

Mental Accounting in College: Students and 'Free Money'

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Spring Semester Dates Campus Open: 1/20/19, Start: 1/22/19, End: 5/8/19, Campus Closed: 5/20/19

Fall Semester Dates Campus Open: 8/31/19 Start: 9/3/19, End: 12/11/19, Campus Closed: 12/21/19

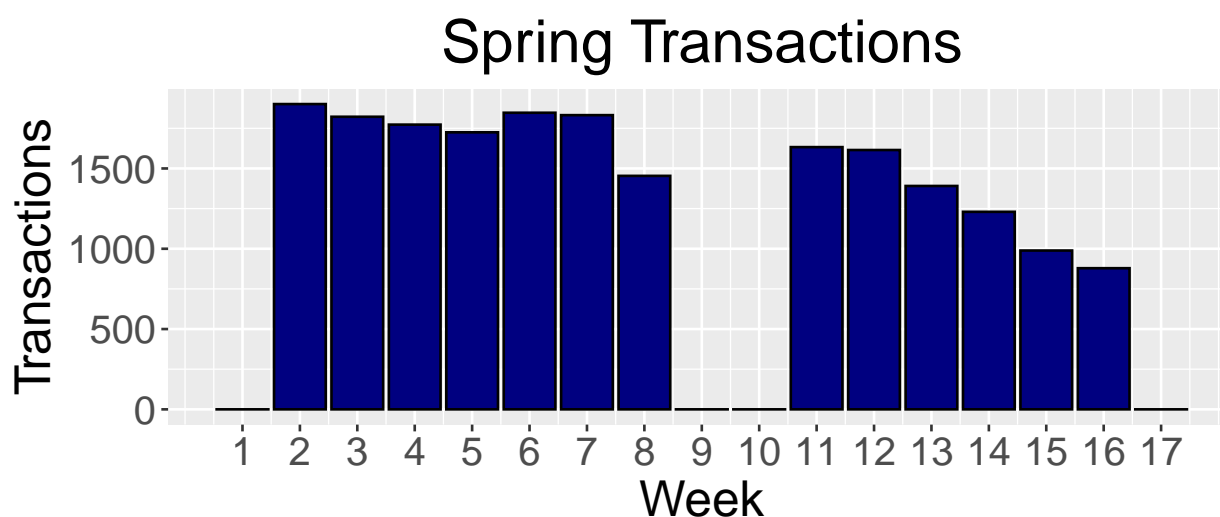
```
flex_data <- read_csv("flex_data.csv")
flex_data <- flex_data %>% mutate(Time = mdy_hm(Time)) %>% mutate(Week = epiweek(Time)) %>% rename(AmountSpent = AmountSpent)
flex_data <- flex_data %>% filter(Time >= '2019-01-20' & Time <= '2019-12-19') %>% filter(AmountSpent > 0)

#Graph adjustments
theme_update(text = element_text(size=20))
theme_update(plot.title = element_text(hjust = 0.5))

#Transactions by week
springtrans <- flex_data %>% filter(Time <= '2019-5-19') %>% mutate(Week = Week-3) %>% filter(Week!=1 & Week!=2)
falltrans <- flex_data %>% filter(Time >= '2019-9-1') %>% mutate(Week = Week-35) %>% filter(Week!=1 & Week!=2)

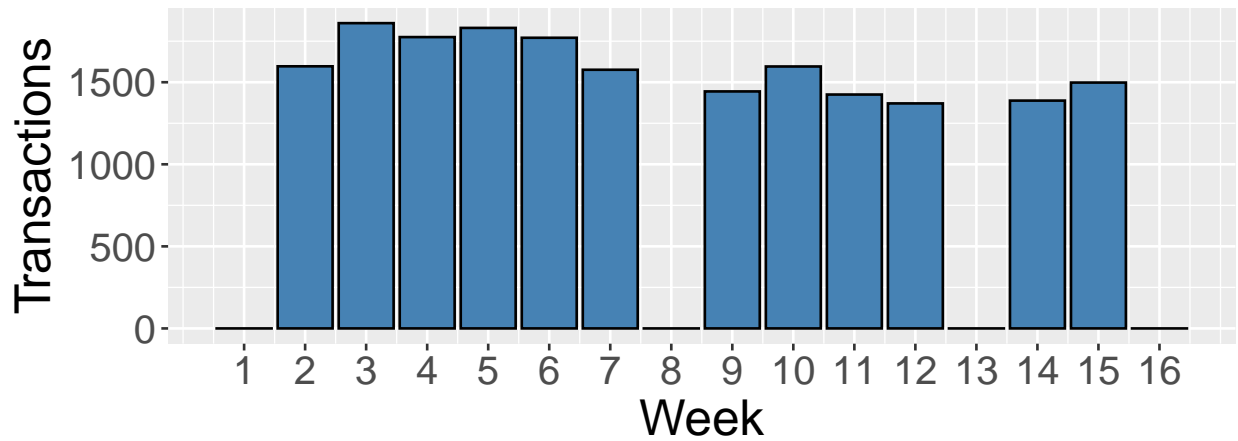
springtransactions <- springtrans %>% group_by(Week) %>% summarize(Transactions = n()) %>% rbind(c(1,0), c(2,0))
falltransactions <- falltrans %>% group_by(Week) %>% summarize(Transactions = n()) %>% rbind(c(1, 0), c(2, 0))

ggplot(springtransactions) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", color = "white")
```



```
ggplot(falltransactions) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue", color = "white")
```

