Multiple Linear Regression and Special Issues Assignment

2/2/2020

library(tidyverse)

## Warning: package 'tidyverse' was built under R version 3.6.2

## -- Attaching packages ----------------------------------- tidyverse 1.3.0 --

## v ggplot2 3.2.1 v purrr 0.3.3  
## v tibble 2.1.3 v dplyr 0.8.3  
## v tidyr 1.0.0 v stringr 1.4.0  
## v readr 1.3.1 v forcats 0.4.0

## -- Conflicts -------------------------------------- tidyverse\_conflicts() --  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

library(GGally)

## Warning: package 'GGally' was built under R version 3.6.2

## Registered S3 method overwritten by 'GGally':  
## method from   
## +.gg ggplot2

##   
## Attaching package: 'GGally'

## The following object is masked from 'package:dplyr':  
##   
## nasa

library(MASS)

##   
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':  
##   
## select

bike = read\_csv("hour.csv")

## Parsed with column specification:  
## cols(  
## instant = col\_double(),  
## dteday = col\_date(format = ""),  
## season = col\_double(),  
## yr = col\_double(),  
## mnth = col\_double(),  
## hr = col\_double(),  
## holiday = col\_double(),  
## weekday = col\_double(),  
## workingday = col\_double(),  
## weathersit = col\_double(),  
## temp = col\_double(),  
## atemp = col\_double(),  
## hum = col\_double(),  
## windspeed = col\_double(),  
## casual = col\_double(),  
## registered = col\_double(),  
## count = col\_double()  
## )

bike = bike %>% mutate(season = as\_factor(as.character(season))) %>%  
mutate(season = fct\_recode(season,  
"Spring" = "1",  
"Summer" = "2",  
"Fall" = "3",  
"Winter" = "4"))

bike = bike %>% mutate(yr = as\_factor(as.character(yr)))  
bike = bike %>% mutate(mnth = as\_factor(as.character(mnth)))  
bike = bike %>% mutate(hr = as\_factor(as.character(hr)))

bike = bike %>% mutate(holiday = as\_factor(as.character(holiday))) %>%  
mutate(holiday = fct\_recode(holiday,  
"NotHoliday" = "0",  
"HoliDay" = "1"))

bike = bike %>% mutate(workingday = as\_factor(as.character(workingday))) %>%  
mutate(workingday = fct\_recode(workingday,  
"NotWorkingDay" = "0",  
"WorkingDay" = "1"))

bike = bike %>% mutate(weathersit = as\_factor(as.character(weathersit))) %>%  
mutate(weathersit = fct\_recode(weathersit,  
"NoPrecip" = "1",  
"Misty" = "2",  
"LightPrecip" = "3",  
"HeavyPrecip" = "4"))

bike = bike %>% mutate(weekday = as\_factor(as.character(weekday))) %>%  
mutate(weekday = fct\_recode(weekday,  
"Monday" = "1",  
"Tuesday" = "2",  
"Wednesday" = "3",  
"Thursday" = "4",  
"Friday" = "5",  
"Saturday" = "6",  
"Sunday" = "0"))

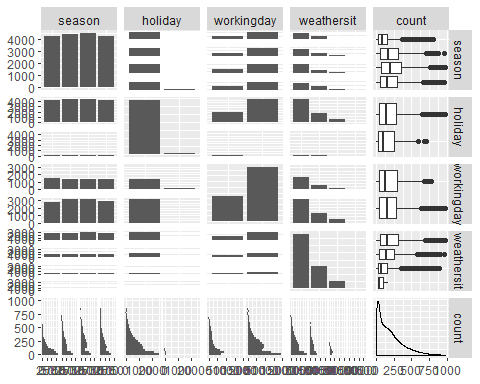
#By converting yr, mnth, and hr into factors instead of numbers, we can look at them as objects. An example would be that the first few months of being in business had year represented as zero, which numberically might not be calculated properly if you wanted to know how many days it rained in the first few months of business.

library(ggcorrplot)

## Warning: package 'ggcorrplot' was built under R version 3.6.2

ggpairs(bike, columns = c(3,7,9,10,17))

## `stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.  
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## `stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.

