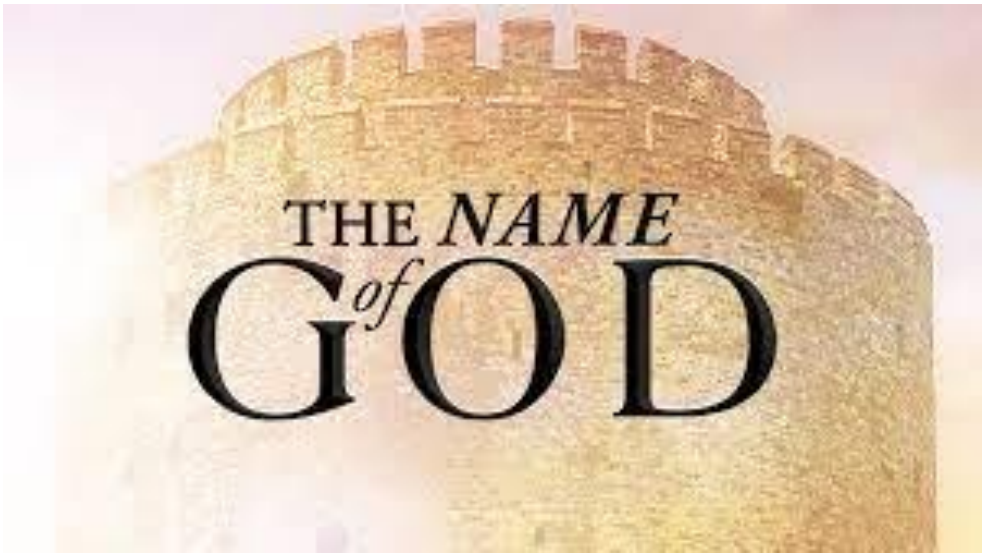


Time series with R

Teacher : Dr.Karimi

Student : Amirhossien Arab

9721350001

```
> data <- read.csv("C:/Users/BEHINLAPTOP/Desktop/ts.csv")
> data
         date AQI
1   1401/01/01  66
2   1401/01/02  69
3   1401/01/03  63
4   1401/01/04  76
5   1401/01/05  69
6   1401/01/06  43
7   1401/01/07  46
8   1401/01/08  50
9   1401/01/09  60
10  1401/01/10  71
11  1401/01/11  78
12  1401/01/12  53
13  1401/01/13  74
14  1401/01/14  83
15  1401/01/15  67
16  1401/01/16  74
17  1401/01/17  94
18  1401/01/18  64
19  1401/01/19 150
20  1401/01/20 174
21  1401/01/21 150
22  1401/01/22 104
23  1401/01/23  79
24  1401/01/24  96
25  1401/01/25  74
```

26	1401/01/26	78
27	1401/01/27	58
28	1401/01/28	81
29	1401/01/29	62
30	1401/01/30	62
31	1401/02/01	103
32	1401/02/02	95
33	1401/02/03	83
34	1401/02/04	70
35	1401/02/05	68
36	1401/02/06	126
37	1401/02/07	88
38	1401/02/08	123
39	1401/02/09	66
40	1401/02/10	77
41	1401/02/11	90
42	1401/02/12	76
43	1401/02/13	93
44	1401/02/14	63
45	1401/02/15	71
46	1401/02/16	78
47	1401/02/17	98
48	1401/02/18	156
49	1401/02/19	102
50	1401/02/20	69
51	1401/02/21	64
52	1401/02/22	93
53	1401/02/23	83

54	1401/02/24	54
55	1401/02/25	62
56	1401/02/26	103
57	1401/02/27	174
58	1401/02/28	157
59	1401/02/29	86
60	1401/02/30	80
61	1401/03/01	92
62	1401/03/02	102
63	1401/03/03	95
64	1401/03/04	457
65	1401/03/05	126
66	1401/03/06	69
67	1401/03/07	101
68	1401/03/08	75
69	1401/03/09	85
70	1401/03/10	98
71	1401/03/11	84
72	1401/03/12	86
73	1401/03/13	88
74	1401/03/14	122
75	1401/03/15	150
76	1401/03/16	85
77	1401/03/17	57
78	1401/03/18	81
79	1401/03/19	89
80	1401/03/20	66
81	1401/03/21	76

