
## 3      2      Bc1 23.71      B      c 1
## 4      3      Bc1 23.71      B      c 1
## 5      4      Bc1 23.71      B      c 1
## 6      5      Bc1 23.71      B      c 1
```

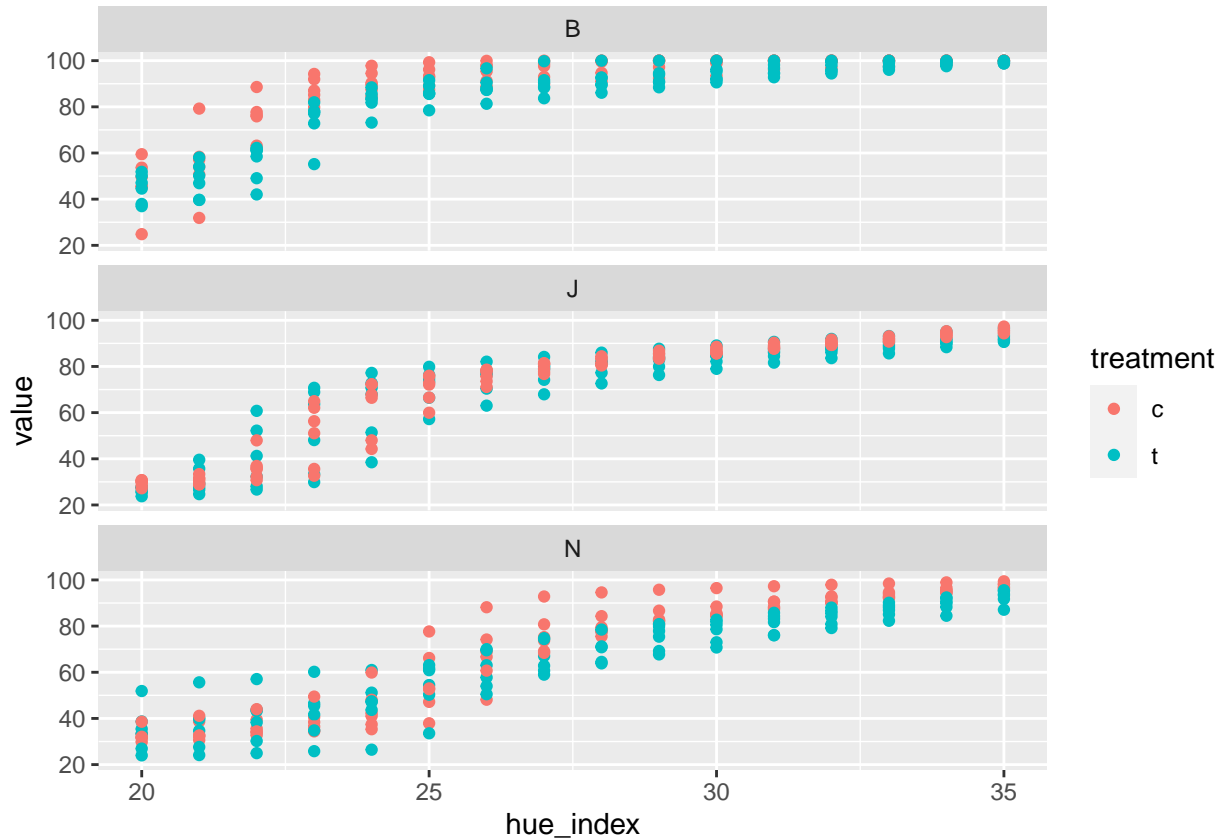
```
d_avo_raw <- df[,c("block", "treatment", "id", "hue_index", "value")]
dim(d_avo_raw)
```

```
## [1] 1800      5
```

The following figure shows both fixed effect for block and individual level Y axis shows percent  
[TODO]

```
d_avo_raw %>% ggplot(aes(x = hue_index, y = value, color=treatment)) +
  geom_point(aes(color = treatment)) + facet_wrap(~block,ncol = 1) + xlim(20,35)
```

```
## Warning: Removed 1224 rows containing missing values (geom_point).
```



## Get individual hue count data

TODO The higher the value of hue, the stronger the filter effect. For an example, For Bill, the background was black For Nobu and Justin, it was white. So, we also need to evaluate the incremental effect

```
## Get the length of data, hue_range
len <- dim(da)[2]

## empty matrix that will get the frequency data
avo_frequency <- as.matrix(0:49)

for (i in colnames(da)){
  if (i == "hue_index"){
  }
  else{
    ##Do something
    temp <- getIncre(as.matrix(da[[i]]))
  }
}
```

```

temp <- as.matrix(temp)
##get the increment
avo_frequency <- cbind(avo_frequency ,temp)
##start adding them
}
}

#now add column names
d_avo <- data.frame(avo_frequency)
colnames(d_avo) <- colnames(da)
head(d_avo)

```

```

##   hue_index Bc1 Bc6 Bc8 Bc9 Bc11 Bc12 Bt2 Bt3 Bt4 Bt5 Bt7 Bt10 Nt1 Nc2 Nt3
## 1         0  0  0  0  0 0.00 0.00 0.00  0 0.00 0.00 0.00 0.00 0.00  0  0
## 2         1  0  0  0  0 0.02 0.29 0.09  0 0.12 0.12 0.27 0.04 0.01  0  0
## 3         2  0  0  0  0 0.00 0.00 0.00  0 0.00 0.00 0.00 0.00 0.00  0  0
## 4         3  0  0  0  0 0.00 0.00 0.00  0 0.00 0.00 0.00 0.00 0.00  0  0
## 5         4  0  0  0  0 0.00 0.00 0.00  0 0.00 0.00 0.00 0.00 0.00  0  0
## 6         5  0  0  0  0 0.00 0.00 0.00  0 0.00 0.00 0.00 0.00 0.00  0  0
##   Nc4 Nc5 Nt6 Nc7 Nt8 Nc9 Nt10 Nc11 Nt12 Jt1 Jt4 Jt7 Jt8 Jt9 Jt11 Jc2 Jc3
## 1  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00  0 0.00  0  0
## 2  0  0 0.01  0 0.01  0 0.01 0.04  0 0.01 0.00  0 0.01  0 0.01  0  0
## 3  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00  0 0.00  0  0
## 4  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00  0 0.00  0  0
## 5  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00  0 0.00  0  0
## 6  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.01  0 0.00  0 0.00  0  0
##   Jc5 Jc6 Jc10 Jc12
## 1  0  0 0.00  0
## 2  0  0 0.00  0
## 3  0  0 0.00  0
## 4  0  0 0.00  0
## 5  0  0 0.01  0
## 6  0  0 0.00  0

```

- Now, d\_avo\_frequency contains frequency of pixels whose color changed when hue was incremented by 1

```

#convert wide to long extract data attribute
#and create new columns
dff <- (melt(d_avo, id.vars=c("hue_index")))
dff$block<- substring(dff$variable,0,1)
dff$treatment <- substring(dff$variable,2,2)
dff$id <- substring(dff$variable,3,4)
d_avo_frequency <- dff[,c("block","treatment","id","hue_index","value")]

```

## TODO: NEED TO CONVERT TO DENSITY PLOT

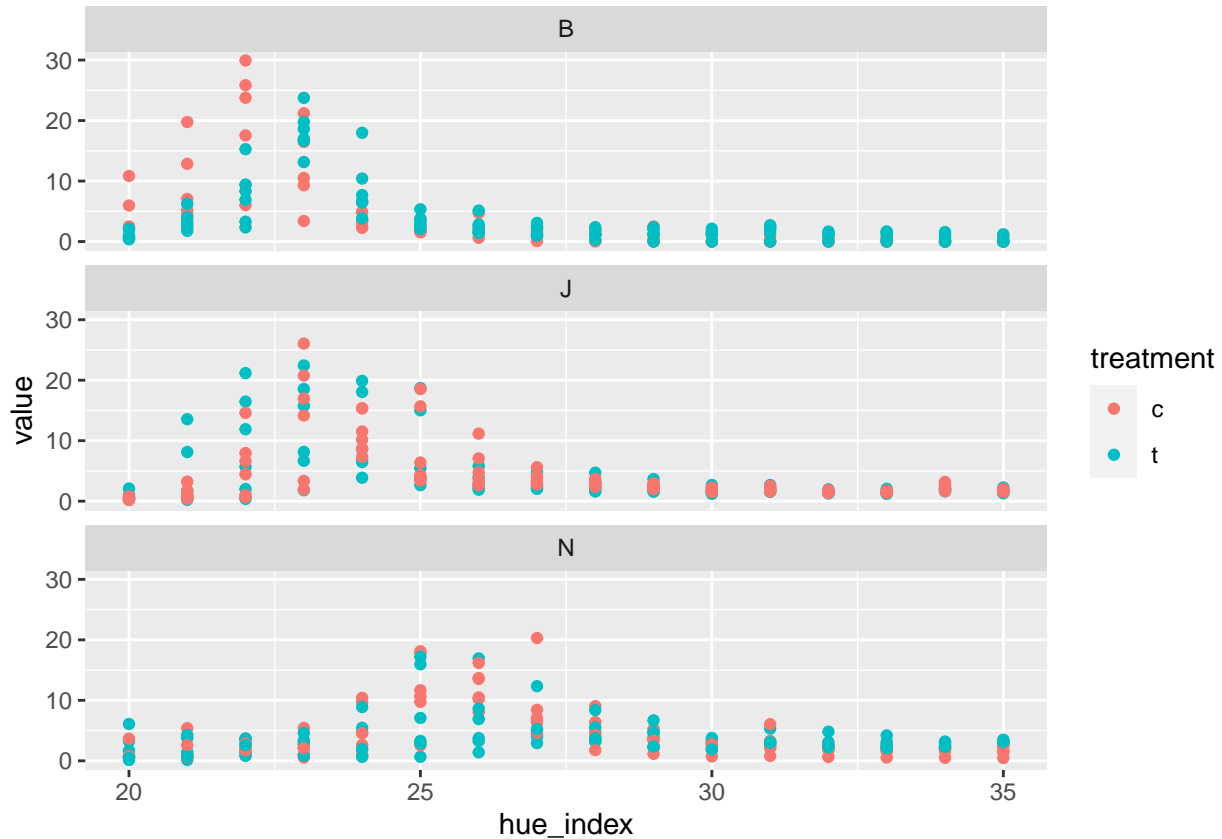
Color wise, N > J and B. [TODO] 20 HUE indicate percent of avocado whose that became black when hue was changed from 19 to 20. (really bad)

25 HUE indicate percent of avocado that turn black when hue was increased from 24 to 25. (still good)

30 HUE indicate percent of avocado that turn black when hue changed from 29 to 30.