 #The variables most correlated with “Count” are “Season”, “Holiday”, “WorkingDay”, and “WeatherSit”.

allmod = bike %>% dplyr::select ("temp", "atemp", "hum", "windspeed", "count")  
  
allmod = lm(temp~., bike)  
summary(allmod)

##   
## Call:  
## lm(formula = temp ~ ., data = bike)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.12147 -0.01353 -0.00047 0.01213 0.52152   
##   
## Coefficients: (2 not defined because of singularities)  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.137e+01 6.365e+00 -3.358 0.000786 \*\*\*  
## instant -5.340e-05 1.780e-05 -2.999 0.002712 \*\*   
## dteday 1.426e-03 4.250e-04 3.356 0.000792 \*\*\*  
## seasonSummer -3.022e-03 1.249e-03 -2.420 0.015545 \*   
## seasonFall 6.895e-03 1.476e-03 4.672 3.01e-06 \*\*\*  
## seasonWinter 2.366e-03 1.263e-03 1.874 0.060982 .   
## yr1 -5.289e-02 8.289e-03 -6.381 1.81e-10 \*\*\*  
## mnth2 -2.486e-03 1.251e-03 -1.987 0.046891 \*   
## mnth3 3.511e-03 1.794e-03 1.957 0.050387 .   
## mnth4 5.435e-03 2.635e-03 2.063 0.039158 \*   
## mnth5 2.304e-02 3.223e-03 7.149 9.11e-13 \*\*\*  
## mnth6 3.298e-02 3.825e-03 8.623 < 2e-16 \*\*\*  
## mnth7 3.014e-02 4.537e-03 6.643 3.17e-11 \*\*\*  
## mnth8 3.037e-02 5.147e-03 5.900 3.69e-09 \*\*\*  
## mnth9 5.848e-03 5.745e-03 1.018 0.308733   
## mnth10 -2.161e-02 6.408e-03 -3.373 0.000746 \*\*\*  
## mnth11 -4.156e-02 7.083e-03 -5.867 4.51e-09 \*\*\*  
## mnth12 -4.853e-02 7.682e-03 -6.318 2.72e-10 \*\*\*  
## hr1 1.261e-04 1.372e-03 0.092 0.926756   
## hr2 -5.048e-04 1.378e-03 -0.366 0.714024   
## hr3 -1.417e-03 1.389e-03 -1.020 0.307567   
## hr4 -2.246e-03 1.391e-03 -1.615 0.106428   
## hr5 -2.535e-03 1.382e-03 -1.835 0.066560 .   
## hr6 -2.581e-03 1.382e-03 -1.868 0.061806 .   
## hr7 -2.477e-03 1.434e-03 -1.727 0.084200 .   
