Assignment 4

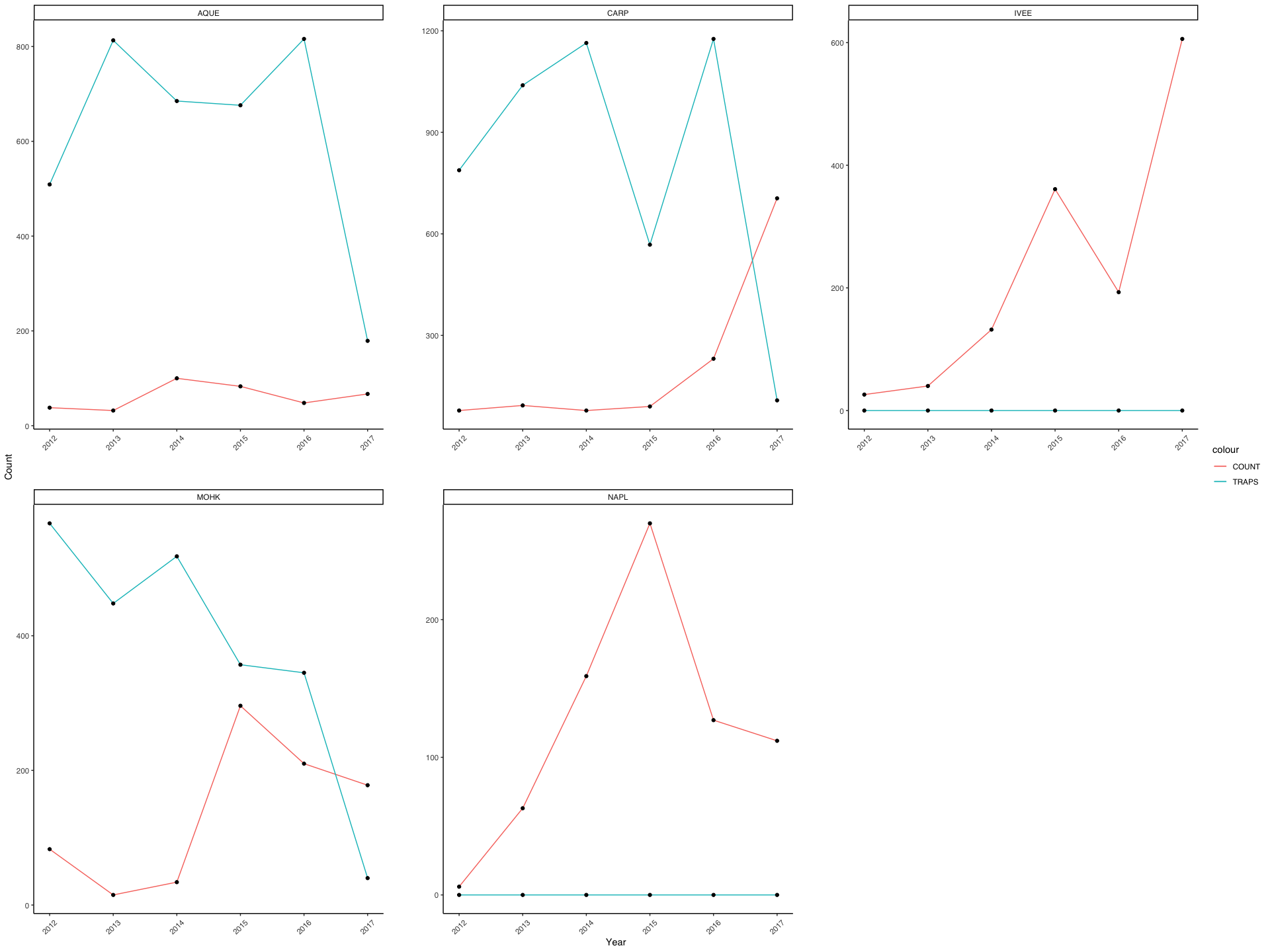
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November 14, 2018

