Time Series Analysis Practical HT 2008

This is an assessed practical. Part 2 **only** should be handed in to the Front Office by 12 noon on Monday 11 February. Late submission will be penalized. Your reports must be your own work; apparent collaboration will be penalized.

Part 1: Land-air temperature anomalies

The data in the file `globtemp2.dat` at
`http://www.stats.ox.ac.uk/ reinert/time/timeseries.html`
are a global temperature record from 1880 to 2004; they are a combination of land-air average temperature anomalies, measured in degrees Centigrade. The first column gives the year, and the second column gives the yearly global temperature variations.

We would like to fit an ARIMA model to the data, and to find out whether there is a significant trend in the data.

First we read the data, convert it to a time series object, and look at summaries.

```
 glob<-read.table("P:/time/globtemp2.dat")
attach(glob)
gtemp <-ts(glob[,2], start=1880, freq=1)
plot(gtemp)
par(mfrow=c(2,1))
acf(gtemp)
pacf(gtemp)
```

The sequence does not look stationary; hence we take the first difference.

```
 gtempdiff<-diff(gtemp)
gtempdiff.ts <- ts(gtempdiff, start=1880, frequency=1)
par(mfrow=c(2,1))
acf(gtempdiff)
pacf(gtempdiff)
```

That looks better! Now we try to fit an ARIMA model. We use the command

```
gtempdiff.ts.arima<-arima(gtempdiff.ts, c(1,0,0), n.cond=6)
```

to select the best model based on the lowest aic. You should try more models than the ones above! We would find that the lowest aic is obtained for an ARIMA(1,1,1) model.

```
gtempdiff.ts.arima<-arima(gtempdiff.ts, c(1,1,1), n.cond=6)
```

To extract the drift, we use the `xreg` option in `arima`;

```
drift<- 1:length(gtempdiff)
arima(gtempdiff, order=c(1,1,1), xreg=drift)
```

But what happens if we use a different model? Try an ARIMA(1,0,1) model.

Now assess the fit of the two models using `cpgram` and `tsdiag`.

```
fit<-arima(gtempdiff, order=c(1,0,1), xreg=drift)
fit2<-arima(gtempdiff, order=c(1,1,1), xreg=drift) .
```

What do you conclude?

Part 2: Annual mean temperatures

The data in the file `n:\bdr\temp.txt` are annual mean temperatures in central England, obtained from the UK Meteorological Office. This temperature is representative of a roughly triangular area of the United Kingdom enclosed by Bristol, Manchester and London. The series began in 1659, and to date is the longest available instrumental record of temperature in the world. Since 1974 the data have been adjusted by 1–2 tenth degree Celsius to allow for urban warming.

1. Fit a suitable ARIMA model for this data. Your analysis should include a logical explanation of the steps taken to find the chosen model, as well as an assessment of the model fit.

2. Use your model to assess whether there is a significant trend in the data.