Periodograms & times series

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2017

1. Using information given in appendix A, identify with the periodogram the period of the main seasonal pattern in the time series beer[1].
2. Using information given in appendix B, identify with the periodogram the period of the main seasonal pattern in the time series airpass.
3. Explain R code in appendices A and B.

[1] time series are taken from the R package *fma*, and R outputs are shown in appendices.

A Time series: beer

beer: Monthly Australian beer production: Jan 1991 - Aug 1995.

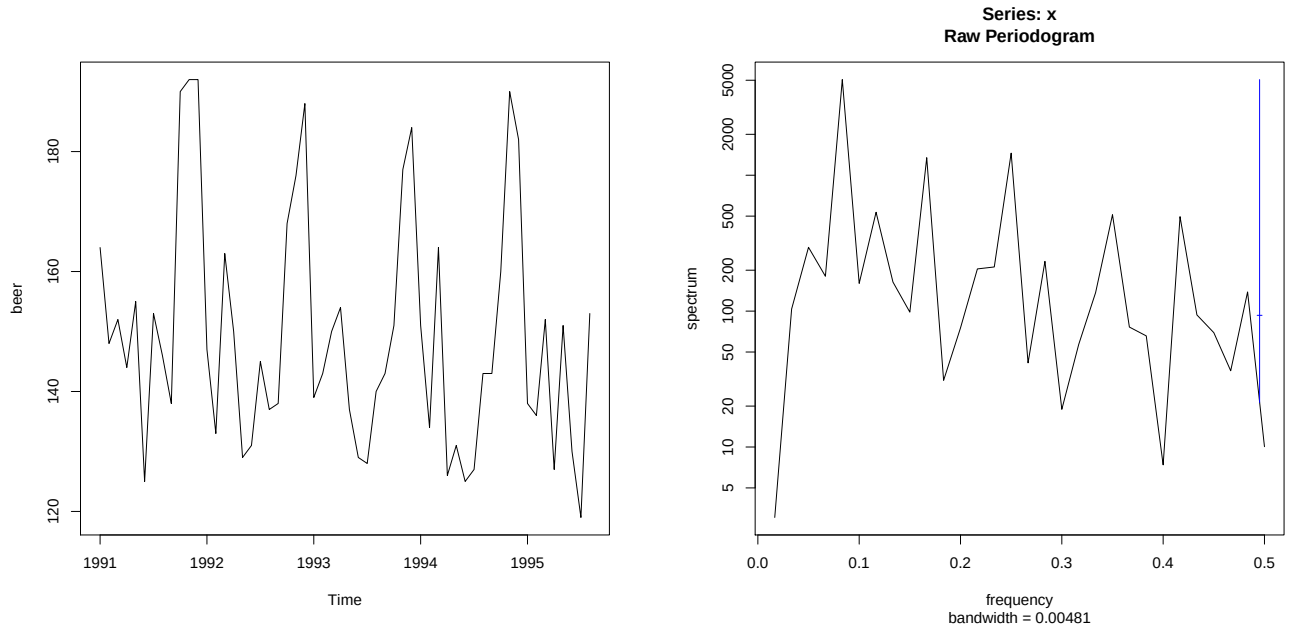

Figure 1: Time plot and periodogram for time series *beer* .

```
> spectrum(ts(beer,freq=1))$spec
 [1]    3.031379  103.677832  294.746953  180.559245 5054.797056  159.920923
 [7]  534.142299  163.646261   98.288564 1346.005649   30.942275   75.276000
[13]  204.444432  211.323592 1454.322008   41.597854  232.369143   18.927320
[19]   56.840569  136.861690  512.507598   76.323812   65.704389    7.385690
[25]  495.435374   93.749957   69.412129   36.384269  138.468109   10.050421

> spectrum(ts(beer,freq=1))$freq
 [1] 0.01666667 0.03333333 0.05000000 0.06666667 0.08333333 0.10000000
 [7] 0.11666667 0.13333333 0.15000000 0.16666667 0.18333333 0.20000000
[13] 0.21666667 0.23333333 0.25000000 0.26666667 0.28333333 0.30000000
[19] 0.31666667 0.33333333 0.35000000 0.36666667 0.38333333 0.40000000
[25] 0.41666667 0.43333333 0.45000000 0.46666667 0.48333333 0.50000000
```

B Time series: airpass

airpass: Monthly totals of international airline passengers (1949-1960).