1. Lobster abundance and fishing pressure (2012 - 2017)

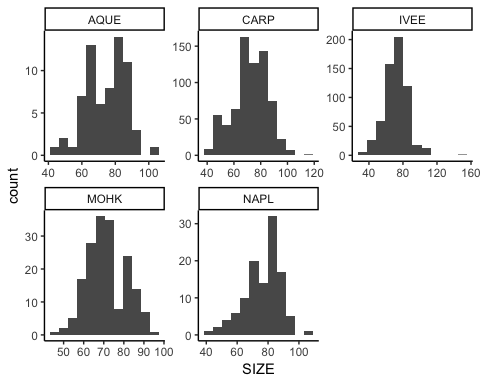
## Joining, by = c("SITE", "YEAR")

## Warning: Column `SITE` joining factor and character vector, coercing into  
## character vector

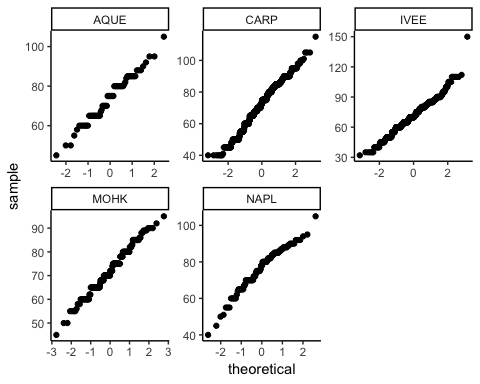


1. Compare mean lobster size by site in 2017

# New dataframe for only year 2017  
  
size\_2017 <- lobster\_abundance %>%   
 filter(YEAR == 2017) %>%   
 select(SITE, SIZE)   
  
  
  
# Data exploration  
  
#Histograms  
  
size\_2017\_hist <- ggplot(size\_2017, aes(x = SIZE)) +  
 geom\_histogram(bins = 12) +  
 facet\_wrap(~ SITE, scale = "free") + # Create a histogram, split graphic visualization by site. Give each histogram its own y-axis scale  
 theme\_classic()  
size\_2017\_hist



# QQ-Plots  
  
size\_2017\_qq <- ggplot(size\_2017, aes(sample = SIZE)) +  
 geom\_qq() +  
 facet\_wrap(~ SITE, scale = "free") + # Create a Q-Q plot, split graphic visualization by site. Give each Q-Q Plot its own y-axis scale  
 theme\_classic()  
size\_2017\_qq



# Question: Is there a significant difference in mean lobster size between the five sites?  
  
# H0: There is no significant difference in mean lobster size between the five sites  
# HA: There is a significant difference in mean lobster size between the five sites  
  
  
  
# Levene's Test   
  
# H0: There are no differences in varance across groups (variances are equal)  
# HA: There are differences in variances across groups (variances are not equal)  
  
lobster\_levene <- leveneTest(SIZE ~ SITE, data = size\_2017)  
lobster\_levene

## Levene's Test for Homogeneity of Variance (center = median)  
## Df F value Pr(>F)   
## group 4 8.3893 1.065e-06 \*\*\*  
## 1663   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

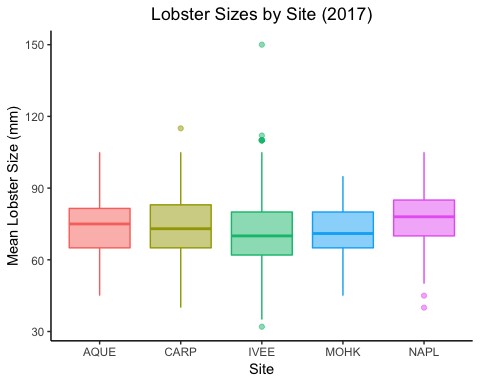
# p < 0.05. Reject the null hypothesis. Our variances are differenct (Variances are not equal)  
  
  
  
# What are the actual variances?  
  
variances <- size\_2017 %>%   
 group\_by(SITE) %>%   
 summarize(  
 mean = mean(SIZE),  
 sd = sd(SIZE),  
 variance = var(SIZE)  
 )  
  