Fall Transactions

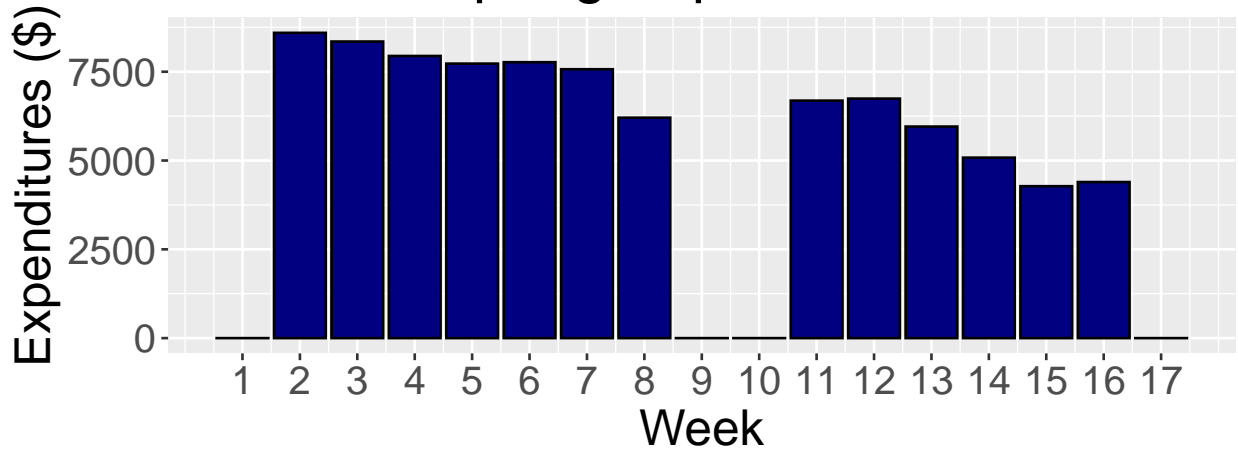


#Purchases by week

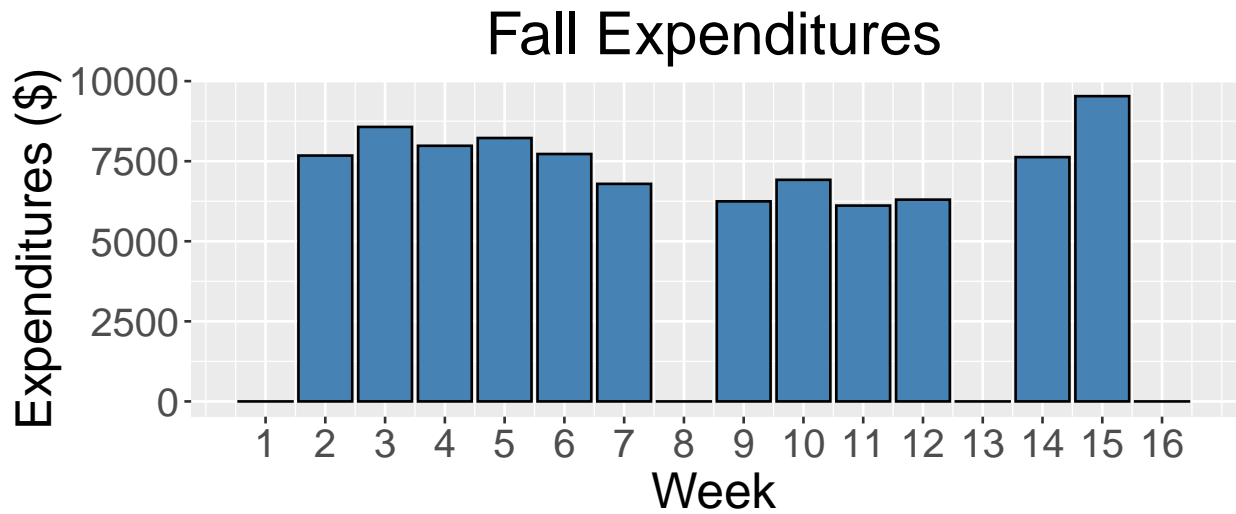
```
springpurchases <- springtrans %>% group_by(Week) %>% summarize(TotalPurch = sum(AmountSpent)) %>% rbind(
fallpurchases <- falltrans %>% group_by(Week) %>% summarize(TotalPurch = sum(AmountSpent)) %>% rbind(c(
```

```
ggplot(springpurchases) + geom_bar(aes(x=Week, y=TotalPurch), stat='identity', fill = "navy", color = "l
```

