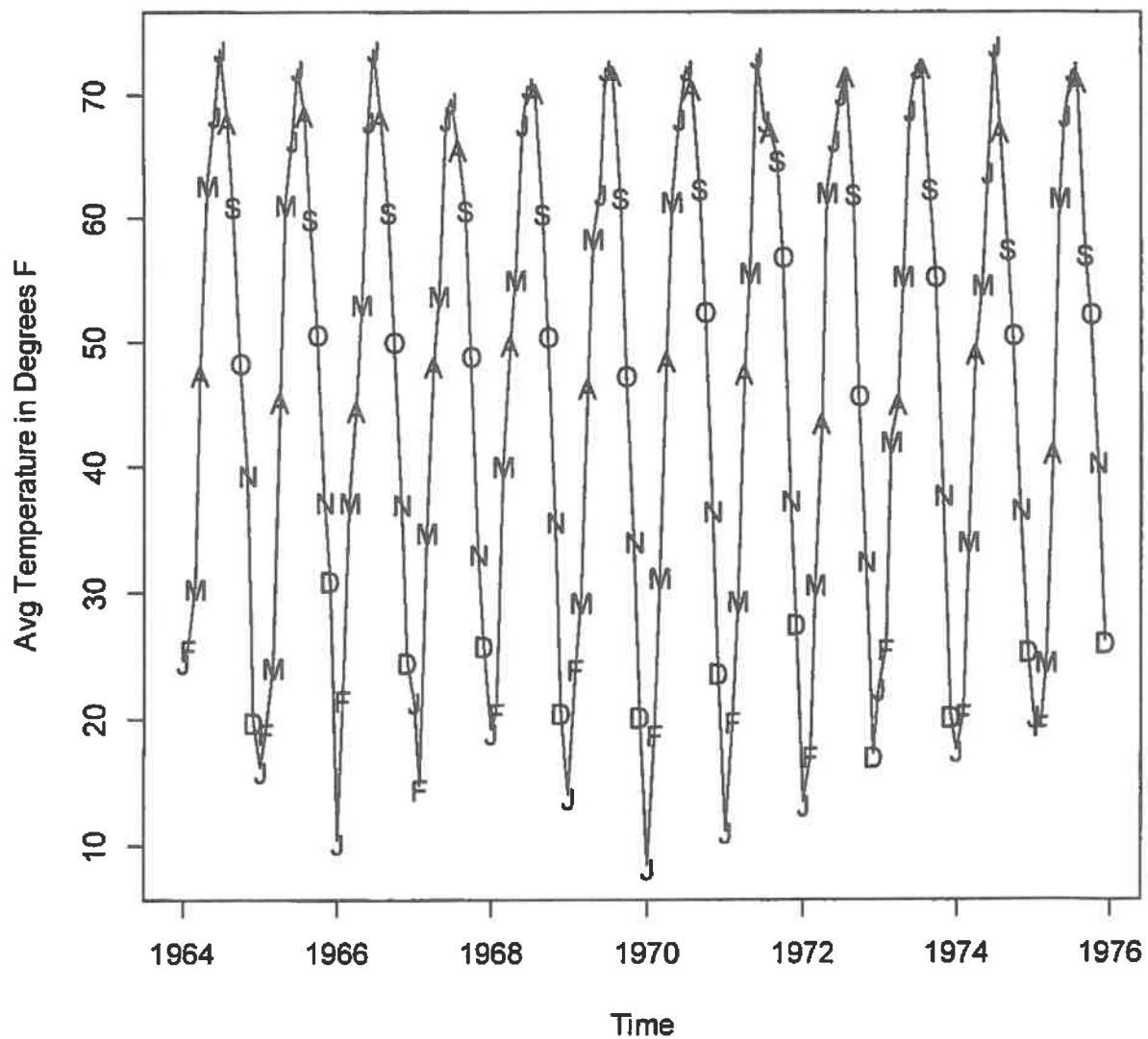# STAT 520 – Homework 1 Example Solutions

1) Construct a time series plot of the Dubuque temperature data that we studied in class, but include the monthly plotting symbols. Note that the temperature data and the month information are in the tempdub object in the TSA package. Type library(TSA); data(tempdub); print(tempdub) in R to see the data set.
R code:

```
plot(tempdub,type='l',ylab='Avg Temperature in Degrees F')
points(y=tempdub,x=time(tempdub),pch=as.vector(season(tempdub)))
```

2) Consider two random variables, X and Y. Suppose $E(X) = 6$, $\text{var}(X) = 9$, $E(Y) = 0$, $\text{var}(Y) = 4$, and $\text{corr}(X, Y) = 0.25$. Find the following, showing all your steps:

(a) $\text{var}(X + Y)$

(b) $\text{cov}(X, X + 2Y)$

(c) $\text{cov}(4X - 3Y, X + 2Y)$

(d) $\text{corr}(X + Y, X - Y)$

Note $0.25 = \text{corr}(X, Y) = \dfrac{\text{cov}(X,Y)}{\sqrt{(9)(4)}} = \dfrac{\text{cov}(X,Y)}{6}$

$\Rightarrow \text{cov}(X,Y) = (0.25)(6) = 1.5$

(a) $\text{var}(X+Y) = \text{cov}(X+Y, X+Y) = \text{cov}(X,X) + \text{cov}(X,Y) + \text{cov}(Y,X) + \text{cov}(Y,Y)$

$= \text{var}(X) + \text{var}(Y) + 2\text{cov}(X,Y) = 9 + 4 + 2(1.5) = \boxed{16}$

(b) $\text{cov}(X, X+2Y) = \text{cov}(X,X) + 2\text{cov}(X,Y) = \text{var}(X) + 2\text{cov}(X,Y)$

$= 9 + 2(1.5) = \boxed{12}$

(c) $\text{cov}(4X - 3Y, X + 2Y) = 4\text{cov}(X,X) + 8\text{cov}(X,Y) - 3\text{cov}(X,Y) - 6\text{cov}(Y,Y)$

$= 4\text{var}(X) - 5\text{cov}(X,Y) - 6\text{var}(Y) = 4(9) - 5(1.5) - 6(4) = \boxed{4.5}$

(d) First, $\text{cov}(X+Y, X-Y) = \text{cov}(X,X) - \text{cov}(X,Y) + \text{cov}(Y,X) - \text{cov}(Y,Y)$

$= 9 - 1.5 + 1.5 - 4 = 5$. And $\text{var}(X-Y) = \text{cov}(X-Y, X-Y)$

$= \text{var}(X) - \text{cov}(X,Y) - \text{cov}(Y,X) + \text{var}(Y) = 9 - 2(1.5) + 4 = 10$

So $\text{corr}(X+Y, X-Y) = \dfrac{5}{\sqrt{(16)(10)}} = \boxed{0.395}$