## hr8 -2.058e-03 1.551e-03 -1.327 0.184451   
## hr9 -5.522e-04 1.419e-03 -0.389 0.697106   
## hr10 2.308e-03 1.405e-03 1.642 0.100604   
## hr11 4.125e-03 1.428e-03 2.890 0.003861 \*\*   
## hr12 5.571e-03 1.456e-03 3.827 0.000130 \*\*\*  
## hr13 7.032e-03 1.467e-03 4.795 1.64e-06 \*\*\*  
## hr14 7.969e-03 1.475e-03 5.404 6.59e-08 \*\*\*  
## hr15 9.103e-03 1.481e-03 6.148 7.99e-10 \*\*\*  
## hr16 9.833e-03 1.503e-03 6.543 6.20e-11 \*\*\*  
## hr17 9.349e-03 1.618e-03 5.779 7.66e-09 \*\*\*  
## hr18 7.638e-03 1.592e-03 4.798 1.61e-06 \*\*\*  
## hr19 5.261e-03 1.498e-03 3.511 0.000448 \*\*\*  
## hr20 3.324e-03 1.454e-03 2.286 0.022275 \*   
## hr21 1.964e-03 1.436e-03 1.368 0.171357   
## hr22 1.744e-03 1.430e-03 1.220 0.222637   
## hr23 1.535e-03 1.429e-03 1.074 0.282697   
## holidayHoliDay 8.652e-03 1.269e-03 6.816 9.70e-12 \*\*\*  
## weekdaySunday -9.565e-04 7.392e-04 -1.294 0.195682   
## weekdayMonday 2.602e-04 8.142e-04 0.320 0.749291   
## weekdayTuesday 3.327e-03 8.071e-04 4.122 3.78e-05 \*\*\*  
## weekdayWednesday 5.334e-03 8.068e-04 6.611 3.92e-11 \*\*\*  
## weekdayThursday 3.740e-03 8.063e-04 4.639 3.53e-06 \*\*\*  
## weekdayFriday 6.012e-03 7.829e-04 7.678 1.70e-14 \*\*\*  
## workingdayWorkingDay NA NA NA NA   
## weathersitMisty 2.498e-03 4.929e-04 5.068 4.05e-07 \*\*\*  
## weathersitLightPrecip 3.680e-03 8.397e-04 4.383 1.18e-05 \*\*\*  
## weathersitHeavyPrecip 2.285e-03 1.511e-02 0.151 0.879825   
## atemp 9.784e-01 2.575e-03 379.989 < 2e-16 \*\*\*  
## hum -9.344e-03 1.440e-03 -6.490 8.83e-11 \*\*\*  
## windspeed 5.782e-02 1.758e-03 32.880 < 2e-16 \*\*\*  
## casual 5.468e-05 6.770e-06 8.077 7.08e-16 \*\*\*  
## registered -3.143e-06 2.510e-06 -1.252 0.210434   
## count NA NA NA NA   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.0261 on 17323 degrees of freedom  
## Multiple R-squared: 0.9817, Adjusted R-squared: 0.9816   
## F-statistic: 1.688e+04 on 55 and 17323 DF, p-value: < 2.2e-16