```
d_avo_frequency %>% ggplot(aes(x = hue_index, y = value, color=treatment)) +  
  geom_point(aes(color = treatment)) + facet_wrap(~block,ncol = 1) + xlim(20,35)
```

```
## Warning: Removed 1224 rows containing missing values (geom_point).
```



Is color good indicator?

## Create avocado pdf

```
#now df_avo cotains percent of pixles whose color changed when  
head(d_avo)
```

```
##   hue_index Bc1 Bc6 Bc8 Bc9 Bc11 Bc12 Bt2 Bt3 Bt4 Bt5 Bt7 Bt10 Nt1 Nc2 Nt3  
## 1         0   0   0   0   0 0.00 0.00 0.00   0 0.00 0.00 0.00 0.00 0.00   0   0  
## 2         1   0   0   0   0 0.02 0.29 0.09   0 0.12 0.12 0.27 0.04 0.01   0   0  
## 3         2   0   0   0   0 0.00 0.00 0.00   0 0.00 0.00 0.00 0.00 0.00   0   0  
## 4         3   0   0   0   0 0.00 0.00 0.00   0 0.00 0.00 0.00 0.00 0.00   0   0  
## 5         4   0   0   0   0 0.00 0.00 0.00   0 0.00 0.00 0.00 0.00 0.00   0   0  
## 6         5   0   0   0   0 0.00 0.00 0.00   0 0.00 0.00 0.00 0.00 0.00   0   0  
##   Nc4 Nc5  Nt6 Nc7  Nt8 Nc9 Nt10 Nc11 Nt12  Jt1  Jt4 Jt7  Jt8 Jt9 Jt11 Jc2 Jc3
```

```
## 1  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00 0  0
## 2  0  0 0.01  0 0.01  0 0.01 0.04  0 0.01 0.00  0 0.01 0  0
## 3  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00 0  0
## 4  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00 0  0
## 5  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.00  0 0.00 0  0
## 6  0  0 0.00  0 0.00  0 0.00 0.00  0 0.00 0.01  0 0.00 0  0
##   Jc5 Jc6 Jc10 Jc12
## 1  0  0 0.00  0
## 2  0  0 0.00  0
## 3  0  0 0.00  0
## 4  0  0 0.00  0
## 5  0  0 0.01  0
## 6  0  0 0.00  0
```

*## empty matrix that will get the frequency data*

```
avo_pdf <- as.matrix(0:49)
```

```
for (i in colnames(d_avo)){
  if (i == "hue_index"){
  }
  else{
    ##Do something
    temp <- sum(d_avo[[i]])
    temp <- d_avo[[i]]/temp
    ##start adding them
    avo_pdf <- cbind(avo_pdf ,temp)
  }
}
```

*##now add column names*

```
d_avo_pdf <- data.frame(avo_pdf)
colnames(d_avo_pdf) <- colnames(da)
head(d_avo_pdf)
```

```
##   hue_index Bc1 Bc6 Bc8 Bc9          Bc11          Bc12          Bt2 Bt3
## 1         0  0  0  0  0 0.0000000000 0.0000000000 0.0000000000  0
## 2         1  0  0  0  0 0.0003219575 0.006109122 0.001422026  0
## 3         2  0  0  0  0 0.0000000000 0.0000000000 0.0000000000  0
## 4         3  0  0  0  0 0.0000000000 0.0000000000 0.0000000000  0
## 5         4  0  0  0  0 0.0000000000 0.0000000000 0.0000000000  0
## 6         5  0  0  0  0 0.0000000000 0.0000000000 0.0000000000  0
##          Bt4          Bt5          Bt7          Bt10          Nt1 Nc2 Nt3 Nc4 Nc5
## 1 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000  0  0  0  0
## 2 0.002397123 0.001863065 0.004893077 0.0007375991 0.0001391401  0  0  0  0
## 3 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000  0  0  0  0
## 4 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000  0  0  0  0
## 5 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000  0  0  0  0
## 6 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000  0  0  0  0
##          Nt6 Nc7          Nt8 Nc9          Nt10          Nc11 Nt12          Jt1
## 1 0.0000000000  0 0.0000000000  0 0.0000000000 0.0000000000  0 0.0000000000
## 2 0.0001435956  0 0.0001428163  0 0.000130719 0.0005719188  0 0.0001305483
## 3 0.0000000000  0 0.0000000000  0 0.0000000000 0.0000000000  0 0.0000000000
## 4 0.0000000000  0 0.0000000000  0 0.0000000000 0.0000000000  0 0.0000000000
## 5 0.0000000000  0 0.0000000000  0 0.0000000000 0.0000000000  0 0.0000000000
```

```
## 6 0.0000000000 0 0.0000000000 0 0.0000000000 0.0000000000 0 0.0000000000
##      Jt4 Jt7      Jt8 Jt9      Jt11 Jc2 Jc3 Jc5 Jc6      Jc10
## 1 0.0000000000 0 0.0000000000 0 0.0000000000 0 0 0 0 0.0000000000
## 2 0.0000000000 0 0.0001358142 0 0.0001275348 0 0 0 0 0.0000000000
## 3 0.0000000000 0 0.0000000000 0 0.0000000000 0 0 0 0 0.0000000000
## 4 0.0000000000 0 0.0000000000 0 0.0000000000 0 0 0 0 0.0000000000
## 5 0.0000000000 0 0.0000000000 0 0.0000000000 0 0 0 0 0.0001402328
## 6 0.0001345895 0 0.0000000000 0 0.0000000000 0 0 0 0 0.0000000000
##      Jc12
## 1      0
## 2      0
## 3      0
## 4      0
## 5      0
## 6      0
```

```
#convert wide to long extract data attribute
#and create new columns
dff <- (melt(d_avo_pdf, id.vars=c("hue_index")))
dff$block<- substring(dff$variable,0,1)
dff$treatment <- substring(dff$variable,2,2)
dff$id <- substring(dff$variable,3,4)
d_avo_pdf_long <- dff[,c("block","treatment","id","hue_index","value")]
head(d_avo_pdf_long)
```

```
##      block treatment id hue_index value
## 1      B          c 1          0      0
## 2      B          c 1          1      0
## 3      B          c 1          2      0
## 4      B          c 1          3      0
## 5      B          c 1          4      0
## 6      B          c 1          5      0
```

## Create sample data based on the pdf

TODO Need to create function

```
BT <- d_avo_pdf_long %>% filter(block=="B" & treatment == "t") %>%
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
BC <- d_avo_pdf_long %>% filter(block=="B" & treatment == "c") %>%
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
NT <- d_avo_pdf_long %>% filter(block=="N" & treatment == "t") %>%
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
NC <- d_avo_pdf_long %>% filter(block=="N" & treatment == "c") %>%  
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
JT <- d_avo_pdf_long %>% filter(block=="J" & treatment == "t") %>%  
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
JC <- d_avo_pdf_long %>% filter(block=="J" & treatment == "c") %>%  
  group_by(hue_index) %>% dplyr::summarize(Mean = mean(value, na.rm=TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
#treatment  
s1 <- get_ind_data(BT)  
t1 <- data.frame(block="B", control = "treatment", value = s1)  
  
s2 <- get_ind_data(JT)  
t2 <- data.frame(block="J", control = "treatment", value = s2)  
  
s3 <- get_ind_data(NT)  
t3 <- data.frame(block="N", control = "treatment", value = s3)  
  
three_treats <- rbind(t1,t2,t3)  
  
#control  
s4 <- get_ind_data(BC)  
t4 <- data.frame(block="B", control = "control", value = s4)  
  
s5 <- get_ind_data(JC)  
t5 <- data.frame(block="J", control = "control", value = s5)  
  
s6 <- get_ind_data(NC)  
t6 <- data.frame(block="N", control = "control", value = s6)  
three_control <- rbind(t4,t5,t6)  
  
data <- rbind(three_treats,three_control)  
  
p1 <- data %>% ggplot(.,aes(x=value)) +  
  geom_density(aes(fill=control),adjust=1.5,alpha=0.3) +  
  facet_wrap(~block, ncol = 1) +  
  xlim(20, 45) +  
  theme(  
    legend.position="top",  
    panel.spacing = unit(0.1, "lines"),  
    axis.ticks.x=element_blank(),  
    plot.title = element_text(hjust = 0.5)
```



```

    ) +
    ggtitle("Figure xx. Distribution of Avocao Hue") +
    xlab("Hue") + ylab("Density")

p2 <- data %>% ggplot(., aes(x=value, colour = control)) + stat_ecdf() +
  facet_wrap(~block, ncol = 1) +
  xlim(20, 45) +
  theme(
    legend.position="top",
    panel.spacing = unit(0.1, "lines"),
    axis.ticks.x=element_blank(),
    plot.title = element_text(hjust = 0.5)
  ) +
  ggtitle("Figure xx. Distribution of Avocao Hue") +
  xlab("Hue") + ylab("Density")

p1 | p2

```

## Warning: Removed 10 rows containing non-finite values (stat\_density).

## Warning: Removed 10 rows containing non-finite values (stat\_ecdf).

Figure xx. Distribution of Avocao Hu

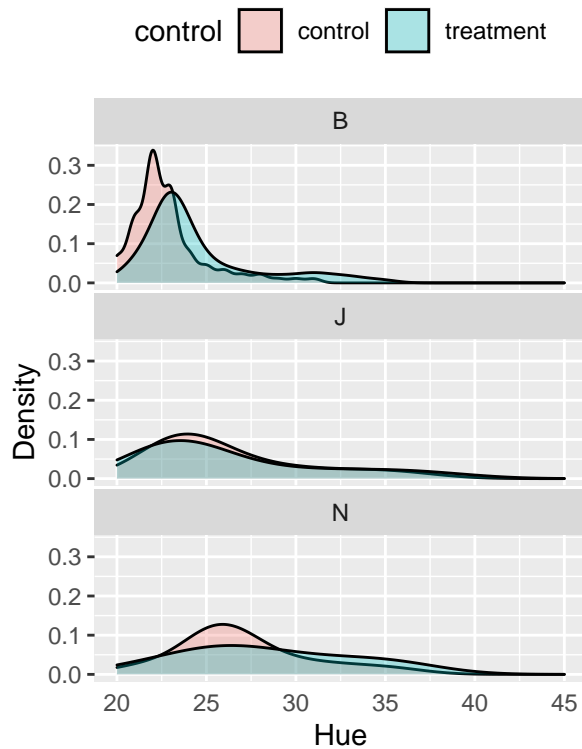
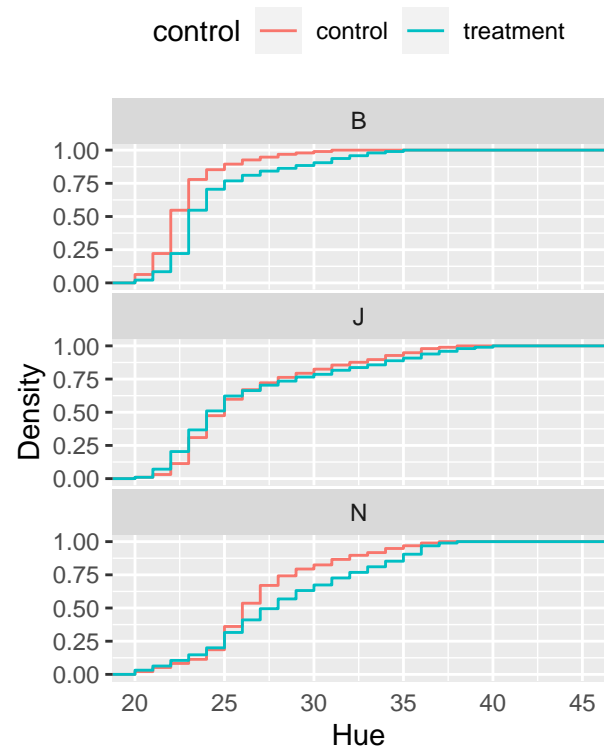


Figure xx. Distribution of Avocao Hue