# Our largest variance is less than 4x larger than our smallest variance  
  
  
  
# ONE-WAY ANOVA:  
  
lobster\_aov <- aov(SIZE ~ SITE, data = size\_2017)  
lobster\_sum\_aov <- summary(lobster\_aov)  
lobster\_sum\_aov

## Df Sum Sq Mean Sq F value Pr(>F)   
## SITE 4 2355 588.6 3.424 0.0085 \*\*  
## Residuals 1663 285871 171.9   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

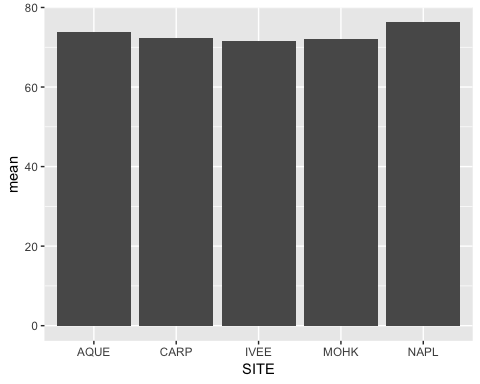
lobster\_ph <- TukeyHSD(lobster\_aov)  
lobster\_ph

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = SIZE ~ SITE, data = size\_2017)  
##   
## $SITE  
## diff lwr upr p adj  
## CARP-AQUE -1.6657352 -6.24294710 2.911477 0.8582355  
## IVEE-AQUE -2.4433772 -7.05292315 2.166169 0.5968998  
## MOHK-AQUE -1.8955224 -7.02720717 3.236162 0.8514711  
## NAPL-AQUE 2.3366205 -3.19311600 7.866357 0.7775633  
## IVEE-CARP -0.7776420 -2.76097123 1.205687 0.8216104  
## MOHK-CARP -0.2297872 -3.23309697 2.773523 0.9995765  
## NAPL-CARP 4.0023556 0.36042398 7.644287 0.0228728  
## MOHK-IVEE 0.5478548 -2.50450730 3.600217 0.9882889  
## NAPL-IVEE 4.7799976 1.09751057 8.462485 0.0037001  
## NAPL-MOHK 4.2321429 -0.08607271 8.550358 0.0579286

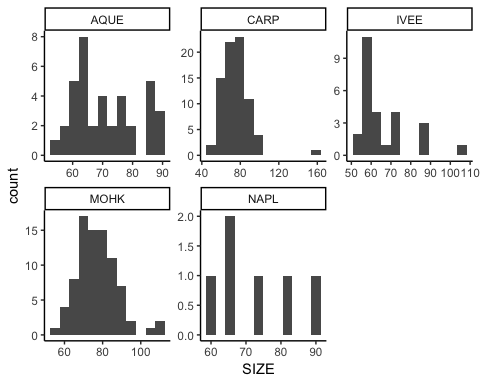
# Box and whisker  
  
lobster\_box <- ggplot(size\_2017, aes(x = SITE, y = SIZE)) +  
 geom\_boxplot(aes(fill = SITE, colour = SITE), alpha = 0.5, show.legend = FALSE) +  
 ylab("Mean Lobster Size (mm)") +  
 ggtitle("Lobster Sizes by Site (2017)") +  
 theme(plot.title = element\_text(hjust = 0.5)) +  
 xlab("Site") +  
 theme(panel.grid.major = element\_blank(), panel.grid.minor = element\_blank(),  
 panel.background = element\_blank(), axis.line = element\_line(colour = "black"))  
lobster\_box # Need to add a way to indicate significance



