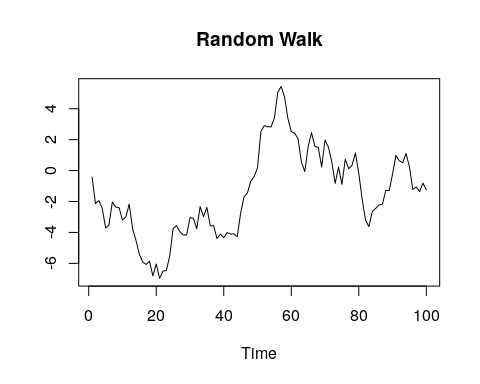
R Notebook

plot(cumsum(rnorm(100)), type="l", ylab="", xlab="Time", main="Random Walk")



set.seed(1)  
e <- rnorm(150)  
y = arima.sim(list(order=c(1, 0, 0), ar = 0.9), n=150, innov = e, n.start = 1, start.innov = 0)

ar1 <- arima(y, order = c(1, 0 , 0))

ar1

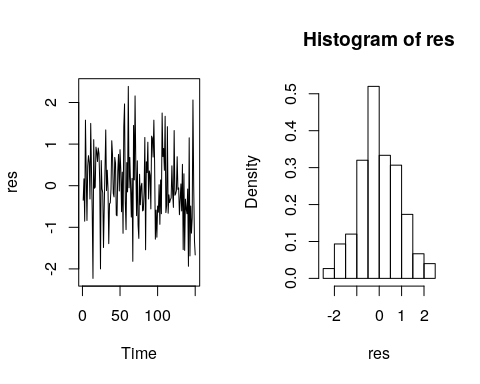
##   
## Call:  
## arima(x = y, order = c(1, 0, 0))  
##   
## Coefficients:  
## ar1 intercept  
## 0.8982 0.1667  
## s.e. 0.0381 0.6940  
##   
## sigma^2 estimated as 0.8102: log likelihood = -197.88, aic = 401.76

str(ar1)

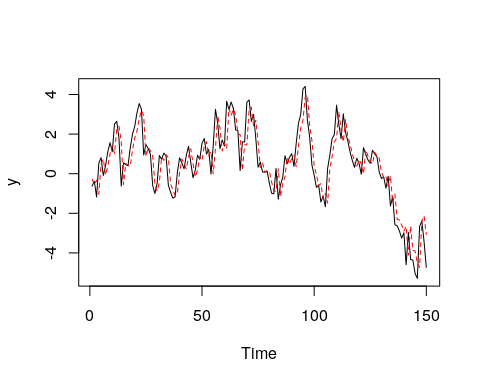
## List of 14  
## $ coef : Named num [1:2] 0.898 0.167  
## ..- attr(\*, "names")= chr [1:2] "ar1" "intercept"  
## $ sigma2 : num 0.81  
## $ var.coef : num [1:2, 1:2] 0.00145 -0.00477 -0.00477 0.48167  
## ..- attr(\*, "dimnames")=List of 2  
## .. ..$ : chr [1:2] "ar1" "intercept"  
## .. ..$ : chr [1:2] "ar1" "intercept"  
## $ mask : logi [1:2] TRUE TRUE  
## $ loglik : num -198  
## $ aic : num 402  
## $ arma : int [1:7] 1 0 0 0 1 0 0  
## $ residuals: Time-Series [1:150] from 1 to 150: -0.349 0.166 -0.853 1.576 0.314 ...  
## $ call : language arima(x = y, order = c(1, 0, 0))  
## $ series : chr "y"  
## $ code : int 0  
## $ n.cond : int 0  
## $ nobs : int 150  
## $ model :List of 10  
## ..$ phi : num 0.898  
## ..$ theta: num(0)   
## ..$ Delta: num(0)   
## ..$ Z : num 1  
## ..$ a : num -4.9  
## ..$ P : num [1, 1] 0  
## ..$ T : num [1, 1] 0.898  
## ..$ V : num [1, 1] 1  
## ..$ h : num 0  
## ..$ Pn : num [1, 1] 1  
## - attr(\*, "class")= chr "Arima"

res <- residuals(ar1)

par(mfrow = c(1, 2))  
plot(res, type = "l")  
hist(res, prob = TRUE)



plot(y, type="l")  
lines(y-res, lty=2, col="red")



library(stargazer)