Spring Expenditures

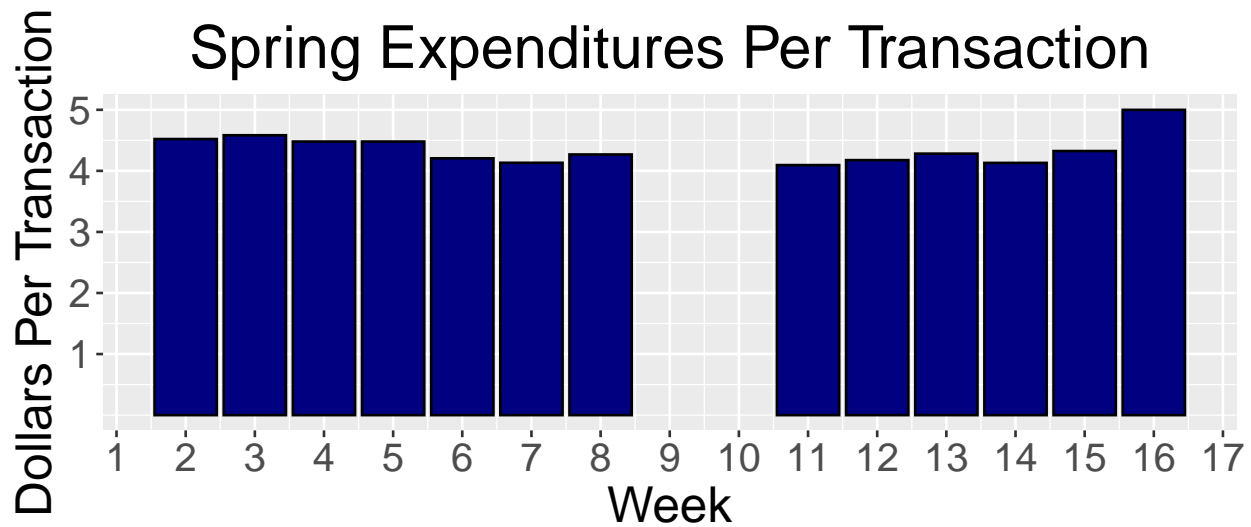


```
ggplot(fallpurchases) + geom_bar(aes(x=Week, y=TotalPurch), stat='identity', fill = "steelblue", color = "l
```

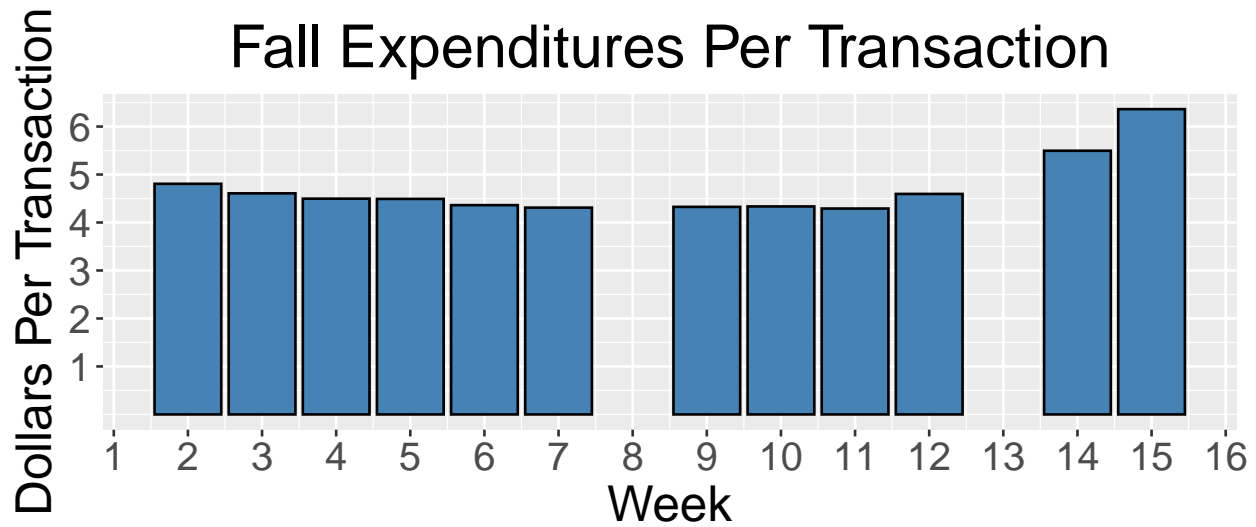


```
#Amount Spent Per Transaction
springppt <- springtrans %>% group_by(Week) %>% summarize(TotalTrans = n(), TotalPurch = sum(AmountSpent))
fallppt <- falltrans %>% group_by(Week) %>% summarize(TotalTrans = n(), TotalPurch = sum(AmountSpent))

ggplot(springppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "navy", color = "black") + ggplot(fallppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "navy", color = "black")
```



```
ggplot(fallppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "steelblue", color = "black") + ggplot(springppt) + geom_bar(aes(x=Week, y=PPT), stat='identity', fill = "steelblue", color = "black")
```