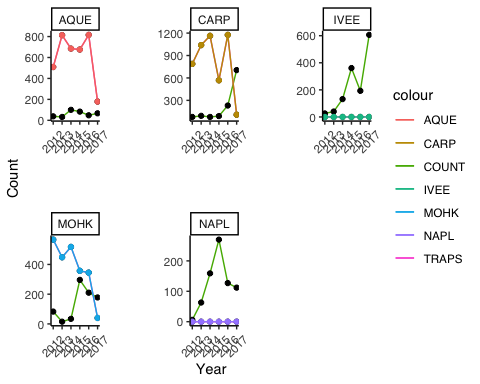
# Column graph of means   
  
lobster\_col <- ggplot(variances, aes (x = SITE, y = mean)) +  
 geom\_col() +  
 scale\_y\_continuous()  
lobster\_col



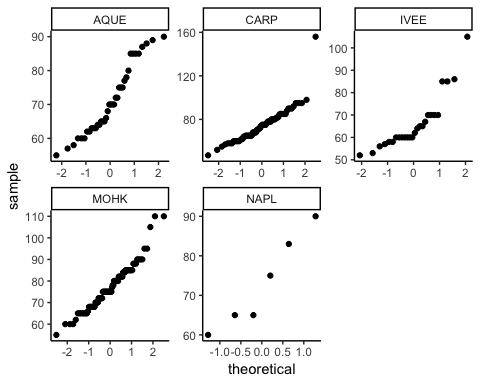
# New data frame for year 2012  
  
size\_2012 <- lobster\_abundance %>%   
 filter(YEAR == 2012) %>%   
 select(SITE, SIZE)   
  
  
  
# Data exploration  
  
#Histograms  
  
size\_2012\_hist <- ggplot(size\_2012, aes(x = SIZE)) +  
 geom\_histogram(bins = 12) +  
 facet\_wrap(~ SITE, scale = "free") + # Create a histogram, split graphic visualization by site. Give each histogram its own y-axis scale  
 theme\_classic()  
size\_2012\_hist



# QQ-Plots  
  
  
  
  
  
# Add the second data set (traps)  
abundance\_traps\_line <- abundance\_traps\_line + geom\_line(aes(y = TRAPS, color = SITE), show.legend = FALSE) +   
 geom\_point(aes(y = TRAPS, color = SITE), show.legend = FALSE)  
abundance\_traps\_line



size\_2012\_qq <- ggplot(size\_2012, aes(sample = SIZE)) +  
 geom\_qq() +  
 facet\_wrap(~ SITE, scale = "free") + # Create a Q-Q plot, split graphic visualization by site. Give each Q-Q Plot its own y-axis scale  
 theme\_classic()  
size\_2012\_qq



# Question: How do lobster sizes in 2012 and 2017 compare?  
  
# H0: There is no difference in mean lobster size in 2012 and 2017  
# HA: There is a difference in mean lobster size in 2012 and 2017  
  
# New dataframes with only MPA sites for 2012 and 2017  
  
MPA\_2012 <- size\_2012 %>%  
 filter(SITE == "IVEE" | SITE == "NAPL")  
MPA\_2012

## SITE SIZE  
## 1 IVEE 70  
## 2 IVEE 60  
## 3 IVEE 65  
## 4 IVEE 70  
## 5 IVEE 85  
## 6 IVEE 60  
## 7 IVEE 65  
## 8 IVEE 67  
## 9 IVEE 70  
## 10 IVEE 85  
## 11 IVEE 52  
## 12 IVEE 60  
## 13 IVEE 64  
## 14 IVEE 70  
## 15 IVEE 58  
## 16 IVEE 60  
## 17 IVEE 60  
## 18 IVEE 62  
## 19 IVEE 86  
## 20 IVEE 105  
## 21 IVEE 57  
## 22 IVEE 60  
## 23 IVEE 53  
## 24 IVEE 56  
## 25 IVEE 58  
## 26 IVEE 60  
## 27 NAPL 83  
## 28 NAPL 75  
## 29 NAPL 60  
## 30 NAPL 65  
## 31 NAPL 65  
## 32 NAPL 90

MPA\_2017 <- size\_2017 %>%  
 filter(SITE == "IVEE" | SITE == "NAPL")  
MPA\_2017