##   
## Please cite as:

## Hlavac, Marek (2018). stargazer: Well-Formatted Regression and Summary Statistics Tables.

## R package version 5.2.2. https://CRAN.R-project.org/package=stargazer

stargazer(ar1, type = "text")

##   
## =============================================  
## Dependent variable:   
## ---------------------------  
## y   
## ---------------------------------------------  
## ar1 0.898\*\*\*   
## (0.038)   
##   
## intercept 0.167   
## (0.694)   
##   
## ---------------------------------------------  
## Observations 150   
## Log Likelihood -197.880   
## sigma2 0.810   
## Akaike Inf. Crit. 401.761   
## =============================================  
## Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

library(dplyr)

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

library(magrittr)  
library(lubridate)

##   
## Attaching package: 'lubridate'

## The following object is masked from 'package:base':  
##   
## date

load("~/ecn321/pages/Lectures/ch10data.Rdata")  
estimation\_data <- ch10data %>%   
 filter(date > as.Date("1967-12-01") & date < as.Date("1994-01-01"))  
estimation\_data$lsales <- log(estimation\_data$liquor)  
estimation\_data

## liquor date lsales  
## 1 522 1968-01-01 6.257668  
## 2 506 1968-02-01 6.226537  
## 3 558 1968-03-01 6.324359  
## 4 538 1968-04-01 6.287859  
## 5 605 1968-05-01 6.405228  
## 6 583 1968-06-01 6.368187  
## 7 607 1968-07-01 6.408529  
## 8 624 1968-08-01 6.436150  
## 9 570 1968-09-01 6.345636  
## 10 609 1968-10-01 6.411818  
## 11 675 1968-11-01 6.514713  
## 12 861 1968-12-01 6.758095  
## 13 605 1969-01-01 6.405228  
## 14 537 1969-02-01 6.285998  
## 15 575 1969-03-01 6.354370  
## 16 588 1969-04-01 6.376727  
## 17 656 1969-05-01 6.486161  
## 18 623 1969-06-01 6.434547  
## 19 661 1969-07-01 6.493754  
## 20 668 1969-08-01 6.504288  
## 21 603 1969-09-01 6.401917  
## 22 639 1969-10-01 6.459904  
## 23 669 1969-11-01 6.505784  
## 24 915 1969-12-01 6.818924  
## 25 643 1970-01-01 6.466145  
## 26 563 1970-02-01 6.333280  
## 27 616 1970-03-01 6.423247  
## 28 645 1970-04-01 6.469250  
## 29 703 1970-05-01 6.555357  
## 30 684 1970-06-01 6.527958  
## 31 731 1970-07-01 6.594413  
## 32 722 1970-08-01 6.582025  
## 33 678 1970-09-01 6.519147  
## 34 713 1970-10-01 6.569481  
## 35 725 1970-11-01 6.586172  
## 36 989 1970-12-01 6.896694  
## 37 687 1971-01-01 6.532334  
## 38 629 1971-02-01 6.444131  
## 39 687 1971-03-01 6.532334  
## 40 706 1971-04-01 6.559615  
## 41 754 1971-05-01 6.625392  
## 42 774 1971-06-01 6.651572  
## 43 825 1971-07-01 6.715383  
## 44 755 1971-08-01 6.626718  
## 45 751 1971-09-01 6.621406  
## 46 783 1971-10-01 6.663133  
## 47 804 1971-11-01 6.689599  
## 48 1139 1971-12-01 7.037906  
## 49 711 1972-01-01 6.566672  
## 50 693 1972-02-01 6.541030  
## 51 790 1972-03-01 6.672033  
## 52 754 1972-04-01 6.625392  
## 53 799 1972-05-01 6.683361  
## 54 824 1972-06-01 6.714171  
## 55 854 1972-07-01 6.749931  
## 56 810 1972-08-01 6.697034  
## 57 798 1972-09-01 6.682109  
## 58 807 1972-10-01 6.693324  
## 59 832 1972-11-01 6.723832  
## 60 