#Creation of consistent null dataframes

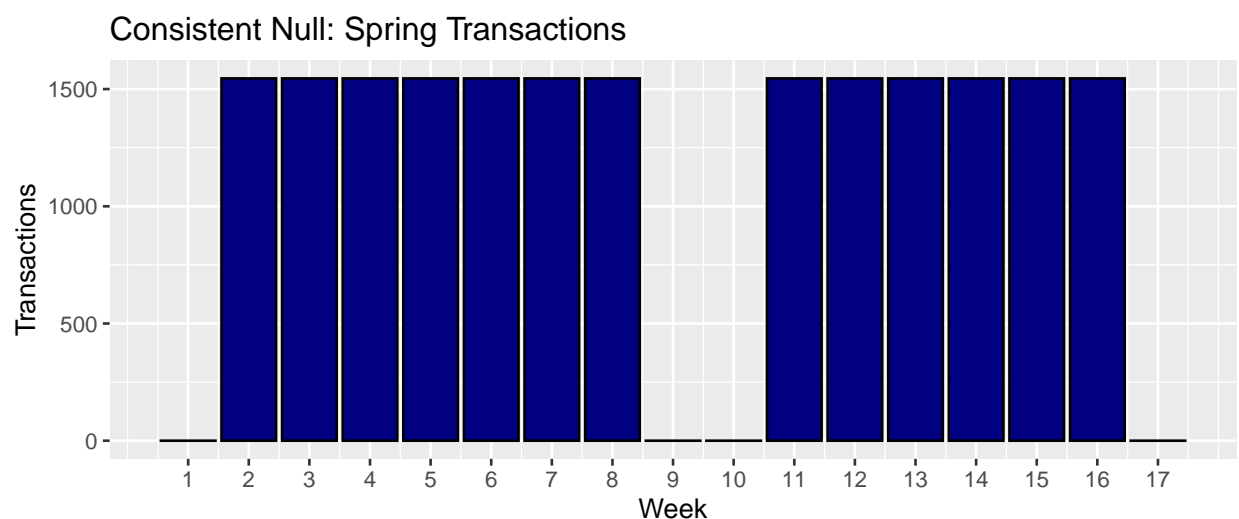
```
sprnullconsistent <- data.frame("Week"=1:17, "Transactions"= c(0,sum(springppt$TotalTrans)/13,sum(springppt$TotalTrans)/13))
```

```
sprnullconsistentprob <- data.frame("Week"=1:17, "Probability"=c(0,1/13,1/13,1/13,1/13,1/13,1/13,1/13,0,0,0,0,0,0,0,0,0))
```

```
fallnullconsistent <- data.frame("Week"=1:16, "Transactions"= c(0,sum(fallppt$TotalTrans)/12,sum(fallppt$TotalTrans)/12))
```

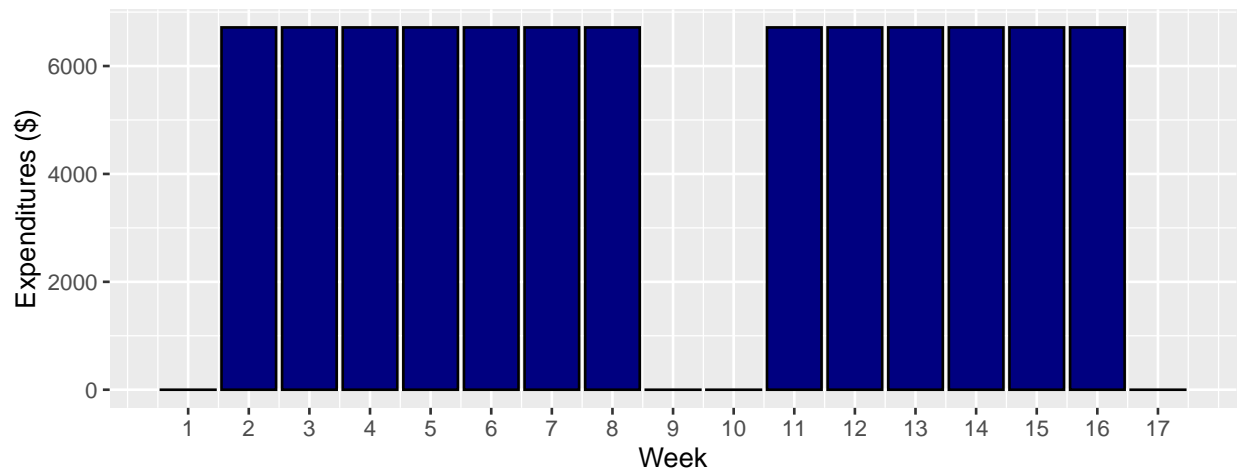
```
fallnullconsistentprob <- data.frame("Week"=1:16, "Probability"=c(0,1/12,1/12,1/12,1/12,1/12,1/12,1/12,0,1/12,1/12,1/12,1/12,1/12,1/12,1/12))
```

```
ggplot(sprnullconsistent) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", color = "white")
```