```
#control <- getIncr(df1)
#treatment <- getIncr(df2)
control <- BT$Mean
treatment <- BC$Mean

#sharp null distribution
get_ks_permutation(BT$Mean,BC$Mean,5000)
```

10









































[illegible]

















































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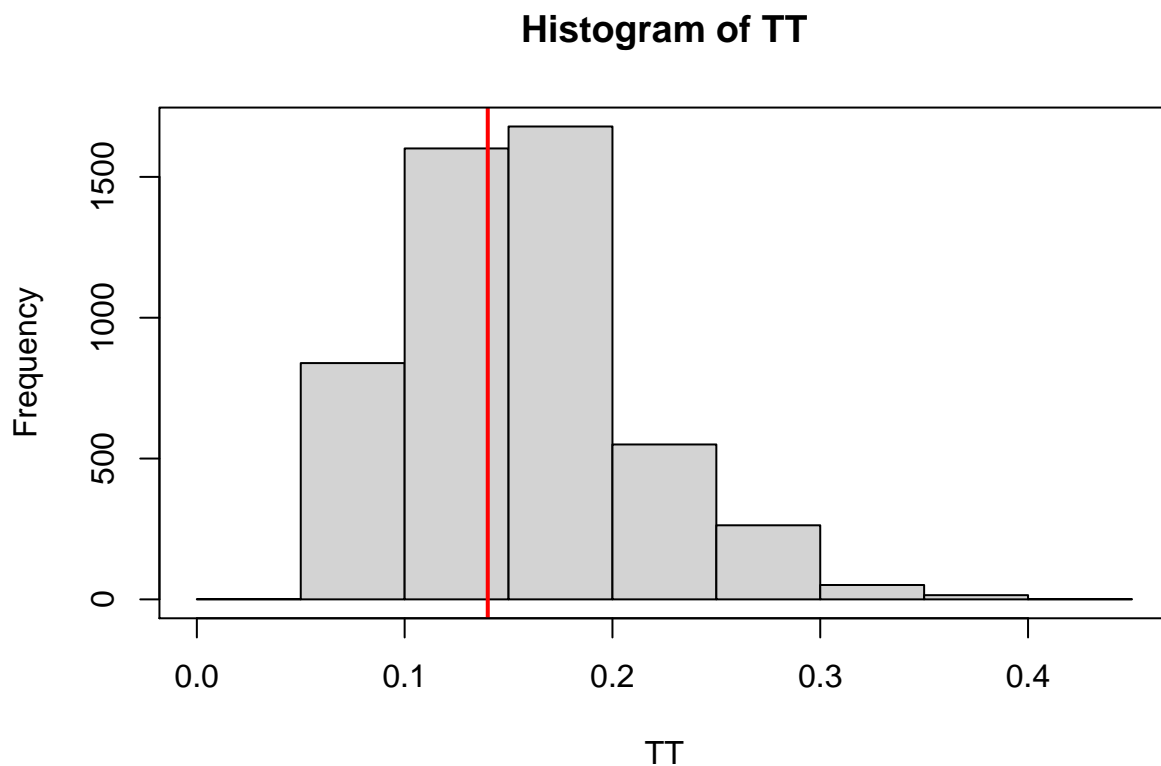




[illegible]



```
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
```



```
## [1] 0.5118
```

```
get_ks_permutation(JT$Mean, JC$Mean, 5000)
```

[illegible]



[illegible]









[illegible]



















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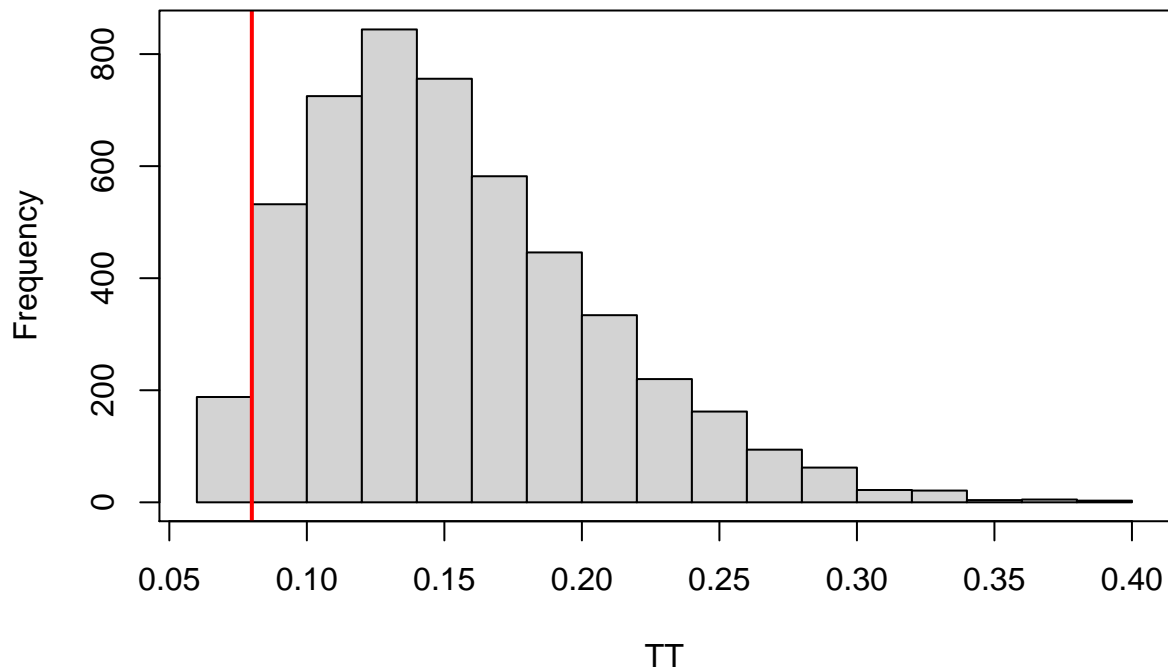
[illegible]





```
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
```

**Histogram of TT**



```
## [1] 0.9624
```

```
get_ks_permutation(NT$Mean,NC$Mean,5000)
```

```
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
```



[illegible]





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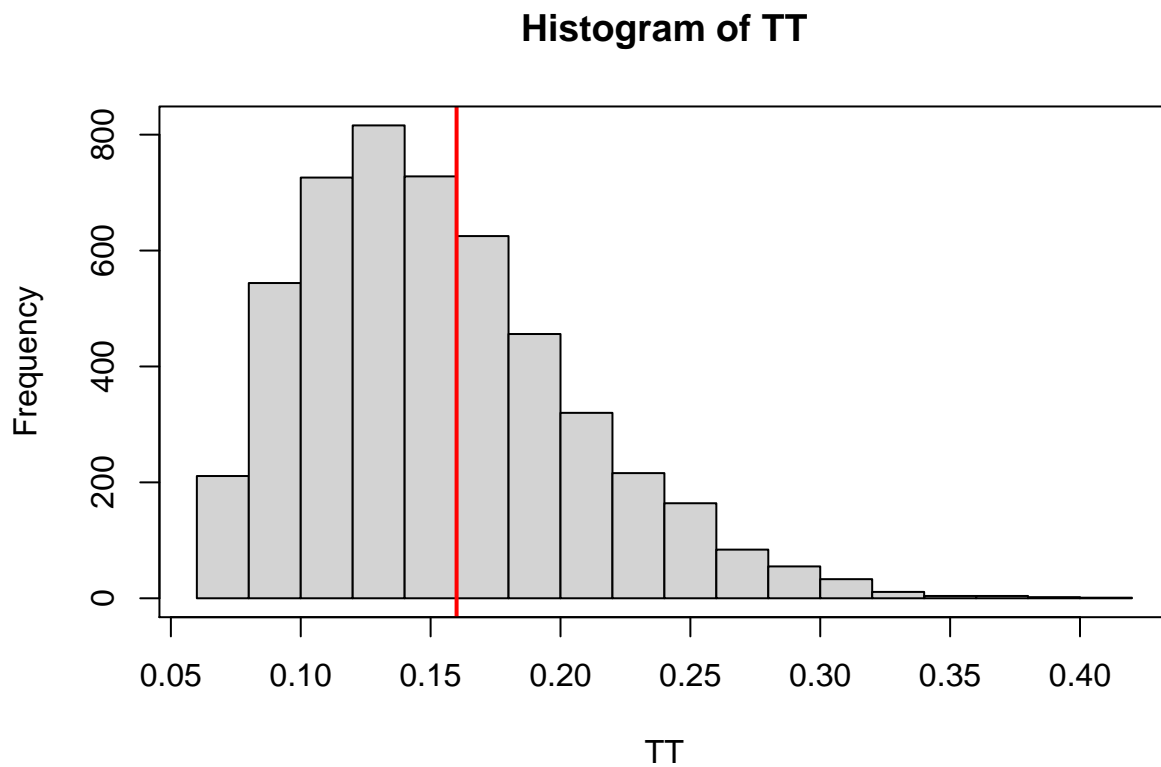
[illegible]







```
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
## Warning in ks.test(A, B): cannot compute exact p-value with ties
```



```
## [1] 0.395
```

```
Z <- c(control,treatment)
n <- length(control )
m <- length(treatment)
N <- length(Z)
```

## Measure 2

Abrupt change detection in HUE

```
#raw data converted to long format
head(d_avo_raw)
```

```
##   block treatment id hue_index value
## 1      B         c 1          0 23.71
```

```
## 2      B      c  1      1 23.71
## 3      B      c  1      2 23.71
## 4      B      c  1      3 23.71
## 5      B      c  1      4 23.71
## 6      B      c  1      5 23.71
```

```
#arrange the data by block, treatment, id and hue_index
d <- as.data.table(d_avo_raw)
db <- d[order(rank(block), treatment, id, hue_index)]
head(db)
```

```
##      block treatment id hue_index value
## 1:      B      c  1      0 23.71
## 2:      B      c  1      1 23.71
## 3:      B      c  1      2 23.71
## 4:      B      c  1      3 23.71
## 5:      B      c  1      4 23.71
## 6:      B      c  1      5 23.71
```