1142 1972-12-01 7.040536  
## 61 740 1973-01-01 6.606650  
## 62 713 1973-02-01 6.569481  
## 63 791 1973-03-01 6.673298  
## 64 768 1973-04-01 6.643790  
## 65 846 1973-05-01 6.740519  
## 66 884 1973-06-01 6.784457  
## 67 886 1973-07-01 6.786717  
## 68 878 1973-08-01 6.777647  
## 69 813 1973-09-01 6.700731  
## 70 840 1973-10-01 6.733402  
## 71 884 1973-11-01 6.784457  
## 72 1245 1973-12-01 7.126891  
## 73 796 1974-01-01 6.679599  
## 74 750 1974-02-01 6.620073  
## 75 834 1974-03-01 6.726233  
## 76 838 1974-04-01 6.731018  
## 77 902 1974-05-01 6.804615  
## 78 895 1974-06-01 6.796824  
## 79 962 1974-07-01 6.869014  
## 80 990 1974-08-01 6.897705  
## 81 882 1974-09-01 6.782192  
## 82 936 1974-10-01 6.841615  
## 83 997 1974-11-01 6.904751  
## 84 1305 1974-12-01 7.173958  
## 85 866 1975-01-01 6.763885  
## 86 805 1975-02-01 6.690842  
## 87 905 1975-03-01 6.807935  
## 88 873 1975-04-01 6.771936  
## 89 1024 1975-05-01 6.931472  
## 90 985 1975-06-01 6.892642  
## 91 1049 1975-07-01 6.955593  
## 92 1034 1975-08-01 6.941190  
## 93 951 1975-09-01 6.857514  
## 94 1010 1975-10-01 6.917706  
## 95 1016 1975-11-01 6.923629  
## 96 1378 1975-12-01 7.228388  
## 97 915 1976-01-01 6.818924  
## 98 854 1976-02-01 6.749931  
## 99 922 1976-03-01 6.826545  
## 100 965 1976-04-01 6.872128  
## 101 1014 1976-05-01 6.921658  
## 102 1040 1976-06-01 6.946976  
## 103 1137 1976-07-01 7.036148  
## 104 1026 1976-08-01 6.933423  
## 105 992 1976-09-01 6.899723  
## 106 1052 1976-10-01 6.958448  
## 107 1056 1976-11-01 6.962243  
## 108 1469 1976-12-01 7.292337  
## 109 916 1977-01-01 6.820016  
## 110 934 1977-02-01 6.839476  
## 111 987 1977-03-01 6.894670  
## 112 1018 1977-04-01 6.925595  
## 113 1048 1977-05-01 6.954639  
## 114 1086 1977-06-01 6.990257  
## 115 1144 1977-07-01 7.042286  
## 116 1077 1977-08-01 6.981935  
## 117 1036 1977-09-01 6.943122  
## 118 1076 1977-10-01 6.981006  
## 119 1114 1977-11-01 7.015712  
## 120 1595 1977-12-01 7.374629  
## 121 949 1978-01-01 6.855409  
## 122 930 1978-02-01 6.835185  
## 123 1045 1978-03-01 6.951772  
## 124 1015 1978-04-01 6.922644  
## 125 1091 1978-05-01 6.994850  
## 126 1142 1978-06-01 7.040536  
## 127 1182 1978-07-01 7.074963  
## 128 1161 1978-08-01 7.057037  
## 129 1145 1978-09-01 7.043160  
## 130 1119 1978-10-01 7.020191  
## 131 1189 1978-11-01 7.080868  
## 132 1662 1978-12-01 7.415777  
## 133 1048 1979-01-01 6.954639  
## 134 1019 1979-02-01 6.926577  
## 135 1129 1979-03-01 7.029088  
## 136 1092 1979-04-01 6.995766  
## 137 1176 1979-05-01 7.069874  
## 138 1297 1979-06-01 7.167809  
## 139 1322 1979-07-01 7.186901  
## 140 1330 1979-08-01 7.192934  
## 141 1263 1979-09-01 7.141245  
## 142 1250 1979-10-01 7.130899  
## 143 1341 1979-11-01 7.201171  
## 144 1927 1979-12-01 7.563720  
## 145 1271 1980-01-01 7.147559  
## 146 1238 1980-02-01 7.121252  
## 147 1283 1980-03-01 7.156956  
## 148 1283 1980-04-01 7.156956  
## 149 1413 1980-05-01 7.253470  
## 150 1371 1980-06-01 7.223296  
## 151 1425 1980-07-01 7.261927  
## 152 1453 1980-08-01 7.281386  
## 153 1311 1980-09-01 7.178545  
## 