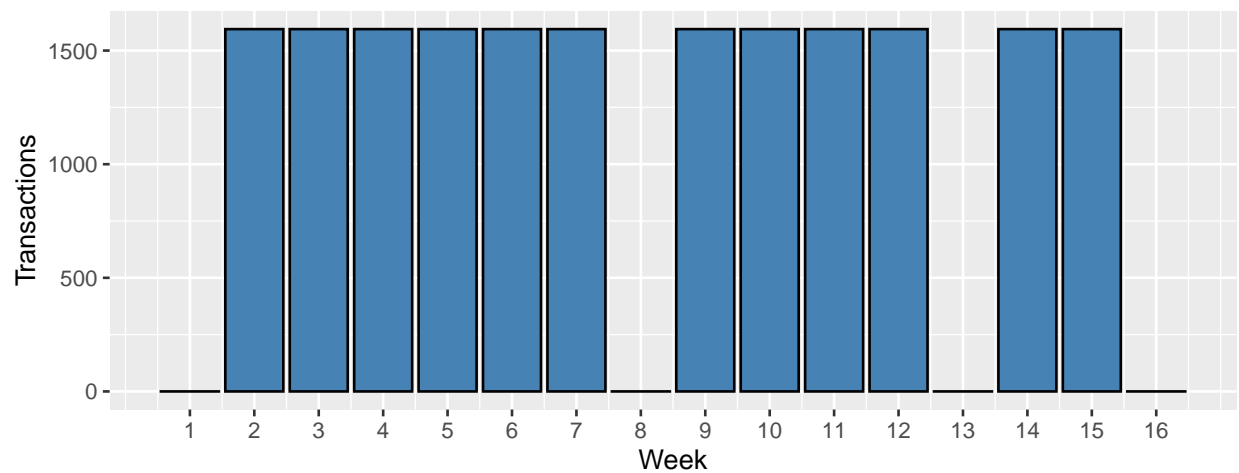
```
ggplot(sprnullconsistent) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "navy", color = "white")
```

Consistent Null: Spring Expenditures



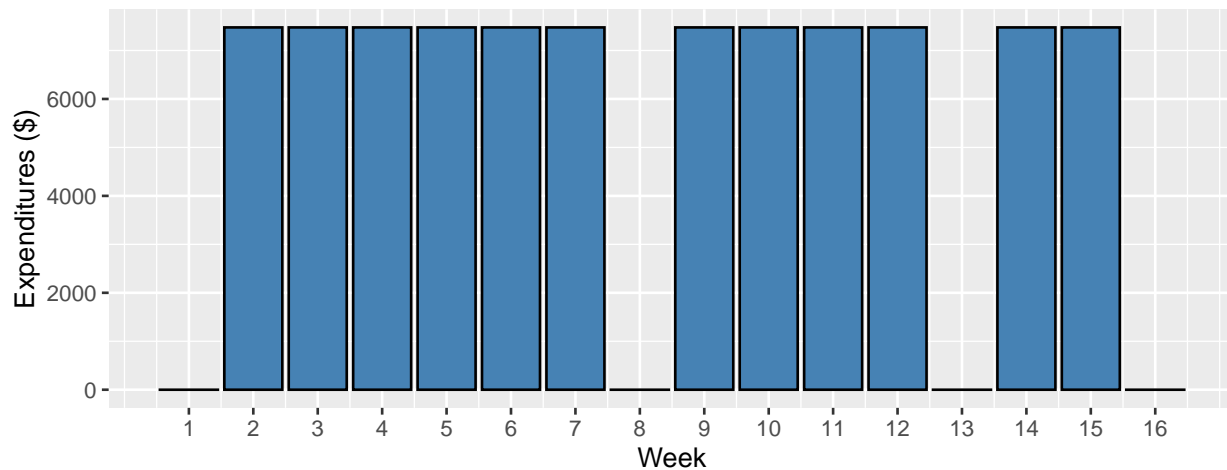
```
ggplot(fallnullconsistent) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue",
```

Consistent Null: Fall Transactions



```
ggplot(fallnullconsistent) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "steelblue", co
```

Consistent Null: Fall Expenditures



#285/518=55.02% of students believe they spend consistently (1/3 beginning, 1/3 middle, 1/3 end)

#86/518=16.60% of students believe they spend most in beginning (1/2 beginning, 1/3 middle, 1/6 end)

#147/518=28.38% of students believe they spend most at end (1/6 beginning, 1/3 middle, 1/2 end)

#Tested - Sums of spring/fall weighted expectation nulls add up to sum of purchases/transactions from s