emptymod = lm(temp~1, bike)  
summary(emptymod)

##   
## Call:  
## lm(formula = temp ~ 1, data = bike)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.47699 -0.15699 0.00301 0.16301 0.50301   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.496987 0.001461 340.3 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.1926 on 17378 degrees of freedom

forwardmod = stepAIC(emptymod, direction = "forward", scope = list(upper = allmod, lower = emptymod), trace = TRUE)

## Start: AIC=-57258.2  
## temp ~ 1  
##   
## Df Sum of Sq RSS AIC  
## + atemp 1 628.55 15.79 -121714  
## + mnth 11 484.27 160.07 -81438  
## + season 3 396.32 248.02 -73844  
## + casual 1 136.11 508.22 -61380  
## + count 1 105.57 538.77 -60366  
## + registered 1 72.47 571.87 -59330  
## + hr 23 35.47 608.87 -58196  
## + instant 1 11.95 632.39 -57582  
## + dteday 1 11.93 632.41 -57581  
## + weathersit 3 7.16 637.18 -57446  
## + hum 1 3.15 641.19 -57341  
## + workingday 1 1.98 642.36 -57310  
## + weekday 6 1.83 642.51 -57296  
## + yr 1 1.08 643.26 -57285  
## + holiday 1 0.48 643.86 -57269  
## + windspeed 1 0.34 643.99 -57266  
## <none> 644.34 -57258  
##   
## Step: AIC=-121713.7  
## temp ~ atemp  
##   
## Df Sum of Sq RSS AIC  
## + mnth 11 2.03693 13.752 -124092  
## + season 3 1.22963 14.559 -123117  
## + windspeed 1 0.95593 14.833 -122797  
## + hum 1 0.22361 15.565 -121960  
## + casual 1 0.10061 15.688 -121823  
## + hr 23 0.13611 15.653 -121818  
## + count 1 0.05926 15.729 -121777  
## + weekday 6 0.06093 15.728 -121769  
## + registered 1 0.03451 15.754 -121750  
## + weathersit 3 0.02359 15.765 -121734  
## + holiday 1 0.00681 15.782 -121719  
## + yr 1 0.00305 15.786 -121715  
## <none> 15.789 -121714  
## + workingday 1 0.00126 15.787 -121713  
## + instant 1 0.00004 15.789 -121712  
## + dteday 1 0.00003 15.789 -121712  
##   
## Step: AIC=-124092.2  
## temp ~ atemp + mnth  
##   
## Df Sum of Sq RSS AIC  
## + windspeed 1 1.24106 12.511 -125734  
## + hr 23 0.79503 12.957 -125081  
## + hum 1 0.48344 13.268 -124712  
## + casual 1 0.34594 13.406 -124533  
## + count 1 0.26611 13.486 -124430  
## + registered 1 0.17443 13.577 -124312  
## + weekday 6 0.05655 13.695 -124152  
## + season 3 0.04024 13.712 -124137  
## + holiday 1 0.03154 13.720 -124130  
## + instant 1 0.02321 13.729 -124120  
## + dteday 1 0.02305 13.729 -124119  
## + yr 1 0.02063 13.731 -124116  
## + weathersit 3 0.01088 13.741 -124100  
## + workingday 1 0.00348 13.748 -124095  
## <none> 13.752 -124092  
##   
## Step: AIC=-125733.9  
## temp ~ atemp + mnth + windspeed  
##   
## Df Sum of Sq RSS AIC  
## + hr 23 0.40654 12.104 -126262  
## + casual 1 0.21511 12.296 -126033  
## + hum 1 0.16884 12.342 -125968  
## + count 1 0.14684 12.364 -125937  
## + registered 1 0.09081 12.420 -125859  
## + weekday 6 0.06183 12.449 -125808  
## + holiday 1 0.03030 12.480 -125774  
## + instant 1 0.02815 12.483 -125771  
## + dteday 1 0.02804 12.483 -125771  
## + season 3 0.02879 12.482 -125768  
## + yr 1 0.02558 12.485 -125767  
## + workingday 1 0.00569 12.505 -125740  
## <none> 12.511 -125734  
## + weathersit 3 0.00286 12.508 -125732  
##   
## Step: AIC=-126262  
## temp ~ atemp + mnth + windspeed + hr  
##   
## Df Sum of Sq RSS AIC  
## + weekday 6 0.064072 12.040 -126342  
## + dteday 1 0.038390 12.066 -126315  
## + instant 1 0.038329 12.066 -126315  
## + season 3 0.039855 12.064 -126313  
## + yr 1 0.035391 12.069 -126311  
## + holiday 1 0.033697 12.070 -126308  
## + casual 1 0.033330 12.071 -126308  
## + count 1 0.030991 12.073 -126305  
## + hum 1 0.029976 12.074 -126303  
## + registered 1 0.018987 12.085 -126287  
## + workingday 1 0.008086 12.096 -126272  
## <none> 12.104 -126262  
## + weathersit 3 0.003632 12.101 -126261  
##   
## Step: AIC=-126342.3  
## temp ~ atemp + mnth + windspeed + hr + weekday  
##   
## Df Sum of Sq RSS AIC  
## + casual 1 0.072738 11.967 -126446  
## + workingday 1 0.044023 11.996 -126404  
## + holiday 1 0.044023 11.996 -126404  
## + dteday 1 0.038711 12.001 -126396  
## + instant 1 0.038651 12.002 -126396  
## + season 3 0.039329 12.001 -126393  
## + yr 1 0.035713 12.004 -126392  
## + hum 1 0.028780 12.011 -126382  
## + count 1 0.028098 12.012 -126381  
## + registered 1 0.011315 12.029 -126357  
## <none> 12.040 -126342  
## + weathersit 3 0.003346 12.037 -126341  
##   
## Step: AIC=-126445.6  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual  
##   
## Df Sum of Sq RSS AIC  
## + season 3 0.042494 11.925 -126501  
## + workingday 1 0.032925 11.934 -126491  
## + holiday 1 0.032925 11.934 -126491  
## + dteday 1 0.021537 11.946 -126475  
## + instant 1 0.021479 11.946 -126475  
## + yr 1 0.019209 11.948 -126472  
## + hum 1 0.013670 11.954 -126463  
## + weathersit 3 0.007864 11.960 -126451  
## <none> 11.967 -126446  
## + registered 1 0.000112 11.967 -126444  
## + count 1 0.000112 11.967 -126444  
##   
## Step: AIC=-126501.4  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season  
##   
## Df Sum of Sq RSS AIC  
## + holiday 1 0.032185 11.893 -126546  
## + workingday 1 0.032185 11.893 -126546  
## + dteday 1 0.021765 11.903 -126531  
## + instant 1 0.021703 11.903 -126531  
## + yr 1 0.019432 11.905 -126528  
## + hum 1 0.011816 11.913 -126517  
## + weathersit 3 0.008766 11.916 -126508  
## <none> 11.925 -126501  
## + registered 1 0.000080 11.925 -126500  
## + count 1 0.000080 11.925 -126500  
##   
## Step: AIC=-126546.4  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday  
##   
## Df Sum of Sq RSS AIC  
## + dteday 1 0.0227831 11.870 -126578  
## + instant 1 0.0227219 11.870 -126578  
## + yr 1 0.0203596 11.872 -126574  
## + hum 1 0.0118829 11.881 -126562  
## + weathersit 3 0.0089190 11.884 -126553  
## <none> 11.893 -126546  
## + registered 1 0.0002205 11.893 -126545  
## + count 1 0.0002205 11.893 -126545  
##   
## Step: AIC=-126577.7  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday + dteday  
##   
## Df Sum of Sq RSS AIC  
## + yr 1 0.0270381 11.843 -126615  
## + hum 1 0.0099548 11.860 -126590  
## + instant 1 0.0059831 11.864 -126584  
## + weathersit 3 0.0083057 11.862 -126584  
## + registered 1 0.0016587 11.868 -126578  
## + count 1 0.0016587 11.868 -126578  
## <none> 11.870 -126578  
##   
## Step: AIC=-126615.3  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday + dteday + yr  
##   
## Df Sum of Sq RSS AIC  
## + hum 1 0.0109575 11.832 -126629  
## + weathersit 3 0.0085611 11.834 -126622  
## + instant 1 0.0048629 11.838 -126620  
## <none> 11.843 -126615  
## + registered 1 0.0012937 11.842 -126615  
## + count 1 0.0012937 11.842 -126615  
##   
## Step: AIC=-126629.4  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday + dteday + yr + hum  
##   
## Df Sum of Sq RSS AIC  
## + weathersit 3 0.0242821 11.808 -126659  
## + instant 1 0.0059482 11.826 -126636  
## + registered 1 0.0022124 11.830 -126631  
## + count 1 0.0022124 11.830 -126631  
## <none> 11.832 -126629  
##   
## Step: AIC=-126659.1  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday + dteday + yr + hum + weathersit  
##   
## Df Sum of Sq RSS AIC  
## + instant 1 0.0062507 11.801 -126666  
## <none> 11.808 -126659  
## + registered 1 0.0011921 11.806 -126659  
## + count 1 0.0011921 11.806 -126659  
##   
## Step: AIC=-126666.3  
## temp ~ atemp + mnth + windspeed + hr + weekday + casual + season +   
## holiday + dteday + yr + hum + weathersit + instant  
##   
## Df Sum of Sq RSS AIC  
## <none> 11.801 -126666  
## + registered 1 0.0010685 11.800 -126666  
## + count 1 0.0010685 11.800 -126666