154 1387 1980-10-01 7.234898  
## 155 1454 1980-11-01 7.282074  
## 156 1993 1980-12-01 7.597396  
## 157 1328 1981-01-01 7.191429  
## 158 1250 1981-02-01 7.130899  
## 159 1308 1981-03-01 7.176255  
## 160 1350 1981-04-01 7.207860  
## 161 1455 1981-05-01 7.282761  
## 162 1442 1981-06-01 7.273786  
## 163 1530 1981-07-01 7.333023  
## 164 1505 1981-08-01 7.316548  
## 165 1421 1981-09-01 7.259116  
## 166 1485 1981-10-01 7.303170  
## 167 1465 1981-11-01 7.289611  
## 168 2163 1981-12-01 7.679251  
## 169 1361 1982-01-01 7.215975  
## 170 1284 1982-02-01 7.157735  
## 171 1392 1982-03-01 7.238497  
## 172 1442 1982-04-01 7.273786  
## 173 1504 1982-05-01 7.315884  
## 174 1488 1982-06-01 7.305188  
## 175 1606 1982-07-01 7.381502  
## 176 1488 1982-08-01 7.305188  
## 177 1442 1982-09-01 7.273786  
## 178 1495 1982-10-01 7.309881  
## 179 1509 1982-11-01 7.319202  
## 180 2135 1982-12-01 7.666222  
## 181 1369 1983-01-01 7.221836  
## 182 1320 1983-02-01 7.185387  
## 183 1448 1983-03-01 7.277939  
## 184 1495 1983-04-01 7.309881  
## 185 1522 1983-05-01 7.327781  
## 186 1575 1983-06-01 7.362011  
## 187 1666 1983-07-01 7.418181  
## 188 1617 1983-08-01 7.388328  
## 189 1567 1983-09-01 7.356918  
## 190 1551 1983-10-01 7.346655  
## 191 1624 1983-11-01 7.392648  
## 192 2367 1983-12-01 7.769379  
## 193 1377 1984-01-01 7.227662  
## 194 1294 1984-02-01 7.165493  
## 195 1401 1984-03-01 7.244942  
## 196 1362 1984-04-01 7.216709  
## 197 1466 1984-05-01 7.290293  
## 198 1559 1984-06-01 7.351800  
## 199 1569 1984-07-01 7.358194  
## 200 1575 1984-08-01 7.362011  
## 201 1456 1984-09-01 7.283448  
## 202 1487 1984-10-01 7.304516  
## 203 1549 1984-11-01 7.345365  
## 204 2178 1984-12-01 7.686162  
## 205 1423 1985-01-01 7.260523  
## 206 1312 1985-02-01 7.179308  
## 207 1465 1985-03-01 7.289611  
## 208 1488 1985-04-01 7.305188  
## 209 1577 1985-05-01 7.363280  
## 210 1591 1985-06-01 7.372118  
## 211 1669 1985-07-01 7.419980  
## 212 1697 1985-08-01 7.436617  
## 213 1659 1985-09-01 7.413970  
## 214 1597 1985-10-01 7.375882  
## 215 1728 1985-11-01 7.454720  
## 216 2326 1985-12-01 7.751905  
## 217 1529 1986-01-01 7.332369  
## 218 1395 1986-02-01 7.240650  
## 219 1567 1986-03-01 7.356918  
## 220 1536 1986-04-01 7.336937  
## 221 1682 1986-05-01 7.427739  
## 222 1675 1986-06-01 7.423568  
## 223 1758 1986-07-01 7.471932  
## 224 1708 1986-08-01 7.443078  
## 225 1561 1986-09-01 7.353082  
## 226 1643 1986-10-01 7.404279  
## 227 1635 1986-11-01 7.399398  
## 228 2240 1986-12-01 7.714231  
## 229 1485 1987-01-01 7.303170  
## 230 1376 1987-02-01 7.226936  
## 231 1459 1987-03-01 7.285507  
## 232 1526 1987-04-01 7.330405  
## 233 1659 1987-05-01 7.413970  
## 234 1623 1987-06-01 7.392032  
## 235 1731 1987-07-01 7.456455  
## 236 1662 1987-08-01 7.415777  
## 237 1589 1987-09-01 7.370860  
## 238 1683 1987-10-01 7.428333  
## 239 1672 1987-11-01 7.421776  
## 240 2361 1987-12-01 7.766841  
## 241 1480 1988-01-01 7.299797  
## 242 1385 1988-02-01 7.233455  
## 243 1505 1988-03-01 7.316548  
## 244 1576 1988-04-01 7.362645  
## 245 1649 1988-05-01 