```
b_result <- data.frame(block = numeric(0), avocado_number= numeric(0),
                       treatment = numeric(0),
                       hue_turn = numeric(0) )

#has 160 rows
for (val in 1:36)
{
  start <- 1 + (val-1)*50
  end <- (50*val)
  #get the subject information
  val_block <- db[start,block]
  val_subject <- db[start,id]
  val_treat <- db[start,treatment]

  # # print(paste(start,":",end))
  d_temp <- db[start:end,]
  hue_turn <- getChangeHUE(d_temp)
  b_result[val,] <- c(val_block, val_subject, val_treat, hue_turn)
}
```

```
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0 23.71
## 2      0 23.71
## 3      0 23.71
## 4      0 23.71
## 5      0 23.71
## 6      0 23.71
## 7      0 23.71
## 8      0 23.71
```



```

## 9      0 23.71
## 10     0 23.71
## 11     0 23.71
## 12     0 23.71
## 13     0 23.71
## 14     0 23.71
## 15     1 23.71
## 16     0 23.72
## 17     1 23.72
## 18     1 23.74
## 19     1 23.81
## 20     1 24.21
## 21     1 24.84
## 22     1 31.88
## 23     1 61.81
## 24     1 83.02
## 25     1 89.56
## 26     1 93.34
## 27     1 98.07
## 28     1 99.85
## 29     1 99.99
## 30     0 100.00
## 31     0 100.00
## 32     0 100.00
## 33     0 100.00
## 34     0 100.00
## 35     0 100.00
## 36     0 100.00
## 37     0 100.00
## 38     0 100.00
## 39     0 100.00
## 40     0 100.00
## 41     0 100.00
## 42     0 100.00
## 43     0 100.00
## 44     0 100.00
## 45     0 100.00
## 46     0 100.00
## 47     0 100.00
## 48     0 100.00
## 49     0 100.00
## 50     NA 100.00
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 37.87
## 2      0.002 37.87
## 3      0.002 37.87
## 4      0.000 37.87

```

```

## 5      0.004 37.87
## 6      0.020 37.87
## 7      0.404 37.88
## 8      0.096 37.89
## 9      0.044 37.89
## 10     0.006 37.89
## 11     0.000 37.89
## 12     0.004 37.89
## 13     0.012 37.89
## 14     0.974 37.89
## 15     0.000 37.97
## 16     0.240 37.97
## 17     0.256 37.98
## 18     1.000 38.00
## 19     1.000 38.18
## 20     1.000 39.53
## 21     1.000 45.49
## 22     1.000 58.34
## 23     1.000 75.88
## 24     1.000 85.18
## 25     1.000 87.44
## 26     1.000 89.21
## 27     1.000 91.20
## 28     1.000 92.96
## 29     1.000 94.71
## 30     1.000 97.20
## 31     1.000 98.77
## 32     1.000 99.74
## 33     0.000 99.97
## 34     0.002 99.97
## 35     0.000 99.97
## 36     0.000 99.97
## 37     0.000 99.97
## 38     0.000 99.97
## 39     0.000 99.97
## 40     0.000 99.97
## 41     0.000 99.97
## 42     0.000 99.97
## 43     0.000 99.97
## 44     0.000 99.97
## 45     0.000 99.97
## 46     0.000 99.97
## 47     0.000 99.97
## 48     0.000 99.97
## 49     0.000 99.97
## 50      NA 99.97
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1

```

## 1	0.004	52.59
## 2	0.006	52.60
## 3	0.004	52.60
## 4	0.004	52.60
## 5	0.004	52.60
## 6	0.004	52.60
## 7	0.014	52.60
## 8	0.018	52.61
## 9	0.010	52.61
## 10	0.004	52.62
## 11	0.010	52.62
## 12	0.016	52.62
## 13	0.012	52.63
## 14	0.046	52.64
## 15	0.032	52.66
## 16	0.058	52.67
## 17	0.060	52.71
## 18	0.096	52.74
## 19	0.074	52.81
## 20	0.034	52.87
## 21	1.000	52.91
## 22	1.000	57.16
## 23	1.000	63.18
## 24	1.000	79.82
## 25	0.982	84.73
## 26	0.252	87.96
## 27	0.748	88.49
## 28	0.216	90.22
## 29	0.866	90.74
## 30	0.048	92.82
## 31	1.000	92.89
## 32	0.076	96.70
## 33	0.376	96.81
## 34	0.418	97.39
## 35	0.520	98.36
## 36	0.136	99.28
## 37	0.038	99.44
## 38	0.020	99.47
## 39	0.010	99.48
## 40	0.002	99.48
## 41	0.008	99.48
## 42	0.006	99.49
## 43	0.000	99.49
## 44	0.002	99.49
## 45	0.006	99.49
## 46	0.002	99.49
## 47	0.000	99.49
## 48	0.000	99.49
## 49	0.000	99.49
## 50	NA	99.49
##		
##		
##	Bayesian Change Point (bcp) summary:	
##		

```

##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1          0  45.27
## 2          0  45.27
## 3          0  45.27
## 4          0  45.27
## 5          0  45.27
## 6          0  45.27
## 7          0  45.27
## 8          0  45.27
## 9          0  45.27
## 10         0  45.27
## 11         0  45.27
## 12         1  45.27
## 13         1  45.30
## 14         1  45.31
## 15         1  45.42
## 16         1  45.46
## 17         1  45.60
## 18         1  45.94
## 19         1  46.30
## 20         1  47.10
## 21         1  49.60
## 22         1  53.99
## 23         1  77.76
## 24         1  94.24
## 25         1  97.79
## 26         1  99.31
## 27         1  99.92
## 28         1  99.99
## 29         0 100.00
## 30         0 100.00
## 31         0 100.00
## 32         0 100.00
## 33         0 100.00
## 34         0 100.00
## 35         0 100.00
## 36         0 100.00
## 37         0 100.00
## 38         0 100.00
## 39         0 100.00
## 40         0 100.00
## 41         0 100.00
## 42         0 100.00
## 43         0 100.00
## 44         0 100.00
## 45         0 100.00
## 46         0 100.00
## 47         0 100.00
## 48         0 100.00
## 49         0 100.00
## 50        NA 100.00

```

```

##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1          0  43.63
## 2          0  43.63
## 3          0  43.63
## 4          0  43.63
## 5          0  43.63
## 6          0  43.63
## 7          0  43.63
## 8          0  43.63
## 9          0  43.63
## 10         0  43.63
## 11         0  43.63
## 12         1  43.63
## 13         1  43.64
## 14         1  43.65
## 15         1  43.70
## 16         1  43.76
## 17         1  43.82
## 18         1  44.21
## 19         1  44.39
## 20         1  44.78
## 21         1  45.49
## 22         1  50.65
## 23         1  76.50
## 24         1  87.01
## 25         1  90.38
## 26         1  92.79
## 27         1  95.39
## 28         1  97.66
## 29         1  99.55
## 30         1  99.98
## 31         0 100.00
## 32         0 100.00
## 33         0 100.00
## 34         0 100.00
## 35         0 100.00
## 36         0 100.00
## 37         0 100.00
## 38         0 100.00
## 39         0 100.00
## 40         0 100.00
## 41         0 100.00
## 42         0 100.00
## 43         0 100.00
## 44         0 100.00
## 45         0 100.00
## 46         0 100.00

```

```

## 47          0 100.00
## 48          0 100.00
## 49          0 100.00
## 50         NA 100.00
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1          0 41.31
## 2          0 41.31
## 3          0 41.31
## 4          0 41.31
## 5          0 41.31
## 6          1 41.31
## 7          0 41.32
## 8          0 41.32
## 9          1 41.32
## 10         1 41.33
## 11         1 41.34
## 12         1 41.35
## 13         1 41.38
## 14         1 41.44
## 15         1 41.55
## 16         1 41.71
## 17         1 42.06
## 18         1 43.07
## 19         1 44.98
## 20         1 48.63
## 21         1 59.47
## 22         1 79.23
## 23         1 88.58
## 24         1 91.97
## 25         1 94.51
## 26         1 96.15
## 27         1 97.68
## 28         1 98.67
## 29         1 99.92
## 30         0 100.00
## 31         0 100.00
## 32         0 100.00
## 33         0 100.00
## 34         0 100.00
## 35         0 100.00
## 36         0 100.00
## 37         0 100.00
## 38         0 100.00
## 39         0 100.00
## 40         0 100.00
## 41         0 100.00
## 42         0 100.00

```

```

## 43      0 100.00
## 44      0 100.00
## 45      0 100.00
## 46      0 100.00
## 47      0 100.00
## 48      0 100.00
## 49      0 100.00
## 50     NA 100.00
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 45.89
## 2      0.002 45.89
## 3      0.002 45.89
## 4      0.002 45.89
## 5      0.002 45.89
## 6      0.004 45.89
## 7      0.010 45.89
## 8      0.016 45.89
## 9      0.004 45.90
## 10     0.004 45.90
## 11     0.010 45.90
## 12     0.020 45.91
## 13     0.018 45.93
## 14     0.592 45.95
## 15     0.286 46.74
## 16     0.058 47.14
## 17     0.078 47.22
## 18     0.028 47.32
## 19     0.028 47.35
## 20     0.956 47.39
## 21     1.000 50.01
## 22     1.000 54.07
## 23     1.000 60.97
## 24     1.000 77.95
## 25     1.000 85.63
## 26     0.282 89.66
## 27     0.646 90.24
## 28     0.316 91.73
## 29     0.682 92.45
## 30     0.358 94.14
## 31     0.778 95.03
## 32     0.240 97.08
## 33     0.890 97.66
## 34     0.038 99.68
## 35     0.016 99.73
## 36     0.014 99.74
## 37     0.010 99.75
## 38     0.012 99.76

```

```

## 39      0.008 99.76
## 40      0.002 99.76
## 41      0.006 99.76
## 42      0.008 99.77
## 43      0.002 99.77
## 44      0.002 99.77
## 45      0.004 99.77
## 46      0.002 99.77
## 47      0.000 99.77
## 48      0.000 99.77
## 49      0.000 99.77
## 50      NA 99.77
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 36.58
## 2      0.002 36.58
## 3      0.004 36.58
## 4      0.002 36.58
## 5      0.008 36.58
## 6      0.032 36.58
## 7      0.604 36.59
## 8      0.090 36.74
## 9      0.020 36.76
## 10     0.020 36.76
## 11     0.030 36.77
## 12     0.028 36.78
## 13     0.048 36.79
## 14     0.366 36.80
## 15     0.112 36.90
## 16     0.096 36.94
## 17     0.350 36.98
## 18     0.420 37.15
## 19     0.352 37.37
## 20     0.452 37.56
## 21     1.000 37.79
## 22     1.000 39.70
## 23     1.000 42.04
## 24     1.000 55.18
## 25     1.000 73.16
## 26     1.000 78.49
## 27     1.000 81.33
## 28     1.000 83.72
## 29     1.000 86.10
## 30     1.000 88.46
## 31     1.000 90.59
## 32     0.998 92.80
## 33     1.000 94.45
## 34     1.000 96.03

```