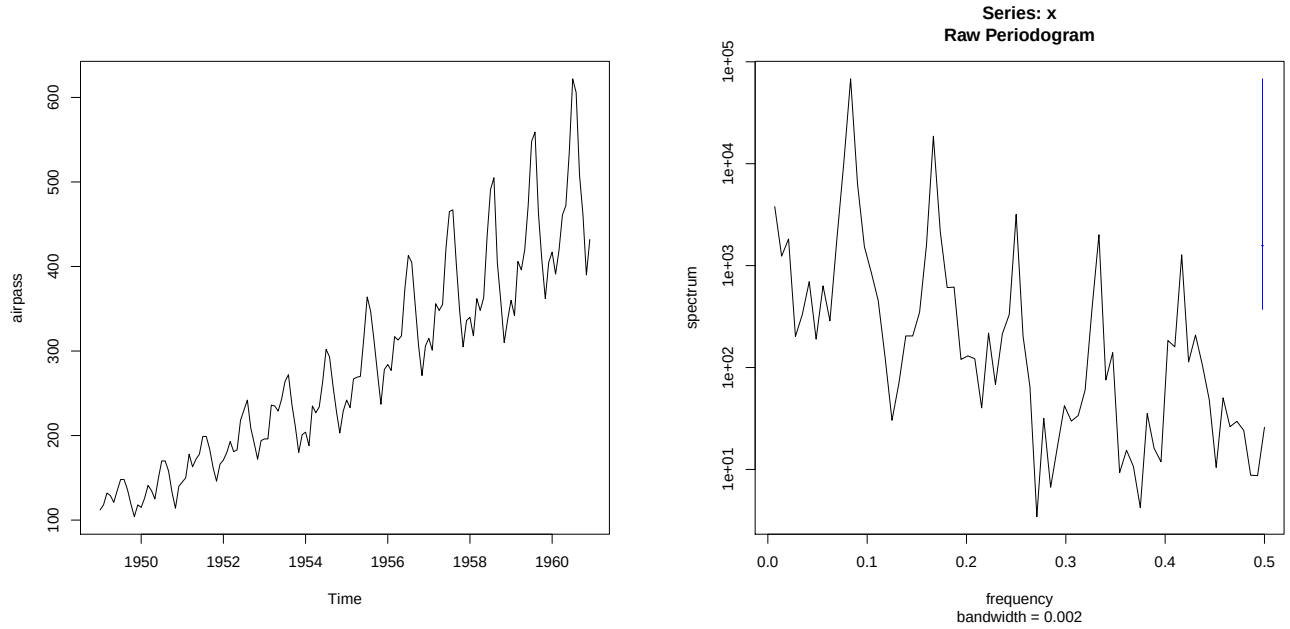

Figure 2: Time plot and periodogram for time series *airpass* .

```
> spectrum(ts(airpass,freq=1))$spec
 [1]  3792.028873  1238.009494  1826.626686   201.904560   331.907846
 [6]   695.956872   189.838038   632.668292   287.593613  1791.509224
[11]  9958.986159 68001.700911  6339.305190  1529.925619   854.106417
[16]   454.283437   125.530203    30.347246    70.029431   204.158401
[21]   203.994506   348.864801  1597.138661 18608.352793  2154.647278
[26]   608.650096   615.202265   120.078527   130.147126   121.851890
[31]    40.141534   217.826943    68.288003   214.055484   331.595519
[36]  3179.724197   203.863339    64.506860     3.437210    31.782121
[41]     6.688219    16.986738    42.173804    29.803217    33.804933
[46]    60.212446   379.911387  2005.721320    75.434588   140.072127
[51]     9.294066    15.430795    10.698128     4.218340    35.411804
[56]    16.115760    11.881808   183.988521   159.788028  1276.345370
[61]   113.356981   208.360400   105.674799    48.095940    10.461349
[66]    50.391079    26.292831    29.647284    24.120557     8.778387
[71]     8.689016    25.907638
```

```
> spectrum(ts(airpass,freq=1))$freq
 [1] 0.006944444 0.013888889 0.020833333 0.027777778 0.034722222 0.041666667
 [7] 0.048611111 0.055555556 0.062500000 0.069444444 0.076388889 0.083333333
[13] 0.090277778 0.097222222 0.104166667 0.111111111 0.118055556 0.125000000
[19] 0.131944444 0.138888889 0.145833333 0.152777778 0.159722222 0.166666667
[25] 0.173611111 0.180555556 0.187500000 0.194444444 0.201388889 0.208333333
```

```
[31] 0.215277778 0.222222222 0.229166667 0.236111111 0.243055556 0.250000000
[37] 0.256944444 0.263888889 0.270833333 0.277777778 0.284722222 0.291666667
[43] 0.298611111 0.305555556 0.312500000 0.319444444 0.326388889 0.333333333
[49] 0.340277778 0.347222222 0.354166667 0.361111111 0.368055556 0.375000000
[55] 0.381944444 0.388888889 0.395833333 0.402777778 0.409722222 0.416666667
[61] 0.423611111 0.430555556 0.437500000 0.444444444 0.451388889 0.458333333
[67] 0.465277778 0.472222222 0.479166667 0.486111111 0.493055556 0.500000000
```