summary(forwardmod)

##   
## Call:  
## lm(formula = temp ~ atemp + mnth + windspeed + hr + weekday +   
## casual + season + holiday + dteday + yr + hum + weathersit +   
## instant, data = bike)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.12152 -0.01352 -0.00044 0.01216 0.52173   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.156e+01 6.363e+00 -3.389 0.000703 \*\*\*  
## atemp 9.782e-01 2.571e-03 380.535 < 2e-16 \*\*\*  
## mnth2 -2.525e-03 1.251e-03 -2.019 0.043543 \*   
## mnth3 3.489e-03 1.794e-03 1.945 0.051839 .   
## mnth4 5.415e-03 2.635e-03 2.055 0.039890 \*   
## mnth5 2.298e-02 3.223e-03 7.129 1.05e-12 \*\*\*  
## mnth6 3.290e-02 3.824e-03 8.603 < 2e-16 \*\*\*  
## mnth7 3.011e-02 4.537e-03 6.635 3.34e-11 \*\*\*  
## mnth8 3.029e-02 5.147e-03 5.886 4.03e-09 \*\*\*  
## mnth9 5.737e-03 5.744e-03 0.999 0.317900   
## mnth10 -2.166e-02 6.408e-03 -3.381 0.000725 \*\*\*  
## mnth11 -4.159e-02 7.083e-03 -5.871 4.40e-09 \*\*\*  
## mnth12 -4.861e-02 7.682e-03 -6.328 2.54e-10 \*\*\*  
## windspeed 5.781e-02 1.758e-03 32.874 < 2e-16 \*\*\*  
## hr1 1.646e-04 1.372e-03 0.120 0.904491   
## hr2 -4.443e-04 1.377e-03 -0.323 0.746887   
## hr3 -1.335e-03 1.387e-03 -0.963 0.335737   
## hr4 -2.157e-03 1.390e-03 -1.552 0.120630   
## hr5 -2.487e-03 1.381e-03 -1.800 0.071801 .   
## hr6 -2.696e-03 1.379e-03 -1.956 0.050526 .   
## hr7 -2.977e-03 1.378e-03 -2.161 0.030717 \*   
## hr8 -2.945e-03 1.380e-03 -2.135 0.032788 \*   
## hr9 -9.339e-04 1.386e-03 -0.674 0.500289   
## hr10 2.176e-03 1.401e-03 1.553 0.120475   
## hr11 3.977e-03 1.423e-03 2.795 0.005189 \*\*   
## hr12 5.341e-03 1.444e-03 3.699 0.000217 \*\*\*  
## hr13 6.831e-03 1.458e-03 4.686 2.81e-06 \*\*\*  
## hr14 7.831e-03 1.470e-03 5.326 1.02e-07 \*\*\*  
## hr15 8.930e-03 1.474e-03 6.058 1.41e-09 \*\*\*  
## hr16 9.461e-03 1.473e-03 6.422 1.38e-10 \*\*\*  
## hr17 8.507e-03 1.471e-03 5.781 7.55e-09 \*\*\*  
## hr18 6.824e-03 1.453e-03 4.696 2.67e-06 \*\*\*  
## hr19 4.723e-03 1.436e-03 3.290 0.001004 \*\*   
## hr20 2.970e-03 1.426e-03 2.082 0.037355 \*   
## hr21 1.726e-03 1.423e-03 1.213 0.225206   
## hr22 1.594e-03 1.425e-03 1.119 0.263314   
## hr23 1.472e-03 1.428e-03 1.031 0.302587   
## weekdaySunday -9.421e-04 7.391e-04 -1.275 0.202461   
## weekdayMonday 4.719e-05 7.962e-04 0.059 0.952742   
## weekdayTuesday 3.089e-03 7.845e-04 3.938 8.27e-05 \*\*\*  
## weekdayWednesday 5.088e-03 7.826e-04 6.502 8.16e-11 \*\*\*  
## weekdayThursday 3.496e-03 7.825e-04 4.469 7.93e-06 \*\*\*  
## weekdayFriday 5.805e-03 7.653e-04 7.585 3.50e-14 \*\*\*  
## casual 5.147e-05 6.267e-06 8.214 2.30e-16 \*\*\*  
## seasonSummer -3.082e-03 1.248e-03 -2.470 0.013538 \*   
## seasonFall 6.807e-03 1.474e-03 4.617 3.92e-06 \*\*\*  
## seasonWinter 2.169e-03 1.253e-03 1.731 0.083392 .   
## holidayHoliDay 8.869e-03 1.258e-03 7.052 1.83e-12 \*\*\*  
## dteday 1.439e-03 4.249e-04 3.387 0.000709 \*\*\*  
## yr1 -5.318e-02 8.286e-03 -6.418 1.42e-10 \*\*\*  
## hum -9.271e-03 1.439e-03 -6.444 1.19e-10 \*\*\*  
## weathersitMisty 2.509e-03 4.929e-04 5.090 3.62e-07 \*\*\*  
## weathersitLightPrecip 3.815e-03 8.328e-04 4.581 4.67e-06 \*\*\*  
## weathersitHeavyPrecip 2.452e-03 1.511e-02 0.162 0.871089   
## instant -5.392e-05 1.780e-05 -3.029 0.002456 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.0261 on 17324 degrees of freedom  
## Multiple R-squared: 0.9817, Adjusted R-squared: 0.9816   
## F-statistic: 1.72e+04 on 54 and 17324 DF, p-value: < 2.2e-16