7.407924  
## 246 1684 1988-06-01 7.428927  
## 247 1748 1988-07-01 7.466228  
## 248 1642 1988-08-01 7.403670  
## 249 1571 1988-09-01 7.359468  
## 250 1567 1988-10-01 7.356918  
## 251 1637 1988-11-01 7.400621  
## 252 2397 1988-12-01 7.781973  
## 253 1483 1989-01-01 7.301822  
## 254 1390 1989-02-01 7.237059  
## 255 1562 1989-03-01 7.353722  
## 256 1573 1989-04-01 7.360740  
## 257 1718 1989-05-01 7.448916  
## 258 1752 1989-06-01 7.468513  
## 259 1809 1989-07-01 7.500529  
## 260 1759 1989-08-01 7.472501  
## 261 1698 1989-09-01 7.437206  
## 262 1643 1989-10-01 7.404279  
## 263 1718 1989-11-01 7.448916  
## 264 2399 1989-12-01 7.782807  
## 265 1551 1990-01-01 7.346655  
## 266 1497 1990-02-01 7.311218  
## 267 1697 1990-03-01 7.436617  
## 268 1672 1990-04-01 7.421776  
## 269 1805 1990-05-01 7.498316  
## 270 1903 1990-06-01 7.551187  
## 271 1928 1990-07-01 7.564238  
## 272 1963 1990-08-01 7.582229  
## 273 1807 1990-09-01 7.499423  
## 274 1843 1990-10-01 7.519150  
## 275 1950 1990-11-01 7.575585  
## 276 2736 1990-12-01 7.914252  
## 277 1798 1991-01-01 7.494430  
## 278 1700 1991-02-01 7.438384  
## 279 1901 1991-03-01 7.550135  
## 280 1820 1991-04-01 7.506592  
## 281 1982 1991-05-01 7.591862  
## 282 1957 1991-06-01 7.579168  
## 283 2076 1991-07-01 7.638198  
## 284 2107 1991-08-01 7.653020  
## 285 1799 1991-09-01 7.494986  
## 286 1854 1991-10-01 7.525101  
## 287 1968 1991-11-01 7.584773  
## 288 2364 1991-12-01 7.768110  
## 289 1662 1992-01-01 7.415777  
## 290 1681 1992-02-01 7.427144  
## 291 1725 1992-03-01 7.452982  
## 292 1796 1992-04-01 7.493317  
## 293 1938 1992-05-01 7.569412  
## 294 1871 1992-06-01 7.534228  
## 295 2001 1992-07-01 7.601402  
## 296 1934 1992-08-01 7.567346  
## 297 1825 1992-09-01 7.509335  
## 298 1930 1992-10-01 7.565275  
## 299 1867 1992-11-01 7.532088  
## 300 2553 1992-12-01 7.845024  
## 301 1624 1993-01-01 7.392648  
## 302 1533 1993-02-01 7.334982  
## 303 1676 1993-03-01 7.424165  
## 304 1706 1993-04-01 7.441907  
## 305 1781 1993-05-01 7.484930  
## 306 1772 1993-06-01 7.479864  
## 307 1922 1993-07-01 7.561122  
## 308 1743 1993-08-01 7.463363  
## 309 1669 1993-09-01 7.419980  
## 310 1713 1993-10-01 7.446001  
## 311 1733 1993-11-01 7.457609  
## 312 2369 1993-12-01 7.770223

y <- estimation\_data$lsales  
time <- 1:length(y)  
seasonal <- as.factor(month(estimation\_data$date))  
X <- cbind(time, time2 = time^2, model.matrix(~seasonal - 1))  
reg <- arima(y, order = c(3, 0, 0), xreg = X, include.mean = FALSE)  
summary(reg)

## Length Class Mode   
## coef 17 -none- numeric   
## sigma2 1 -none- numeric   
## var.coef 289 -none- numeric   
## mask 17 -none- logical   
## loglik 1 -none- numeric   
## aic 1 -none- numeric   
## arma 7 -none- numeric   
## residuals 312 ts numeric   
## call 5 -none- call   
## series 1 -none- character  
## code 1 -none- numeric   
## n.cond 1 -none- numeric   
## nobs 1 -none- numeric   
## model 10 -none- list

plot(estimation\_data$date, y, type = "l", lwd = 2, xlab = "Time")  
lines(estimation\_data$date, y - residuals(reg), lty = 2, col = "red")