#Note - each period represents total spending expected during that period, then divided by number of we

```
p1springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/2) + .2838
```

```
p2springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/3) + .2838
```

```
p3springtrans <- (.5502*sum(springppt$TotalTrans)*(1/3) + .1660*sum(springppt$TotalTrans)*(1/6) + .2838
```

```
p1springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/2) + .2838
```

```
p2springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/3) + .2838
```

```
p3springpurch <- (.5502*sum(springppt$TotalPurch)*(1/3) + .1660*sum(springppt$TotalPurch)*(1/6) + .2838
```

```
p1springprob <- (.5502*(1/3) + .1660*(1/2) + .2838*(1/6))*0.913
```

```
p2springprob <- (.5502*(1/3) + .1660*(1/3) + .2838*(1/3))*1.174
```

```
p3springprob <- (.5502*(1/3) + .1660*(1/6) + .2838*(1/2))*0.913
```

```
springnullweighted <- data.frame("Week"=1:17, "Transactions"= c(0,p1springtrans/4,p1springtrans/4,p1spring
```

```
springnullweightedprob <- data.frame("Week"=1:17, "Probability"= c(0,p1springprob/4,p1springprob/4,p1spring
```

```
p1falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/2) + .2838*sum(fa
```

```
p2falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/3) + .2838*sum(fa
```

```
p3falltrans <- .5502*sum(fallppt$TotalTrans)*(1/3) + .1660*sum(fallppt$TotalTrans)*(1/6) + .2838*sum(fa
```

```
p1fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/2) + .2838*sum(fa
```

```
p2fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/3) + .2838*sum(fa
```

```
p3fallpurch <- .5502*sum(fallppt$TotalPurch)*(1/3) + .1660*sum(fallppt$TotalPurch)*(1/6) + .2838*sum(fa
```

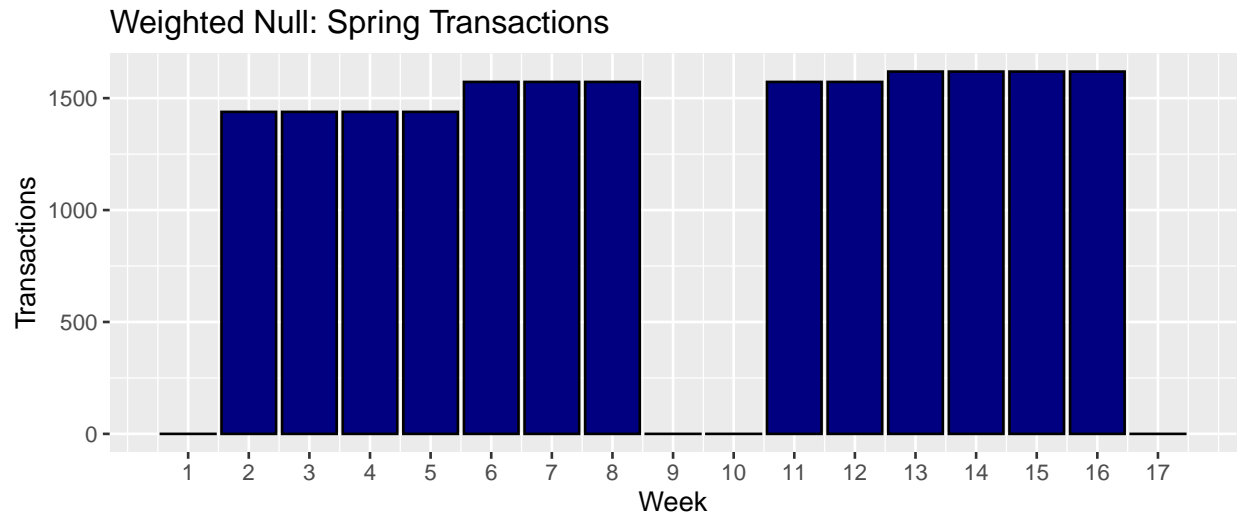
```
p1fallprob <- .5502*(1/3) + .1660*(1/2) + .2838*(1/6)
```

```
p2fallprob <- .5502*(1/3) + .1660*(1/3) + .2838*(1/3)
```

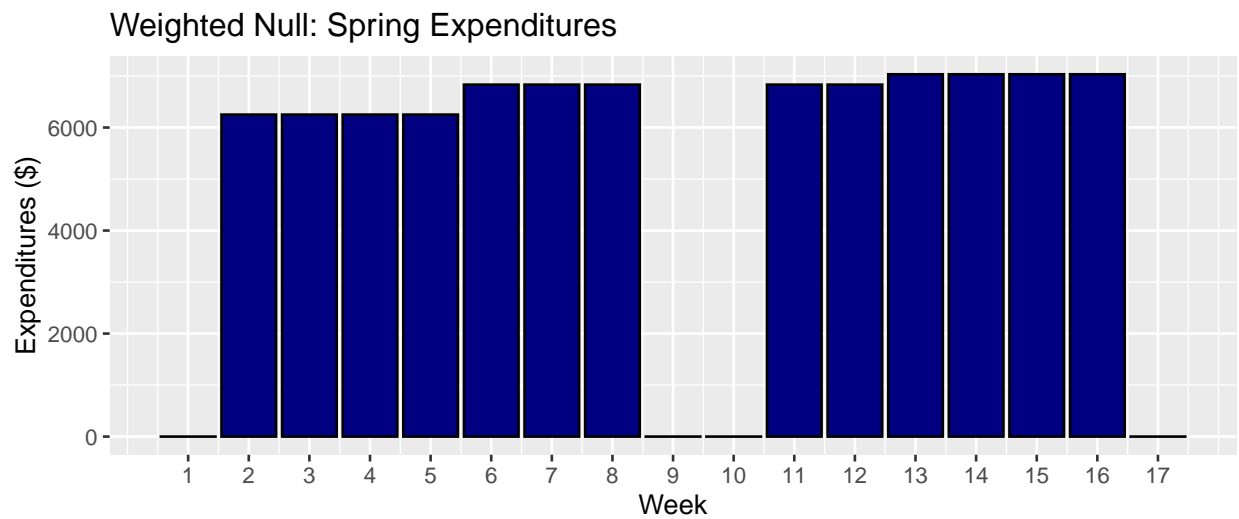
```
p3fallprob <- .5502*(1/3) + .1660*(1/6) + .2838*(1/2)
```

```
fallnullweighted <- data.frame("Week"=1:16, "Transactions"= c(0,p1falltrans/4,p1falltrans/4,p1falltrans,
```

```
fallnullweightedprob <- data.frame("Week"=1:16, "Probability"= c(0,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4,p1fallprob/4))
ggplot(sprnullweighted) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "navy", color = "black")
```