## SITE SIZE  
## 1 IVEE 80  
## 2 IVEE 80  
## 3 IVEE 65  
## 4 IVEE 50  
## 5 IVEE 57  
## 6 IVEE 58  
## 7 IVEE 58  
## 8 IVEE 60  
## 9 IVEE 62  
## 10 IVEE 65  
## 11 IVEE 72  
## 12 IVEE 75  
## 13 IVEE 80  
## 14 IVEE 80  
## 15 IVEE 85  
## 16 IVEE 75  
## 17 IVEE 82  
## 18 IVEE 63  
## 19 IVEE 70  
## 20 IVEE 76  
## 21 IVEE 82  
## 22 IVEE 85  
## 23 IVEE 85  
## 24 IVEE 87  
## 25 IVEE 90  
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## 630 NAPL 83  
## 631 NAPL 86  
## 632 NAPL 86  
## 633 NAPL 55  
## 634 NAPL 78  
## 635 NAPL 84  
## 636 NAPL 88  
## 637 NAPL 70  
## 638 NAPL 72  
## 639 NAPL 74  
## 640 NAPL 75  
## 641 NAPL 80  
## 642 NAPL 85  
## 643 NAPL 90  
## 644 NAPL 40  
## 645 NAPL 45  
## 646 NAPL 50  
## 647 NAPL 51  
## 648 NAPL 60  
## 649 NAPL 70  
## 650 NAPL 70  
## 651 NAPL 78  
## 652 NAPL 80  
## 653 NAPL 85  
## 654 NAPL 88  
## 655 NAPL 90  
## 656 NAPL 92  
## 657 NAPL 105  
## 658 NAPL 65  
## 659 NAPL 70  
## 660 NAPL 72  
## 661 NAPL 81  
## 662 NAPL 82  
## 663 NAPL 70  
## 664 NAPL 85  
## 665 NAPL 90  
## 666 NAPL 75  
## 667 NAPL 95  
## 668 NAPL 68  
## 669 NAPL 70  
## 670 NAPL 80  
## 671 NAPL 82  
## 672 NAPL 84  
## 673 NAPL 88  
## 674 NAPL 65  
## 675 NAPL 80  
## 676 NAPL 80  
## 677 NAPL 84  
## 678 NAPL 85  
## 679 NAPL 86  
## 680 NAPL 87  
## 681 NAPL 89  
## 682 NAPL 89  
## 683 NAPL 70  
## 684 NAPL 75  
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## 698 NAPL 70  
## 699 NAPL 75  
## 700 NAPL 80  
## 701 NAPL 88  
## 702 NAPL 67  
## 703 NAPL 67  
## 704 NAPL 70  
## 705 NAPL 70  
## 706 NAPL 72  
## 707 NAPL 84  
## 708 NAPL 85  
## 709 NAPL 87  
## 710 NAPL 87  
## 711 NAPL 75  
## 712 NAPL 85  
## 713 NAPL 90  
## 714 NAPL 92  
## 715 NAPL 75  
## 716 NAPL 92  
## 717 NAPL 82  
## 718 NAPL 81

# F-test for equal variances:  
  
# H0: Variances are equal  
# HA: Variances are not equal  
  
f\_test <- var.test(MPA\_2012$SIZE, MPA\_2017$SIZE)  
  
f\_test

##   
## F test to compare two variances  
##   
## data: MPA\_2012$SIZE and MPA\_2017$SIZE  
## F = 0.75323, num df = 31, denom df = 717, p-value = 0.3346  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.477719 1.341900  
## sample estimates:  
## ratio of variances   
## 0.7532319

# p = 0.33, retain the null. Variacnes are equal.  
  
  
  
# Two-sided t-test  
  
MPA\_ttest <- t.test(MPA\_2012$SIZE, MPA\_2017$SIZE, var.equal = TRUE)  
MPA\_ttest

##   
## Two Sample t-test  
##   
## data: MPA\_2012$SIZE and MPA\_2017$SIZE  
## t = -1.9159, df = 748, p-value = 0.05576  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -9.7644724 0.1189292  
## sample estimates:  
## mean of x mean of y   
## 67.37500 72.19777

#

```