```

## 35      0.996 97.60
## 36      0.990 98.80
## 37      0.142 99.66
## 38      0.040 99.70
## 39      0.014 99.71
## 40      0.004 99.71
## 41      0.016 99.71
## 42      0.006 99.71
## 43      0.002 99.71
## 44      0.002 99.71
## 45      0.002 99.71
## 46      0.002 99.71
## 47      0.000 99.71
## 48      0.000 99.71
## 49      0.000 99.71
## 50      NA 99.71
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 40.10
## 2      0.000 40.10
## 3      0.000 40.10
## 4      0.000 40.10
## 5      0.000 40.10
## 6      0.000 40.10
## 7      0.000 40.10
## 8      0.000 40.10
## 9      0.000 40.10
## 10     1.000 40.10
## 11     0.000 40.11
## 12     1.000 40.11
## 13     0.000 40.14
## 14     1.000 40.14
## 15     1.000 40.26
## 16     1.000 40.34
## 17     1.000 40.48
## 18     1.000 41.22
## 19     1.000 41.67
## 20     1.000 42.56
## 21     1.000 44.58
## 22     1.000 46.92
## 23     1.000 62.19
## 24     1.000 81.96
## 25     1.000 88.42
## 26     1.000 91.55
## 27     1.000 96.67
## 28     1.000 99.75
## 29     0.000 100.00
## 30     0.000 100.00

```

```

## 31      0.000 100.00
## 32      0.002 100.00
## 33      0.000 100.00
## 34      0.000 100.00
## 35      0.000 100.00
## 36      0.000 100.00
## 37      0.000 100.00
## 38      0.000 100.00
## 39      0.000 100.00
## 40      0.000 100.00
## 41      0.000 100.00
## 42      0.000 100.00
## 43      0.000 100.00
## 44      0.000 100.00
## 45      0.000 100.00
## 46      0.000 100.00
## 47      0.000 100.00
## 48      0.000 100.00
## 49      0.000 100.00
## 50      NA 100.00
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 50.07
## 2      0.004 50.07
## 3      0.010 50.08
## 4      0.004 50.08
## 5      0.006 50.08
## 6      0.010 50.09
## 7      0.034 50.10
## 8      0.026 50.12
## 9      0.036 50.14
## 10     0.014 50.17
## 11     0.028 50.18
## 12     0.034 50.21
## 13     0.088 50.24
## 14     0.110 50.33
## 15     0.134 50.44
## 16     0.058 50.58
## 17     0.058 50.64
## 18     0.030 50.71
## 19     0.018 50.74
## 20     0.014 50.76
## 21     1.000 50.78
## 22     0.434 58.98
## 23     1.000 60.41
## 24     0.576 78.79
## 25     0.980 81.04
## 26     0.234 86.61

```

```

## 27      0.250 87.26
## 28      0.492 87.97
## 29      0.386 89.62
## 30      0.060 90.71
## 31      0.954 90.91
## 32      0.072 95.28
## 33      0.704 95.49
## 34      0.324 98.01
## 35      0.100 98.98
## 36      0.072 99.13
## 37      0.110 99.23
## 38      0.030 99.35
## 39      0.014 99.38
## 40      0.008 99.39
## 41      0.010 99.39
## 42      0.008 99.40
## 43      0.004 99.40
## 44      0.004 99.40
## 45      0.006 99.41
## 46      0.002 99.41
## 47      0.000 99.41
## 48      0.000 99.41
## 49      0.002 99.41
## 50      NA 99.41
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.094 35.52
## 2      0.010 35.54
## 3      0.006 35.54
## 4      0.006 35.54
## 5      0.004 35.54
## 6      0.010 35.54
## 7      0.046 35.54
## 8      0.030 35.54
## 9      0.014 35.54
## 10     0.012 35.54
## 11     0.034 35.55
## 12     0.064 35.55
## 13     0.014 35.56
## 14     0.592 35.56
## 15     0.264 35.67
## 16     0.090 35.73
## 17     0.514 35.76
## 18     0.348 35.88
## 19     0.894 35.98
## 20     1.000 36.32
## 21     1.000 36.97
## 22     1.000 39.66

```

```

## 23      1.000 49.08
## 24      1.000 72.83
## 25      1.000 83.24
## 26      1.000 85.83
## 27      1.000 88.17
## 28      1.000 90.51
## 29      1.000 92.61
## 30      1.000 94.56
## 31      1.000 96.19
## 32      1.000 98.15
## 33      1.000 99.37
## 34      0.002 99.79
## 35      0.000 99.80
## 36      0.002 99.80
## 37      0.004 99.80
## 38      0.000 99.80
## 39      0.000 99.80
## 40      0.000 99.80
## 41      0.000 99.80
## 42      0.000 99.80
## 43      0.000 99.80
## 44      0.000 99.80
## 45      0.002 99.80
## 46      0.000 99.80
## 47      0.000 99.80
## 48      0.000 99.80
## 49      0.000 99.80
## 50      NA 99.80
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.006 44.97
## 2      0.004 44.97
## 3      0.004 44.97
## 4      0.002 44.97
## 5      0.002 44.97
## 6      0.004 44.97
## 7      0.002 44.97
## 8      0.006 44.97
## 9      0.002 44.97
## 10     0.004 44.98
## 11     0.004 44.98
## 12     0.004 44.98
## 13     0.004 44.98
## 14     0.012 44.98
## 15     0.050 44.99
## 16     0.020 45.00
## 17     0.038 45.02
## 18     0.086 45.05

```

```

## 19      0.650 45.16
## 20      0.228 46.14
## 21      0.974 46.58
## 22      1.000 50.12
## 23      1.000 58.51
## 24      1.000 77.12
## 25      0.758 84.08
## 26      0.378 86.11
## 27      0.722 87.14
## 28      0.236 88.96
## 29      0.804 89.52
## 30      0.094 91.37
## 31      0.996 91.52
## 32      0.086 95.13
## 33      0.830 95.24
## 34      0.362 97.34
## 35      0.716 98.37
## 36      0.010 99.70
## 37      0.002 99.71
## 38      0.008 99.71
## 39      0.006 99.71
## 40      0.002 99.71
## 41      0.004 99.71
## 42      0.002 99.71
## 43      0.000 99.71
## 44      0.002 99.71
## 45      0.002 99.71
## 46      0.002 99.71
## 47      0.000 99.71
## 48      0.000 99.71
## 49      0.000 99.71
## 50      NA 99.71
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 28.72
## 2      0.000 28.72
## 3      0.000 28.72
## 4      0.002 28.72
## 5      0.000 28.72
## 6      0.002 28.72
## 7      0.000 28.72
## 8      0.002 28.72
## 9      0.000 28.72
## 10     0.002 28.72
## 11     0.002 28.72
## 12     0.002 28.72
## 13     0.006 28.72
## 14     0.046 28.72

```

```

## 15      0.088 28.73
## 16      0.500 28.74
## 17      0.320 28.86
## 18      0.684 28.99
## 19      0.156 29.25
## 20      0.856 29.31
## 21      0.792 29.72
## 22      0.982 30.07
## 23      1.000 30.74
## 24      1.000 32.67
## 25      1.000 48.01
## 26      1.000 66.53
## 27      1.000 73.60
## 28      1.000 77.71
## 29      1.000 80.83
## 30      1.000 83.69
## 31      1.000 85.68
## 32      1.000 88.21
## 33      1.000 90.07
## 34      1.000 91.55
## 35      1.000 94.02
## 36      1.000 95.55
## 37      0.998 98.09
## 38      1.000 99.06
## 39      0.022 99.97
## 40      0.010 99.97
## 41      0.004 99.98
## 42      0.002 99.98
## 43      0.000 99.98
## 44      0.000 99.98
## 45      0.002 99.98
## 46      0.000 99.98
## 47      0.000 99.98
## 48      0.000 99.98
## 49      0.000 99.98
## 50      NA 99.98
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 29.61
## 2      0.000 29.61
## 3      0.000 29.61
## 4      0.002 29.61
## 5      0.000 29.61
## 6      0.002 29.61
## 7      0.000 29.61
## 8      0.002 29.61
## 9      0.000 29.61
## 10     0.000 29.61

```

```

## 11      0.000 29.61
## 12      0.000 29.61
## 13      0.008 29.61
## 14      0.010 29.61
## 15      0.198 29.61
## 16      0.080 29.64
## 17      0.618 29.66
## 18      0.472 29.90
## 19      0.524 30.13
## 20      0.658 30.39
## 21      0.630 30.79
## 22      0.994 31.15
## 23      1.000 32.27
## 24      1.000 35.61
## 25      1.000 44.28
## 26      1.000 59.96
## 27      1.000 71.13
## 28      1.000 76.75
## 29      1.000 80.42
## 30      1.000 83.37
## 31      1.000 85.65
## 32      1.000 87.66
## 33      1.000 89.33
## 34      1.000 91.01
## 35      1.000 93.07
## 36      1.000 94.71
## 37      0.994 97.16
## 38      0.998 98.45
## 39      0.762 99.55
## 40      0.230 99.91
## 41      0.012 99.97
## 42      0.004 99.97
## 43      0.000 99.97
## 44      0.000 99.97
## 45      0.002 99.97
## 46      0.002 99.97
## 47      0.000 99.97
## 48      0.000 99.97
## 49      0.000 99.97
## 50      NA 99.97
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 29.59
## 2      0.004 29.59
## 3      0.002 29.60
## 4      0.002 29.60
## 5      0.002 29.60
## 6      0.004 29.60

```

