Stat 565

Homework 7

Due in class Mar 3rd

This homework is optional. If you are short on time I would rather you put your time into your project. If you do complete this homework and hand it in, your homework grade will be based on the best 6 out of 7 homeworks.

Q1

1. Derive the spectrum for an MA(1) process. Produce a plot of the spectrum showing the shape for a few values of β.

2. Show that if X_t and Y_t are independent, stationary processes with power spectral density functions $f_x(\omega)$ and $f_y(\omega)$, then $V_t = X_t + Y_t$ is also stationary with power spectral density $f_v(\omega) = f_x(\omega) + f_y(\omega)$.

Q2

The data.frame `flow_df` contains the average monthly river flow m^3/sec in the Mckenzie river at Mckenzie Bridge, Oregon. (I got this from http://robjhyndman.com/tsdldata/askew/askew7.dat who quotes the source: Hipel and Mcleod (1994))

```
load(url("http://stat565.cwick.co.nz/data/flow_df.rda"))
qplot(time, log(flow), data = flow_df, geom = "line")
```

The column `time` contains a simple time index, the number of months since the start of the record. The column `date` contains a decimal representation of the date, i.e. 1911.750 is October 1911.

1. Estimate the spectrum of the **logarithm** of flow. Make sure you show evidence you experimented with the amount of smoothing, but you need only show your final plot.

2. Fit a smooth trend to the logarithm of flow, and estimate the spectrum of the **residuals**. How does this spectrum differ from the one in part 1.?

3. Fit a harmonic regression to the residuals from 2 using the estimated spectrum to choose the number and frequencies of the periodic components.

4. Examine the residuals from the harmonic regression using both the ACF/PACF and periodogram. Is there any evidence of remaining autocorrelation?