#Task 4: The variables included in my forward model are “temp”, “atemp”, “hum”, “windspeed”, and "count. The modelis good and seems to match our intuition/common sense.

backmod = stepAIC(allmod, direction = "backward", trace = TRUE)

## Start: AIC=-126665.9  
## temp ~ instant + dteday + season + yr + mnth + hr + holiday +   
## weekday + workingday + weathersit + atemp + hum + windspeed +   
## casual + registered + count  
##   
##   
## Step: AIC=-126665.9  
## temp ~ instant + dteday + season + yr + mnth + hr + holiday +   
## weekday + workingday + weathersit + atemp + hum + windspeed +   
## casual + registered  
##   
##   
## Step: AIC=-126665.9  
## temp ~ instant + dteday + season + yr + mnth + hr + holiday +   
## weekday + weathersit + atemp + hum + windspeed + casual +   
## registered  
##   
## Df Sum of Sq RSS AIC  
## - registered 1 0.001 11.801 -126666  
## <none> 11.800 -126666  
## - instant 1 0.006 11.806 -126659  
## - dteday 1 0.008 11.808 -126657  
## - weathersit 3 0.024 11.824 -126637  
## - yr 1 0.028 11.828 -126627  
## - hum 1 0.029 11.829 -126626  
## - holiday 1 0.032 11.832 -126621  
## - season 3 0.042 11.842 -126611  
## - casual 1 0.044 11.845 -126603  
## - weekday 6 0.094 11.895 -126539  
## - hr 23 0.140 11.940 -126507  
## - windspeed 1 0.736 12.537 -125616  
## - mnth 11 1.343 13.143 -124815  
## - atemp 1 98.359 110.159 -87847  
##   
## Step: AIC=-126666.3  
## temp ~ instant + dteday + season + yr + mnth + hr + holiday +   
## weekday + weathersit + atemp + hum + windspeed + casual  
##   
## Df Sum of Sq RSS AIC  
## <none> 11.801 -126666  
## - instant 1 0.006 11.808 -126659  
## - dteday 1 0.008 11.809 -126657  
## - weathersit 3 0.025 11.826 -126636  
## - yr 1 0.028 11.829 -126627  
## - hum 1 0.028 11.830 -126627  
## - holiday 1 0.034 11.835 -126619  
## - season 3 0.041 11.843 -126611  
## - casual 1 0.046 11.847 -126601  
## - weekday 6 0.096 11.897 -126538  
## - hr 23 0.139 11.940 -126509  
## - windspeed 1 0.736 12.538 -125617  
## - mnth 11 1.342 13.143 -124817  
## - atemp 1 98.645 110.446 -87803

summary(backmod)