```

## 7      0.002 29.60
## 8      0.006 29.60
## 9      0.002 29.60
## 10     0.002 29.60
## 11     0.004 29.60
## 12     0.002 29.60
## 13     0.000 29.60
## 14     0.008 29.60
## 15     0.018 29.61
## 16     0.008 29.62
## 17     0.034 29.63
## 18     0.040 29.66
## 19     0.068 29.71
## 20     0.058 29.80
## 21     0.042 29.90
## 22     0.984 30.02
## 23     1.000 36.02
## 24     1.000 62.10
## 25     0.544 73.16
## 26     0.444 75.68
## 27     0.636 78.13
## 28     0.366 81.55
## 29     0.554 83.37
## 30     0.308 85.99
## 31     0.486 87.41
## 32     0.280 89.38
## 33     0.332 90.47
## 34     0.508 91.83
## 35     0.252 94.04
## 36     0.604 95.06
## 37     0.308 97.98
## 38     0.248 99.10
## 39     0.024 99.71
## 40     0.008 99.75
## 41     0.014 99.76
## 42     0.010 99.77
## 43     0.002 99.78
## 44     0.002 99.78
## 45     0.006 99.78
## 46     0.002 99.78
## 47     0.000 99.78
## 48     0.000 99.78
## 49     0.000 99.78
## 50      NA 99.78
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 27.83
## 2      0.002 27.83

```



## 3	0.000	27.83
## 4	0.002	27.83
## 5	0.000	27.83
## 6	0.004	27.83
## 7	0.002	27.83
## 8	0.002	27.83
## 9	0.000	27.83
## 10	0.004	27.83
## 11	0.000	27.83
## 12	0.002	27.83
## 13	0.002	27.83
## 14	0.028	27.83
## 15	0.068	27.83
## 16	0.328	27.84
## 17	0.168	27.91
## 18	0.182	27.96
## 19	0.368	28.01
## 20	0.186	28.12
## 21	0.646	28.17
## 22	1.000	28.57
## 23	1.000	35.52
## 24	1.000	56.28
## 25	0.936	67.95
## 26	0.926	72.13
## 27	0.910	75.69
## 28	0.856	79.11
## 29	0.870	81.77
## 30	0.740	84.10
## 31	0.942	85.59
## 32	0.730	88.13
## 33	0.766	89.29
## 34	0.908	90.60
## 35	0.710	92.86
## 36	0.930	94.15
## 37	0.710	96.61
## 38	0.904	97.69
## 39	0.646	99.37
## 40	0.586	99.73
## 41	0.022	99.93
## 42	0.006	99.94
## 43	0.000	99.94
## 44	0.000	99.94
## 45	0.002	99.94
## 46	0.000	99.94
## 47	0.000	99.94
## 48	0.000	99.94
## 49	0.000	99.94
## 50	NA	99.94

##

##

## Bayesian Change Point (bcp) summary:

##

##

## Probability of a change in mean and posterior means:

```

##
##      Probability      X1
## 1      0.002 28.66
## 2      0.004 28.66
## 3      0.002 28.66
## 4      0.002 28.66
## 5      0.002 28.66
## 6      0.004 28.66
## 7      0.002 28.67
## 8      0.006 28.67
## 9      0.002 28.67
## 10     0.002 28.67
## 11     0.002 28.67
## 12     0.002 28.67
## 13     0.000 28.67
## 14     0.006 28.67
## 15     0.012 28.67
## 16     0.006 28.68
## 17     0.024 28.68
## 18     0.018 28.70
## 19     0.028 28.72
## 20     0.088 28.76
## 21     0.904 29.02
## 22     1.000 33.19
## 23     1.000 47.98
## 24     0.994 64.97
## 25     0.804 72.66
## 26     0.296 76.59
## 27     0.762 77.99
## 28     0.506 81.86
## 29     0.570 84.27
## 30     0.388 86.95
## 31     0.488 88.54
## 32     0.346 90.41
## 33     0.274 91.70
## 34     0.606 92.76
## 35     0.168 94.97
## 36     0.848 95.70
## 37     0.098 99.52
## 38     0.032 99.77
## 39     0.010 99.82
## 40     0.004 99.83
## 41     0.006 99.83
## 42     0.006 99.84
## 43     0.000 99.84
## 44     0.002 99.84
## 45     0.002 99.84
## 46     0.002 99.84
## 47     0.000 99.84
## 48     0.000 99.84
## 49     0.000 99.84
## 50      NA 99.84
##
##

```

```

## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 25.85
## 2      0.000 25.85
## 3      0.000 25.85
## 4      0.000 25.85
## 5      0.000 25.85
## 6      0.000 25.85
## 7      0.000 25.85
## 8      0.000 25.85
## 9      0.000 25.85
## 10     0.000 25.85
## 11     0.000 25.85
## 12     0.008 25.85
## 13     0.052 25.85
## 14     0.232 25.85
## 15     0.388 25.86
## 16     0.628 25.90
## 17     0.690 25.99
## 18     1.000 26.08
## 19     1.000 26.32
## 20     1.000 26.65
## 21     1.000 27.24
## 22     1.000 28.96
## 23     1.000 36.91
## 24     1.000 51.07
## 25     1.000 66.43
## 26     1.000 72.82
## 27     1.000 77.57
## 28     1.000 80.97
## 29     1.000 83.33
## 30     1.000 85.30
## 31     1.000 86.80
## 32     1.000 88.64
## 33     1.000 90.34
## 34     1.000 92.07
## 35     1.000 95.26
## 36     1.000 97.28
## 37     1.000 99.53
## 38     0.970 99.84
## 39     0.098 99.99
## 40     0.012 99.99
## 41     0.000 99.99
## 42     0.004 99.99
## 43     0.000 99.99
## 44     0.000 99.99
## 45     0.002 99.99
## 46     0.000 99.99
## 47     0.000 99.99
## 48     0.000 99.99

```

```

## 49      0.000 99.99
## 50      NA 99.99
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 23.57
## 2      0.004 23.57
## 3      0.002 23.57
## 4      0.002 23.57
## 5      0.002 23.57
## 6      0.004 23.57
## 7      0.002 23.57
## 8      0.006 23.57
## 9      0.002 23.57
## 10     0.002 23.57
## 11     0.002 23.57
## 12     0.002 23.57
## 13     0.000 23.57
## 14     0.004 23.57
## 15     0.012 23.58
## 16     0.004 23.58
## 17     0.018 23.59
## 18     0.008 23.60
## 19     0.026 23.61
## 20     0.114 23.65
## 21     1.000 23.94
## 22     1.000 39.59
## 23     0.994 60.79
## 24     0.248 70.36
## 25     0.892 71.57
## 26     0.100 77.35
## 27     0.582 77.79
## 28     0.316 80.44
## 29     0.336 81.95
## 30     0.220 83.34
## 31     0.524 84.25
## 32     0.318 86.65
## 33     0.204 88.05
## 34     0.538 88.92
## 35     0.240 91.31
## 36     0.674 92.53
## 37     0.080 95.72
## 38     0.530 96.12
## 39     0.398 98.40
## 40     0.030 99.69
## 41     0.008 99.77
## 42     0.006 99.78
## 43     0.002 99.78
## 44     0.002 99.78

```

```

## 45      0.006 99.78
## 46      0.002 99.79
## 47      0.000 99.79
## 48      0.000 99.79
## 49      0.002 99.79
## 50      NA 99.79
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 21.82
## 2      0.004 21.82
## 3      0.004 21.82
## 4      0.004 21.82
## 5      0.002 21.82
## 6      0.004 21.82
## 7      0.002 21.82
## 8      0.006 21.82
## 9      0.002 21.83
## 10     0.006 21.83
## 11     0.008 21.83
## 12     0.008 21.84
## 13     0.010 21.84
## 14     0.016 21.85
## 15     0.020 21.87
## 16     0.042 21.89
## 17     0.106 21.97
## 18     0.176 22.18
## 19     0.194 22.59
## 20     0.234 23.10
## 21     0.202 23.81
## 22     0.142 24.49
## 23     0.946 25.20
## 24     1.000 33.18
## 25     1.000 51.42
## 26     0.184 68.08
## 27     0.916 68.95
## 28     0.186 75.54
## 29     0.676 76.55
## 30     0.304 80.28
## 31     0.532 82.15
## 32     0.238 84.82
## 33     0.332 86.02
## 34     0.478 87.64
## 35     0.220 89.99
## 36     0.748 91.27
## 37     0.096 95.36
## 38     0.782 95.94
## 39     0.124 99.34
## 40     0.006 99.74

```

```

## 41      0.010 99.76
## 42      0.008 99.77
## 43      0.004 99.78
## 44      0.002 99.78
## 45      0.006 99.78
## 46      0.002 99.78
## 47      0.000 99.78
## 48      0.000 99.78
## 49      0.002 99.78
## 50      NA 99.79
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 25.70
## 2      0.000 25.70
## 3      0.000 25.70
## 4      0.000 25.70
## 5      0.000 25.70
## 6      0.000 25.70
## 7      0.000 25.70
## 8      0.000 25.70
## 9      0.002 25.70
## 10     0.000 25.70
## 11     0.002 25.70
## 12     0.006 25.70
## 13     0.088 25.70
## 14     0.670 25.71
## 15     0.114 25.75
## 16     0.094 25.76
## 17     0.938 25.77
## 18     0.992 25.92
## 19     1.000 26.17
## 20     1.000 26.56
## 21     1.000 27.61
## 22     1.000 35.74
## 23     1.000 52.20
## 24     1.000 70.75
## 25     1.000 77.21
## 26     1.000 79.85
## 27     1.000 82.07
## 28     1.000 84.13
## 29     1.000 85.99
## 30     1.000 87.68
## 31     1.000 89.08
## 32     1.000 90.65
## 33     1.000 91.93
## 34     1.000 93.18
## 35     1.000 95.19
## 36     1.000 96.65

```

```

## 37      1.000 98.39
## 38      1.000 99.17
## 39      0.990 99.80
## 40      0.006 99.98
## 41      0.010 99.98
## 42      0.004 99.98
## 43      0.000 99.98
## 44      0.000 99.98
## 45      0.002 99.98
## 46      0.000 99.98
## 47      0.000 99.98
## 48      0.000 99.98
## 49      0.000 99.98
## 50      NA 99.98
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 24.45
## 2      0.004 24.45
## 3      0.002 24.45
## 4      0.002 24.45
## 5      0.002 24.45
## 6      0.004 24.45
## 7      0.004 24.45
## 8      0.006 24.45
## 9      0.002 24.45
## 10     0.004 24.45
## 11     0.006 24.46
## 12     0.004 24.46
## 13     0.000 24.46
## 14     0.012 24.46
## 15     0.012 24.47
## 16     0.008 24.48
## 17     0.022 24.49
## 18     0.022 24.51
## 19     0.044 24.53
## 20     0.068 24.60
## 21     0.060 24.72
## 22     0.986 24.89
## 23     1.000 32.31
## 24     1.000 48.11
## 25     0.936 68.17
## 26     0.206 74.58
## 27     0.726 75.68
## 28     0.226 79.50
## 29     0.554 80.66
## 30     0.294 83.19
## 31     0.304 84.56
## 32     0.366 85.79

```

```

## 33      0.316 87.32
## 34      0.364 88.62
## 35      0.212 90.12
## 36      0.604 91.08
## 37      0.180 93.78
## 38      0.252 94.48
## 39      0.664 95.58
## 40      0.260 98.86
## 41      0.026 99.72
## 42      0.006 99.77
## 43      0.004 99.78
## 44      0.004 99.78
## 45      0.006 99.78
## 46      0.002 99.78
## 47      0.000 99.78
## 48      0.000 99.78
## 49      0.000 99.78
## 50      NA 99.78
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 26.59
## 2      0.004 26.59
## 3      0.002 26.59
## 4      0.002 26.59
## 5      0.002 26.59
## 6      0.004 26.59
## 7      0.002 26.59
## 8      0.006 26.59
## 9      0.002 26.60
## 10     0.006 26.60
## 11     0.004 26.60
## 12     0.002 26.60
## 13     0.000 26.60
## 14     0.006 26.60
## 15     0.014 26.61
## 16     0.010 26.62
## 17     0.026 26.62
## 18     0.028 26.65
## 19     0.058 26.68
## 20     0.106 26.77
## 21     0.160 26.98
## 22     1.000 27.42
## 23     1.000 41.25
## 24     0.974 63.78
## 25     0.546 71.61
## 26     0.508 74.55
## 27     0.454 77.44
## 28     0.488 79.80

```



