Problem Set – 9
PSY 5210

Joint Submission By:

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Problem 1:
Come up with a forecast for the amount of snow that will fall in Houghton in December 2018.

Solution:

The forecast for the amount of snowfall for December 2018 is predicted as: 78.17261.

Problem 2:
Provide a rationale and justification for this. In this justification, provide and explain the models you used. You may discuss predictors or models you tried and discarded as a way to rationalize why you chose the model you did. You should include one or more figures showing how good you anticipate the prediction to be, based on predicting past data.

Solution:

Models:

- The Average Temperature of December – 2018 is predicted using data of previous 10 years Decembers average temperatures.
- The Sunspots of December – 2018 is predicted using data of previous 10 years December Sunspots.
- The Superior Ice of December – 2018 is predicted using data of previous 10 years data of December Superior Ice.
- Using all the above as predictors and November Snowfall of previous 10 years and current year, December – 2018 Snow fall is predicted.
- We used the December's – Sunspots, Average Temperature and Superior Ice as the main predictors.
- Since November's Snowfall can also influence the Snowfall of December, it is also taken into consideration for the final model.

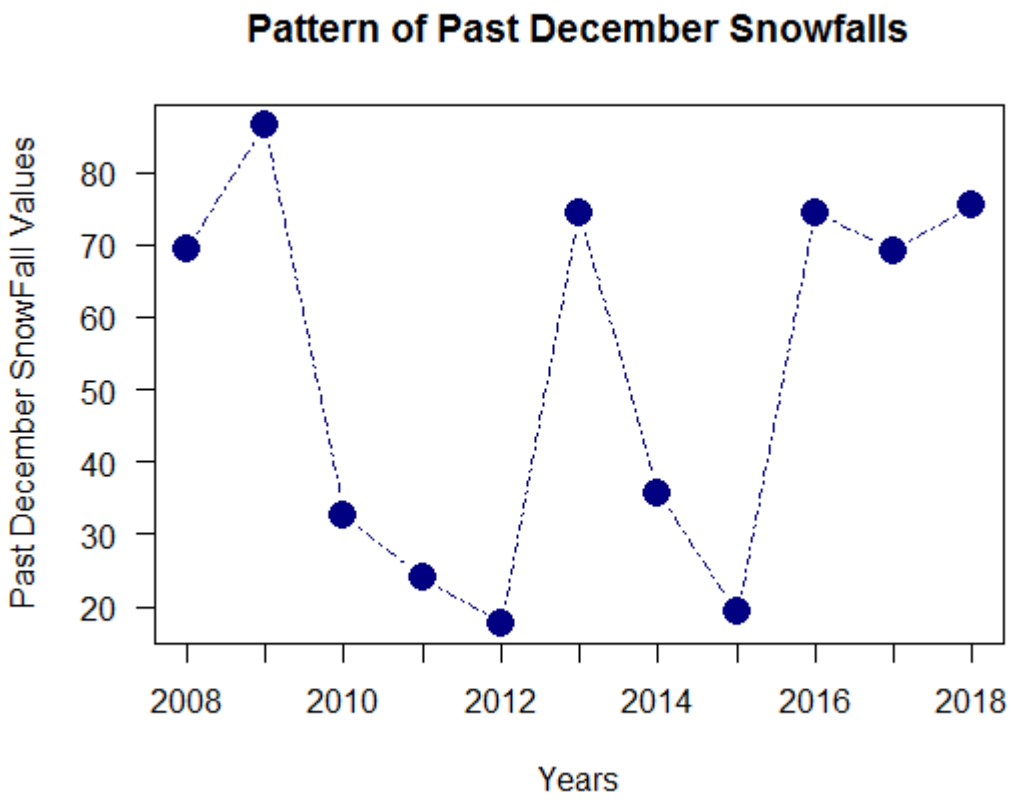
Summary:

```
> summary(lmSNOWFALL)

Call:
lm(formula = alldat$DEC ~ alldat$decDT + alldat$ssDEC + alldat$DecIce +
    alldat$Nov)

Residuals:
      1       2       3       4       5       6       7       8       9
-8.6726 11.0873 -12.6311 -10.4261 -12.7456  -3.4209 18.9311  0.2966 12.3449
     10
 5.2364

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  163.636377  41.155658   3.976   0.0106 *
alldat$decDT  -4.363190   1.683738  -2.591   0.0488 *
alldat$ssDEC  -0.008899   0.138500  -0.064   0.9513
alldat$DecIce -0.357315   1.867806  -0.191   0.8558
alldat$Nov    -1.179942   0.535022  -2.205   0.0786 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15.35 on 5 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.8167,    Adjusted R-squared:  0.6701
F-statistic:  5.57 on 4 and 5 DF,  p-value: 0.04374
```

Inference:

- From Summary of the model, we observe that only the P-values of Average Temperatures of previous Decembers have significant value(P-value = 0.0488).
- Also, the previous November's P-value is an almost significant value (P-value = 0.0786).
- The Sunspots and Superior Ice do not have significant P-values.
- The R-square value is found to be 0.8167, hence the model is nearly accurate.

Plot:



- The image represents the data of all past 10 years Snowfall and Current year December's predicted snowfall.

Appendix:

Code:

```
library(gplots)
alldat <- read.csv("D:/MTU MS/SEM 1/ASAD/Problem Set 9/ProblemsEt9/weather.csv")
alldat=tail(alldat,11)

####### DEC AVG TEMP
modelAVGTEMPDEC<-lm(alldat$decDT~alldat$year,data=alldat)
missing<-alldat[is.na(alldat$decDT)]
f<-predict(modelAVGTEMPDEC,missing)
alldat$decDT[is.na(alldat$decDT)]<-f
a<-alldat$decDT
print(a)

####### DEC SUNSPOTS
modelSSDEC<-lm(alldat$ssDEC~alldat$year,data=alldat)
missing<-alldat[is.na(alldat$ssDEC)]
g<-predict(modelSSDEC,missing)
alldat$ssDEC[is.na(alldat$ssDEC)]<-g
b<-alldat$ssDEC
print(b)

####### DEC SUPERIOR ICE
modelDECSUPICE<-lm(alldat$DecIce~alldat$year,data=alldat)
missing<-alldat[is.na(alldat$DecIce)]
h<-predict(modelDECSUPICE,missing)
alldat$DecIce[is.na(alldat$DecIce)]<-h
c<-alldat$DecIce
print(c)

#### SnowFall Prediction
lmSNOWFALL<-
lm(alldat$DEC~alldat$decDT+alldat$ssDEC+alldat$DecIce+alldat$NOV)
missing<-alldat[is.na(alldat$DEC)]
i<-predict(lmSNOWFALL,missing)
alldat$DEC[is.na(alldat$DEC)]<-i
d<-alldat$DEC
print(d)
summary(lmSNOWFALL)

##Plot

matplot(alldat$DEC,type="b",pch=16,cex=2,col="navy",xaxt= "n",lty=10,
      ylab="Past December SnowFall Values",las=1,xlab="Years",main="Pattern of Past
December Snowfalls")
axis(1,1:11,c("2008","2009","2010","2011","2012","2013","2014","2015","2016","2017","201
8"))
```