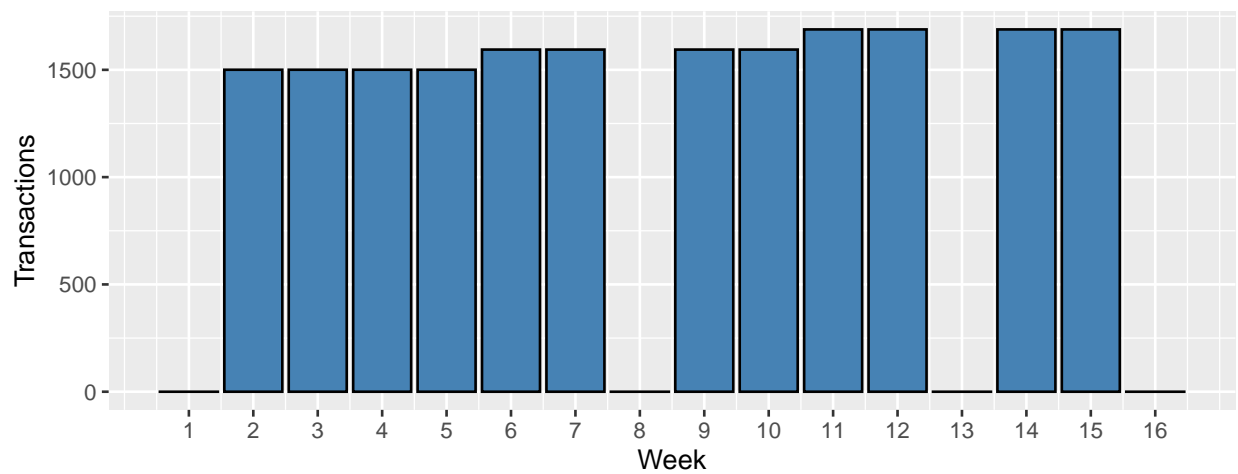


```
ggplot(sprnullweighted) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "navy", color = "black")
```



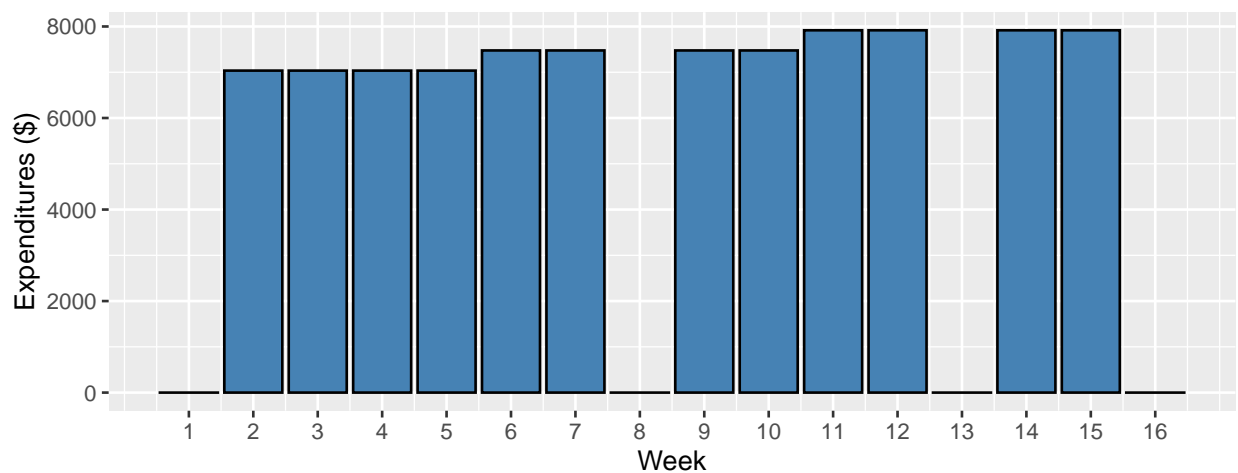
```
ggplot(fallnullweighted) + geom_bar(aes(x=Week, y=Transactions), stat='identity', fill = "steelblue", color = "black")
```