```

## 29      0.402 82.29
## 30      0.338 84.24
## 31      0.390 85.73
## 32      0.326 87.42
## 33      0.346 88.82
## 34      0.370 90.33
## 35      0.294 91.90
## 36      0.546 93.25
## 37      0.234 95.71
## 38      0.670 96.98
## 39      0.098 99.52
## 40      0.004 99.78
## 41      0.014 99.78
## 42      0.008 99.80
## 43      0.004 99.80
## 44      0.002 99.81
## 45      0.006 99.81
## 46      0.002 99.81
## 47      0.000 99.81
## 48      0.000 99.81
## 49      0.000 99.81
## 50      NA 99.81
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 26.71
## 2      0.002 26.71
## 3      0.002 26.71
## 4      0.002 26.71
## 5      0.000 26.71
## 6      0.002 26.71
## 7      0.002 26.71
## 8      0.002 26.71
## 9      0.000 26.71
## 10     0.002 26.71
## 11     0.002 26.71
## 12     0.002 26.71
## 13     0.002 26.71
## 14     0.012 26.71
## 15     0.008 26.72
## 16     0.032 26.72
## 17     0.416 26.73
## 18     0.250 26.95
## 19     0.146 27.12
## 20     0.256 27.21
## 21     0.408 27.39
## 22     0.190 27.68
## 23     0.702 27.83
## 24     1.000 29.26

```

```

## 25      1.000 38.50
## 26      0.946 57.36
## 27      0.904 63.11
## 28      0.944 67.85
## 29      0.842 72.88
## 30      0.822 76.26
## 31      0.852 78.90
## 32      0.792 81.81
## 33      0.740 83.67
## 34      0.922 85.41
## 35      0.702 88.59
## 36      0.938 90.36
## 37      0.718 94.48
## 38      0.940 96.38
## 39      0.658 99.16
## 40      0.048 99.87
## 41      0.024 99.89
## 42      0.014 99.89
## 43      0.002 99.90
## 44      0.002 99.90
## 45      0.004 99.90
## 46      0.002 99.90
## 47      0.000 99.90
## 48      0.000 99.90
## 49      0.000 99.90
## 50      NA 99.90
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 30.13
## 2      0.002 30.13
## 3      0.000 30.13
## 4      0.002 30.13
## 5      0.002 30.13
## 6      0.004 30.13
## 7      0.008 30.13
## 8      0.020 30.13
## 9      0.044 30.13
## 10     0.028 30.14
## 11     0.040 30.14
## 12     0.036 30.14
## 13     0.000 30.15
## 14     1.000 30.15
## 15     0.000 30.69
## 16     0.006 30.69
## 17     0.338 30.69
## 18     0.646 30.80
## 19     0.304 31.11
## 20     1.000 31.23

```

```

## 21      0.942 32.08
## 22      1.000 32.63
## 23      1.000 34.39
## 24      1.000 36.46
## 25      1.000 41.01
## 26      1.000 52.69
## 27      1.000 68.86
## 28      1.000 75.21
## 29      1.000 79.48
## 30      1.000 82.80
## 31      1.000 85.53
## 32      1.000 87.89
## 33      1.000 90.03
## 34      1.000 92.14
## 35      1.000 94.21
## 36      1.000 96.61
## 37      0.996 99.33
## 38      0.002 99.97
## 39      0.000 99.98
## 40      0.000 99.98
## 41      0.002 99.98
## 42      0.000 99.98
## 43      0.000 99.98
## 44      0.000 99.98
## 45      0.002 99.98
## 46      0.000 99.98
## 47      0.000 99.98
## 48      0.000 99.98
## 49      0.000 99.98
## 50      NA 99.98
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 30.02
## 2      0.000 30.02
## 3      0.000 30.02
## 4      0.002 30.02
## 5      0.000 30.02
## 6      0.004 30.02
## 7      0.000 30.02
## 8      0.008 30.02
## 9      0.006 30.02
## 10     0.014 30.02
## 11     0.004 30.02
## 12     0.010 30.02
## 13     0.022 30.02
## 14     0.060 30.02
## 15     0.282 30.03
## 16     0.686 30.07

```

```

## 17      0.368 30.24
## 18      0.998 30.31
## 19      1.000 30.68
## 20      1.000 32.77
## 21      1.000 33.28
## 22      1.000 38.68
## 23      1.000 39.53
## 24      1.000 40.57
## 25      1.000 42.35
## 26      1.000 53.00
## 27      1.000 66.68
## 28      1.000 73.74
## 29      1.000 78.48
## 30      1.000 82.12
## 31      1.000 85.00
## 32      1.000 88.28
## 33      1.000 90.80
## 34      1.000 92.97
## 35      1.000 95.32
## 36      1.000 98.15
## 37      1.000 99.63
## 38      0.072 99.98
## 39      0.026 99.99
## 40      0.002 99.99
## 41      0.002 99.99
## 42      0.002 99.99
## 43      0.000 99.99
## 44      0.000 99.99
## 45      0.002 99.99
## 46      0.000 99.99
## 47      0.000 99.99
## 48      0.000 99.99
## 49      0.000 99.99
## 50      NA 99.99
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 28.58
## 2      0.000 28.58
## 3      0.000 28.58
## 4      0.002 28.58
## 5      0.000 28.58
## 6      0.002 28.58
## 7      0.018 28.58
## 8      0.024 28.58
## 9      0.010 28.58
## 10     0.002 28.58
## 11     0.002 28.58
## 12     0.002 28.58

```

```

## 13      0.000 28.58
## 14      0.996 28.58
## 15      0.008 28.75
## 16      0.006 28.75
## 17      0.996 28.75
## 18      0.542 28.97
## 19      0.996 29.06
## 20      1.000 29.30
## 21      1.000 29.83
## 22      1.000 30.61
## 23      1.000 32.75
## 24      1.000 34.81
## 25      1.000 37.43
## 26      1.000 47.18
## 27      1.000 60.71
## 28      1.000 69.14
## 29      1.000 75.53
## 30      1.000 80.83
## 31      1.000 84.27
## 32      1.000 87.31
## 33      1.000 90.05
## 34      1.000 92.43
## 35      1.000 94.54
## 36      1.000 96.12
## 37      1.000 98.48
## 38      1.000 99.47
## 39      0.000 99.99
## 40      0.000 99.99
## 41      0.000 99.99
## 42      0.000 99.99
## 43      0.000 99.99
## 44      0.000 99.99
## 45      0.002 99.99
## 46      0.000 99.99
## 47      0.000 99.99
## 48      0.000 99.99
## 49      0.000 99.99
## 50      NA 99.99
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 28.84
## 2      0.000 28.84
## 3      0.000 28.84
## 4      0.000 28.84
## 5      0.000 28.84
## 6      0.002 28.84
## 7      0.000 28.84
## 8      0.004 28.84

```

```

## 9      0.002 28.84
## 10     0.006 28.84
## 11     0.006 28.84
## 12     0.006 28.84
## 13     0.000 28.84
## 14     0.988 28.84
## 15     0.016 28.97
## 16     0.860 28.98
## 17     1.000 29.10
## 18     0.898 30.20
## 19     1.000 30.36
## 20     1.000 30.85
## 21     1.000 31.73
## 22     1.000 32.70
## 23     1.000 35.62
## 24     1.000 38.39
## 25     1.000 48.08
## 26     1.000 66.19
## 27     1.000 74.19
## 28     1.000 80.77
## 29     1.000 84.31
## 30     1.000 86.67
## 31     1.000 88.48
## 32     1.000 90.61
## 33     1.000 92.40
## 34     1.000 93.93
## 35     1.000 95.55
## 36     1.000 96.97
## 37     1.000 99.07
## 38     0.998 99.75
## 39     0.004 99.99
## 40     0.002 99.99
## 41     0.002 99.99
## 42     0.002 99.99
## 43     0.000 99.99
## 44     0.000 99.99
## 45     0.002 99.99
## 46     0.000 99.99
## 47     0.000 99.99
## 48     0.000 99.99
## 49     0.000 99.99
## 50      NA 99.99
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 29.84
## 2      0.002 29.84
## 3      0.000 29.84
## 4      0.002 29.84

```

```

## 5      0.000 29.85
## 6      0.004 29.85
## 7      0.000 29.85
## 8      0.004 29.85
## 9      0.002 29.85
## 10     0.002 29.85
## 11     0.002 29.85
## 12     0.004 29.85
## 13     0.000 29.85
## 14     0.016 29.85
## 15     0.012 29.85
## 16     0.034 29.85
## 17     0.960 29.87
## 18     0.014 30.61
## 19     0.012 30.62
## 20     1.000 30.63
## 21     0.054 31.84
## 22     1.000 31.87
## 23     0.036 34.11
## 24     0.998 34.13
## 25     1.000 35.33
## 26     1.000 37.90
## 27     1.000 48.11
## 28     1.000 68.41
## 29     1.000 77.45
## 30     1.000 82.33
## 31     1.000 84.51
## 32     1.000 90.57
## 33     1.000 92.87
## 34     1.000 94.63
## 35     1.000 96.62
## 36     1.000 98.21
## 37     0.008 99.97
## 38     0.004 99.97
## 39     0.002 99.97
## 40     0.002 99.97
## 41     0.002 99.97
## 42     0.002 99.97
## 43     0.000 99.97
## 44     0.000 99.97
## 45     0.002 99.97
## 46     0.002 99.97
## 47     0.000 99.97
## 48     0.000 99.97
## 49     0.000 99.97
## 50      NA 99.97
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1

```

## 1	0.000	32.59
## 2	0.000	32.59
## 3	0.000	32.59
## 4	0.000	32.59
## 5	0.000	32.59
## 6	0.000	32.59
## 7	0.000	32.59
## 8	0.018	32.59
## 9	0.000	32.59
## 10	0.000	32.59
## 11	0.000	32.59
## 12	0.000	32.59
## 13	0.000	32.59
## 14	0.926	32.59
## 15	0.076	32.64
## 16	0.726	32.65
## 17	1.000	32.69
## 18	1.000	32.84
## 19	1.000	33.23
## 20	1.000	34.90
## 21	1.000	38.57
## 22	1.000	41.14
## 23	1.000	44.01
## 24	1.000	49.46
## 25	1.000	59.88
## 26	1.000	77.68
## 27	1.000	88.17
## 28	1.000	92.82
## 29	1.000	94.59
## 30	1.000	95.74
## 31	1.000	96.46
## 32	1.000	97.27
## 33	1.000	97.91
## 34	1.000	98.44
## 35	1.000	98.93
## 36	1.000	99.39
## 37	1.000	99.83
## 38	0.086	99.99
## 39	0.010	100.00
## 40	0.000	100.00
## 41	0.000	100.00
## 42	0.000	100.00
## 43	0.000	100.00
## 44	0.000	100.00
## 45	0.000	100.00
## 46	0.000	100.00
## 47	0.000	100.00
## 48	0.000	100.00
## 49	0.000	100.00
## 50	NA	100.00
##		
##		
## Bayesian Change Point (bcp) summary:		
##		



