B.Sc./Grad. Dip.: Probability Models and Time Series
MAS programmes: Stochastic Models and Time Series

Examples 6

1. The following sample autocorrelation functions have been obtained for a time series $\{y_t\}$ of length 400 and for the first differences $\{\triangle y_t\}$.

	y_t	$\triangle y_t$
lag	acf	acf
1	0.965	0.145
2	0.923	-0.362
3	0.901	0.004
4	0.879	-0.003
5	0.859	-0.053
6	0.843	-0.059
7	0.831	0.047
8	0.816	0.096
9	0.796	-0.029
10	0.778	-0.057
11	0.763	0.009
12	0.748	-0.001
13	0.730	0.057
14	0.707	0.084
15	0.680	-0.031
16	0.653	-0.031
17	0.630	-0.035
18	0.609	-0.036
19	0.590	0.093
20	0.568	0.038

   (a) State what you may infer from the acf of $\{y_t\}$.

   (b) Giving a careful account of your reasons, identify what type of process $\{\triangle y_t\}$ appears to be.

   Deduce to which of the family of ARIMA processes $\{y_t\}$ appears to belong.

2. The sheep population, in ten thousands, of England and Wales for the years 1867 to 1939 is tabulated below.
[Data are available from the moodle course web site. Download the textfile `sheepdata.txt` into the working directory of the R package that you are using and add the line `sheep <- read.table("sheepdata.txt")`, say, at the start of your script file; then proceed to convert this into an appropriate `ts` object.]

Year	Pop.	Year	Pop.	Year	Pop.
1867	2203	1892	2119	1917	1717
1868	2360	1893	1991	1918	1648
1869	2254	1894	1859	1919	1512
1870	2165	1895	1856	1920	1338
1871	2024	1896	1924	1921	1383
1872	2078	1897	1892	1922	1344
1873	2214	1898	1916	1923	1384
1874	2292	1899	1968	1924	1484
1875	2207	1900	1928	1925	1597
1876	2119	1901	1898	1926	1686
1877	2119	1902	1850	1927	1707
1878	2137	1903	1841	1928	1640
1879	2132	1904	1824	1929	1611
1880	1955	1905	1823	1930	1632
1881	1785	1906	1843	1931	1775
1882	1747	1907	1880	1932	1850
1883	1818	1908	1968	1933	1809
1884	1909	1909	2029	1934	1653
1885	1958	1910	1996	1935	1648
1886	1892	1911	1933	1936	1665
1887	1919	1912	1805	1937	1627
1888	1853	1913	1713	1938	1791
1889	1868	1914	1726	1939	1797
1890	1991	1915	1752		
1891	2111	1916	1795		

Using R, investigate the fitting of an appropriate ARIMA model to these data. In particular:

(a) Investigate whether the data appear to come from a stationary process or not.

(b) Consider what might be an appropriate model or models to fit. Fit the model and write down the corresponding fitted model equation.