Weighted Null: Fall Transactions



```
ggplot(fallnullweighted) + geom_bar(aes(x=Week, y=Purchases), stat='identity', fill = "steelblue", color="black")
```

Weighted Null: Fall Expenditures



Chi Squared Models

```
#Removing unwanted weeks from dataframes
sprnullconsistent <- sprnullconsistent %>% filter(Transactions != 0)
fallnullconsistent <- fallnullconsistent %>% filter(Transactions != 0)
sprnullweighted <- sprnullweighted %>% filter(Transactions != 0)
fallnullweighted <- fallnullweighted %>% filter(Transactions != 0)

sprnullconsistentprob <- sprnullconsistentprob %>% filter(Probability != 0)
fallnullconsistentprob <- fallnullconsistentprob %>% filter(Probability != 0)
sprnullweightedprob <- sprnullweightedprob %>% filter(Probability != 0)
fallnullweightedprob <- fallnullweightedprob %>% filter(Probability != 0)

springtransactions <- springtransactions %>% filter(Transactions != 0)
```



```
falltransactions <- falltransactions %>% filter(Transactions != 0)
springpurchases <- springpurchases %>% filter(TotalPurch != 0)
fallpurchases <- fallpurchases %>% filter(TotalPurch != 0)
```

#Two Nulls Against Each Other

```
chisq.test(sprnullweighted$Transactions, p = sprnullconsistentprob$Probability)
```

```
##
## Chi-squared test for given probabilities
##
## data: sprnullweighted$Transactions
## X-squared = 45.792, df = 12, p-value = 7.535e-06
```

```
chisq.test(sprnullweighted$Purchases, p = sprnullconsistentprob$Probability)
```

```
##
## Chi-squared test for given probabilities
##
## data: sprnullweighted$Purchases
## X-squared = 198.98, df = 12, p-value < 2.2e-16
```

```
chisq.test(fallnullweighted$Transactions, p = fallnullconsistentprob$Probability)
```

```
##
## Chi-squared test for given probabilities
##
## data: fallnullweighted$Transactions
## X-squared = 44.249, df = 11, p-value = 6.574e-06
```

```
chisq.test(fallnullweighted$Purchases, p = fallnullconsistentprob$Probability)
```

```
##
## Chi-squared test for given probabilities
##
## data: fallnullweighted$Purchases
## X-squared = 207.48, df = 11, p-value < 2.2e-16
```

#Spring Transactions Chi Squared

```
chisq.test(springtransactions$Transactions, p = sprnullconsistentprob$Probability)
```

```
##
## Chi-squared test for given probabilities
##
## data: springtransactions$Transactions
## X-squared = 878.69, df = 12, p-value < 2.2e-16
```

```
chisq.test(springtransactions$Transactions, p = sprnullweightedprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: springtransactions$Transactions  
## X-squared = 1197, df = 12, p-value < 2.2e-16
```

```
#Spring Purchases Chi Squared
```

```
chisq.test(springpurchases$TotalPurch, p = sprnullconsistentprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: springpurchases$TotalPurch  
## X-squared = 3785.5, df = 12, p-value < 2.2e-16
```

```
chisq.test(springpurchases$TotalPurch, p = sprnullweightedprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: springpurchases$TotalPurch  
## X-squared = 5438.5, df = 12, p-value < 2.2e-16
```

```
#Fall Transactions Chi Squared
```

```
chisq.test(falltransactions$Transactions, p = fallnullconsistentprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: falltransactions$Transactions  
## X-squared = 215.63, df = 11, p-value < 2.2e-16
```

```
chisq.test(falltransactions$Transactions, p = fallnullweightedprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: falltransactions$Transactions  
## X-squared = 424.92, df = 11, p-value < 2.2e-16
```

```
#Fall Purchases Chi Squared
```

```
chisq.test(fallpurchases$TotalPurch, p = fallnullconsistentprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: fallpurchases$TotalPurch  
## X-squared = 1590.2, df = 11, p-value < 2.2e-16
```

```
chisq.test(fallpurchases$TotalPurch, p = fallnullweightedprob$Probability)
```

```
##  
## Chi-squared test for given probabilities  
##  
## data: fallpurchases$TotalPurch  
## X-squared = 2115.8, df = 11, p-value < 2.2e-16
```

```
#Testing the Fall and the Spring semesters against one another  
springtransactions <- springtransactions %>% filter(Week != 16)  
springpurchases <- springpurchases %>% filter(Week != 16)  
#chisq.test(falltransactions$Transactions, p = springtransactions$ProbWeight, rescale.p = TRUE)  
#chisq.test(fallpurchases$TotalPurch, p = springpurchases$ProbWeight, rescale.p = TRUE)  
#chisq.test(springtransactions$Transactions, p = falltransactions$ProbWeight, rescale.p = TRUE)  
#chisq.test(springpurchases$TotalPurch, p = fallpurchases$ProbWeight, rescale.p = TRUE)
```