```

##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.004 28.34
## 2      0.006 28.34
## 3      0.006 28.34
## 4      0.004 28.35
## 5      0.002 28.35
## 6      0.004 28.35
## 7      0.004 28.35
## 8      0.010 28.35
## 9      0.002 28.36
## 10     0.006 28.36
## 11     0.006 28.36
## 12     0.004 28.37
## 13     0.000 28.37
## 14     0.020 28.37
## 15     0.018 28.40
## 16     0.080 28.44
## 17     0.740 28.82
## 18     0.238 34.46
## 19     0.134 36.38
## 20     0.156 37.04
## 21     0.232 37.84
## 22     0.616 39.41
## 23     0.162 44.44
## 24     0.634 45.81
## 25     0.324 51.66
## 26     0.392 54.69
## 27     0.346 57.74
## 28     0.358 60.44
## 29     0.574 63.54
## 30     0.136 68.46
## 31     0.712 69.56
## 32     0.400 76.59
## 33     0.572 80.64
## 34     0.330 85.92
## 35     0.168 88.40
## 36     0.842 89.76
## 37     0.156 98.43
## 38     0.048 99.36
## 39     0.014 99.53
## 40     0.004 99.55
## 41     0.010 99.56
## 42     0.008 99.57
## 43     0.006 99.57
## 44     0.004 99.58
## 45     0.006 99.58
## 46     0.006 99.59
## 47     0.002 99.59
## 48     0.000 99.59
## 49     0.004 99.59
## 50      NA 99.59

```

```

##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 23.52
## 2      0.000 23.52
## 3      0.000 23.52
## 4      0.002 23.52
## 5      0.000 23.52
## 6      0.000 23.52
## 7      0.000 23.52
## 8      0.000 23.52
## 9      0.000 23.52
## 10     0.000 23.52
## 11     0.000 23.52
## 12     0.000 23.52
## 13     0.004 23.52
## 14     0.094 23.52
## 15     0.046 23.53
## 16     0.062 23.54
## 17     0.842 23.55
## 18     0.022 23.73
## 19     0.328 23.74
## 20     0.768 23.82
## 21     0.130 24.04
## 22     1.000 24.06
## 23     1.000 24.96
## 24     1.000 25.82
## 25     1.000 26.47
## 26     1.000 33.56
## 27     1.000 50.49
## 28     1.000 62.83
## 29     1.000 71.21
## 30     1.000 77.90
## 31     1.000 80.52
## 32     1.000 83.20
## 33     1.000 85.57
## 34     1.000 88.11
## 35     1.000 90.62
## 36     1.000 93.86
## 37     1.000 98.31
## 38     0.934 99.65
## 39     0.144 99.96
## 40     0.016 99.98
## 41     0.002 99.98
## 42     0.002 99.98
## 43     0.000 99.98
## 44     0.000 99.98
## 45     0.002 99.98
## 46     0.000 99.98

```

```

## 47      0.000 99.98
## 48      0.000 99.98
## 49      0.000 99.98
## 50      NA 99.98
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 25.82
## 2      0.000 25.82
## 3      0.000 25.82
## 4      0.002 25.82
## 5      0.000 25.82
## 6      0.002 25.82
## 7      0.000 25.82
## 8      0.002 25.82
## 9      0.000 25.82
## 10     0.000 25.82
## 11     0.000 25.82
## 12     0.002 25.82
## 13     0.086 25.82
## 14     0.892 25.83
## 15     0.016 25.95
## 16     0.000 25.95
## 17     1.000 25.95
## 18     0.006 26.18
## 19     0.996 26.18
## 20     1.000 26.45
## 21     1.000 26.93
## 22     1.000 27.63
## 23     1.000 30.22
## 24     1.000 34.81
## 25     1.000 43.70
## 26     1.000 60.89
## 27     1.000 69.52
## 28     1.000 74.75
## 29     1.000 78.49
## 30     1.000 80.87
## 31     1.000 82.77
## 32     1.000 85.76
## 33     1.000 88.02
## 34     1.000 90.10
## 35     1.000 92.42
## 36     1.000 95.53
## 37     1.000 98.50
## 38     1.000 99.56
## 39     0.054 99.98
## 40     0.002 99.98
## 41     0.002 99.98
## 42     0.002 99.98

```

```

## 43      0.000 99.98
## 44      0.000 99.98
## 45      0.002 99.98
## 46      0.000 99.98
## 47      0.000 99.98
## 48      0.000 99.98
## 49      0.000 99.98
## 50      NA 99.98
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.000 39.42
## 2      0.002 39.42
## 3      0.000 39.42
## 4      0.000 39.42
## 5      0.000 39.42
## 6      0.000 39.42
## 7      0.002 39.42
## 8      0.002 39.42
## 9      0.000 39.42
## 10     0.000 39.42
## 11     0.004 39.42
## 12     0.000 39.42
## 13     0.026 39.42
## 14     0.316 39.42
## 15     0.286 39.44
## 16     0.158 39.47
## 17     0.824 39.49
## 18     0.852 39.75
## 19     0.982 40.52
## 20     0.994 45.72
## 21     0.920 52.09
## 22     0.846 55.63
## 23     1.000 56.82
## 24     0.838 60.40
## 25     0.826 61.06
## 26     0.848 61.61
## 27     0.992 62.83
## 28     0.866 67.27
## 29     0.994 70.60
## 30     0.866 75.65
## 31     0.966 78.47
## 32     0.876 81.82
## 33     0.954 84.03
## 34     0.892 87.07
## 35     0.932 89.87
## 36     0.954 93.28
## 37     0.886 97.27
## 38     0.840 98.58

```

```

## 39      0.858 99.01
## 40      0.824 99.47
## 41      0.784 99.75
## 42      0.076 99.91
## 43      0.138 99.92
## 44      0.062 99.93
## 45      0.006 99.93
## 46      0.000 99.93
## 47      0.000 99.93
## 48      0.000 99.93
## 49      0.000 99.93
## 50      NA 99.93
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.002 30.55
## 2      0.004 30.55
## 3      0.004 30.55
## 4      0.004 30.55
## 5      0.002 30.56
## 6      0.004 30.56
## 7      0.002 30.56
## 8      0.006 30.56
## 9      0.002 30.56
## 10     0.006 30.56
## 11     0.004 30.56
## 12     0.006 30.57
## 13     0.004 30.57
## 14     0.008 30.57
## 15     0.030 30.58
## 16     0.048 30.63
## 17     0.200 30.71
## 18     0.172 31.16
## 19     0.364 31.60
## 20     0.142 32.68
## 21     0.122 33.17
## 22     0.852 33.68
## 23     0.268 39.23
## 24     0.850 40.85
## 25     1.000 46.70
## 26     0.952 63.28
## 27     0.516 70.91
## 28     0.728 73.86
## 29     0.292 78.57
## 30     0.314 80.03
## 31     0.498 81.45
## 32     0.512 84.22
## 33     0.282 86.98
## 34     0.672 88.42

```

```

## 35      0.336 92.40
## 36      0.884 94.48
## 37      0.014 99.76
## 38      0.022 99.78
## 39      0.006 99.81
## 40      0.002 99.82
## 41      0.004 99.82
## 42      0.006 99.82
## 43      0.002 99.82
## 44      0.002 99.82
## 45      0.006 99.82
## 46      0.002 99.82
## 47      0.000 99.82
## 48      0.000 99.82
## 49      0.002 99.82
## 50      NA 99.82
##
##
## Bayesian Change Point (bcp) summary:
##
##
## Probability of a change in mean and posterior means:
##
##      Probability      X1
## 1      0.004 30.21
## 2      0.008 30.21
## 3      0.004 30.21
## 4      0.004 30.21
## 5      0.004 30.21
## 6      0.004 30.21
## 7      0.006 30.21
## 8      0.010 30.22
## 9      0.002 30.22
## 10     0.006 30.22
## 11     0.006 30.22
## 12     0.006 30.23
## 13     0.000 30.23
## 14     0.010 30.23
## 15     0.012 30.24
## 16     0.010 30.25
## 17     0.026 30.26
## 18     0.030 30.32
## 19     0.128 30.40
## 20     0.518 30.95
## 21     0.500 34.78
## 22     0.494 40.13
## 23     0.220 44.10
## 24     0.164 45.60
## 25     0.436 46.65
## 26     0.462 49.89
## 27     0.502 54.02
## 28     0.582 58.84
## 29     0.438 64.70
## 30     0.570 69.01

```

```
## 31      0.192 74.00
## 32      0.428 75.41
## 33      0.548 79.03
## 34      0.116 83.38
## 35      0.146 84.03
## 36      0.876 85.12
## 37      0.304 95.33
## 38      0.326 97.55
## 39      0.082 99.05
## 40      0.024 99.33
## 41      0.028 99.40
## 42      0.014 99.45
## 43      0.008 99.47
## 44      0.008 99.48
## 45      0.008 99.50
## 46      0.004 99.50
## 47      0.002 99.50
## 48      0.000 99.50
## 49      0.004 99.50
## 50      NA 99.51
```

b\_result

```
##      block avocado_number treatment hue_turn
## 1      B              1          c         15
## 2      B             11          c         18
## 3      B             12          c         21
## 4      B              6          c         12
## 5      B              8          c         12
## 6      B              9          c          6
## 7      B             10          t         21
## 8      B              2          t         21
## 9      B              3          t         10
## 10     B              4          t         21
## 11     B              5          t         20
## 12     B              7          t         22
## 13     J             10          c         23
## 14     J             12          c         23
## 15     J              2          c         23
## 16     J              3          c         22
## 17     J              5          c         22
## 18     J              6          c         18
## 19     J              1          t         21
## 20     J             11          t         24
## 21     J              4          t         19
## 22     J              7          t         23
## 23     J              8          t         22
## 24     J              9          t         24
## 25     N             11          c         14
## 26     N              2          c         19
## 27     N              4          c         20
## 28     N              5          c         17
## 29     N              7          c         20
## 30     N              9          c         17
```

##	31	N	1	t	36
##	32	N	10	t	22
##	33	N	12	t	17
##	34	N	3	t	23
##	35	N	6	t	25
##	36	N	8	t	36