##   
## Call:  
## lm(formula = temp ~ instant + dteday + season + yr + mnth + hr +   
## holiday + weekday + weathersit + atemp + hum + windspeed +   
## casual, data = bike)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -0.12152 -0.01352 -0.00044 0.01216 0.52173   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.156e+01 6.363e+00 -3.389 0.000703 \*\*\*  
## instant -5.392e-05 1.780e-05 -3.029 0.002456 \*\*   
## dteday 1.439e-03 4.249e-04 3.387 0.000709 \*\*\*  
## seasonSummer -3.082e-03 1.248e-03 -2.470 0.013538 \*   
## seasonFall 6.807e-03 1.474e-03 4.617 3.92e-06 \*\*\*  
## seasonWinter 2.169e-03 1.253e-03 1.731 0.083392 .   
## yr1 -5.318e-02 8.286e-03 -6.418 1.42e-10 \*\*\*  
## mnth2 -2.525e-03 1.251e-03 -2.019 0.043543 \*   
## mnth3 3.489e-03 1.794e-03 1.945 0.051839 .   
## mnth4 5.415e-03 2.635e-03 2.055 0.039890 \*   
## mnth5 2.298e-02 3.223e-03 7.129 1.05e-12 \*\*\*  
## mnth6 3.290e-02 3.824e-03 8.603 < 2e-16 \*\*\*  
## mnth7 3.011e-02 4.537e-03 6.635 3.34e-11 \*\*\*  
## mnth8 3.029e-02 5.147e-03 5.886 4.03e-09 \*\*\*  
## mnth9 5.737e-03 5.744e-03 0.999 0.317900   
## mnth10 -2.166e-02 6.408e-03 -3.381 0.000725 \*\*\*  
## mnth11 -4.159e-02 7.083e-03 -5.871 4.40e-09 \*\*\*  
## mnth12 -4.861e-02 7.682e-03 -6.328 2.54e-10 \*\*\*  
## hr1 1.646e-04 1.372e-03 0.120 0.904491   
## hr2 -4.443e-04 1.377e-03 -0.323 0.746887   
## hr3 -1.335e-03 1.387e-03 -0.963 0.335737   
## hr4 -2.157e-03 1.390e-03 -1.552 0.120630   
## hr5 -2.487e-03 1.381e-03 -1.800 0.071801 .   
## hr6 -2.696e-03 1.379e-03 -1.956 0.050526 .   
## hr7 -2.977e-03 1.378e-03 -2.161 0.030717 \*   
## hr8 -2.945e-03 1.380e-03 -2.135 0.032788 \*   
## hr9 -9.339e-04 1.386e-03 -0.674 0.500289   
## hr10 2.176e-03 1.401e-03 1.553 0.120475   
## hr11 3.977e-03 1.423e-03 2.795 0.005189 \*\*   
## hr12 5.341e-03 1.444e-03 3.699 0.000217 \*\*\*  
## hr13 6.831e-03 1.458e-03 4.686 2.81e-06 \*\*\*  
## hr14 7.831e-03 1.470e-03 5.326 1.02e-07 \*\*\*  
## hr15 8.930e-03 1.474e-03 6.058 1.41e-09 \*\*\*  
## hr16 9.461e-03 1.473e-03 6.422 1.38e-10 \*\*\*  
## hr17 8.507e-03 1.471e-03 5.781 7.55e-09 \*\*\*  
## hr18 6.824e-03 1.453e-03 4.696 2.67e-06 \*\*\*  
## hr19 4.723e-03 1.436e-03 3.290 0.001004 \*\*   
## hr20 2.970e-03 1.426e-03 2.082 0.037355 \*   
## hr21 1.726e-03 1.423e-03 1.213 0.225206   
## hr22 1.594e-03 1.425e-03 1.119 0.263314   
## hr23 1.472e-03 1.428e-03 1.031 0.302587   
## holidayHoliDay 8.869e-03 1.258e-03 7.052 1.83e-12 \*\*\*  
## weekdaySunday -9.421e-04 7.391e-04 -1.275 0.202461   
## weekdayMonday 4.719e-05 7.962e-04 0.059 0.952742   
## weekdayTuesday 3.089e-03 7.845e-04 3.938 8.27e-05 \*\*\*  
## weekdayWednesday 5.088e-03 7.826e-04 6.502 8.16e-11 \*\*\*  
## weekdayThursday 3.496e-03 7.825e-04 4.469 7.93e-06 \*\*\*  
## weekdayFriday 5.805e-03 7.653e-04 7.585 3.50e-14 \*\*\*  
## weathersitMisty 2.509e-03 4.929e-04 5.090 3.62e-07 \*\*\*  
## weathersitLightPrecip 3.815e-03 8.328e-04 4.581 4.67e-06 \*\*\*  
## weathersitHeavyPrecip 2.452e-03 1.511e-02 0.162 0.871089   
## atemp 9.782e-01 2.571e-03 380.535 < 2e-16 \*\*\*  
## hum -9.271e-03 1.439e-03 -6.444 1.19e-10 \*\*\*  
## windspeed 5.781e-02 1.758e-03 32.874 < 2e-16 \*\*\*  
## casual 5.147e-05 6.267e-06 8.214 2.30e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.0261 on 17324 degrees of freedom  
## Multiple R-squared: 0.9817, Adjusted R-squared: 0.9816   
## F-statistic: 1.72e+04 on 54 and 17324 DF, p-value: < 2.2e-16

#Task 5: The forward and backward model are the same

#Task 6: WorkingDay is kicked out because it directly relates to the Weekday and the Holiday columns.

#Task 7: My concerns with the use of this model are that several variables appear to be predictors of other variables while they are not. An example is the workday, holiday, weekday variables as described above.