82 1401/03/22 85

83 1401/03/23 95

84 1401/03/24 78

85 1401/03/25 71

86 1401/03/26 65

87 1401/03/27 80

88 1401/03/28 100

89 1401/03/29 106

90 1401/03/30 107

91 1401/04/01 91

92 1401/04/02 81

93 1401/04/03 95

94 1401/04/04 91

95 1401/04/05 87

96 1401/04/06 113

97 1401/04/07 102

98 1401/04/08 88

99 1401/04/09 104

100 1401/04/10 160

101 1401/04/11 102

102 1401/04/12 110

103 1401/04/13 192

104 1401/04/14 104

105 1401/04/15 96

106 1401/04/16 80

107 1401/04/17 82

108 1401/04/18 107

109 1401/04/19 91

110 1401/04/20 110

111 1401/04/21 102

112 1401/04/22 85

113 1401/04/23 100

114 1401/04/24 139

115 1401/04/25 159

116 1401/04/26 140

117 1401/04/27 112

118 1401/04/28 121

119 1401/04/29 113

120 1401/04/30 99

121 1401/05/01 91

122 1401/05/02 102

123 1401/05/03 134

124 1401/05/04 100

125 1401/05/05 123

126 1401/05/06 127

127 1401/05/07 83

128 1401/05/08 67

129 1401/05/09 70

130 1401/05/10 72

131 1401/05/11 71

132 1401/05/12 169

133 1401/05/13 106

134 1401/05/14 87

135 1401/05/15 100

136 1401/05/16 76

137 1401/05/17 122

138 1401/05/18 129

139 1401/05/19 83

140 1401/05/20 74

141 1401/05/21 121

142 1401/05/22 86

143 1401/05/23 119

144 1401/05/24 101

145 1401/05/25 126

146 1401/05/26 158

147 1401/05/27 99

148 1401/05/28 101

149 1401/05/29 127

150 1401/05/30 95

151 1401/06/01 100

152 1401/06/02 86

153 1401/06/03 77

154 1401/06/04 75

155 1401/06/05 84

156 1401/06/06 84

157 1401/06/07 99

158 1401/06/08 86

159 1401/06/09 90

160 1401/06/10 97

161 1401/06/11 139

162 1401/06/12 93

163 1401/06/13 96

164 1401/06/14 90

165 1401/06/15 107

```
166 1401/06/16  93
167 1401/06/17  81
168 1401/06/18  74
169 1401/06/19 100
170 1401/06/20  77
171 1401/06/21  71
172 1401/06/22  70
173 1401/06/23  94
174 1401/06/24  98
175 1401/06/25  77
176 1401/06/26  71
177 1401/06/27  92
178 1401/06/28  98
179 1401/06/29  93
180 1401/06/30  96
> library(forcats)
> myts <- ts(data$AQI, frequency=365, start=c(1401,01 ,01),end=c(1401,06,31))
>
> myts2 <- as.ts(ts(myts, start=c(1401,01 ,01), end=c(1401,06,31)))
>
>
>
> arimadata=auto.arima(myts)
Error in auto.arima(myts) : could not find function "auto.arima"
> library(forecast)
Registered S3 method overwritten by 'quantmod':
  method           from
  as.zoo.data.frame zoo
```

Warning message:

package ‘forecast’ was built under R version 4.2.2

>

> arimadata=auto.arima(myts)

>

> forecast(arimadata,h=181)

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
1401.0164	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0192	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0219	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0247	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0274	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0301	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0329	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0356	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0384	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0411	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0438	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0466	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0493	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0521	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0548	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0575	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0603	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0630	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0658	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0685	64.33333	49.84179	78.82488	42.17042	86.49624
1401.0712	64.33333	49.84179	78.82488	42.17042	86.49624

1401.0740	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0767	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0795	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0822	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0849	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0877	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0904	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0932	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0959	64.33333 49.84179 78.82488 42.17042 86.49624
1401.0986	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1014	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1041	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1068	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1096	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1123	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1151	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1178	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1205	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1233	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1260	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1288	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1315	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1342	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1370	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1397	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1425	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1452	64.33333 49.84179 78.82488 42.17042 86.49624
1401.1479	64.33333 49.84179 78.82488 42.17042 86.49624

1401.1507	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1534	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1562	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1589	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1616	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1644	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1671	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1699	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1726	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1753	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1781	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1808	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1836	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1863	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1890	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1918	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1945	64.33333	49.84179	78.82488	42.17042	86.49624
1401.1973	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2000	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2027	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2055	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2082	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2110	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2137	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2164	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2192	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2219	64.33333	49.84179	78.82488	42.17042	86.49624
1401.2247	64.33333	49.84179	78.82488	42.17042	86.49624

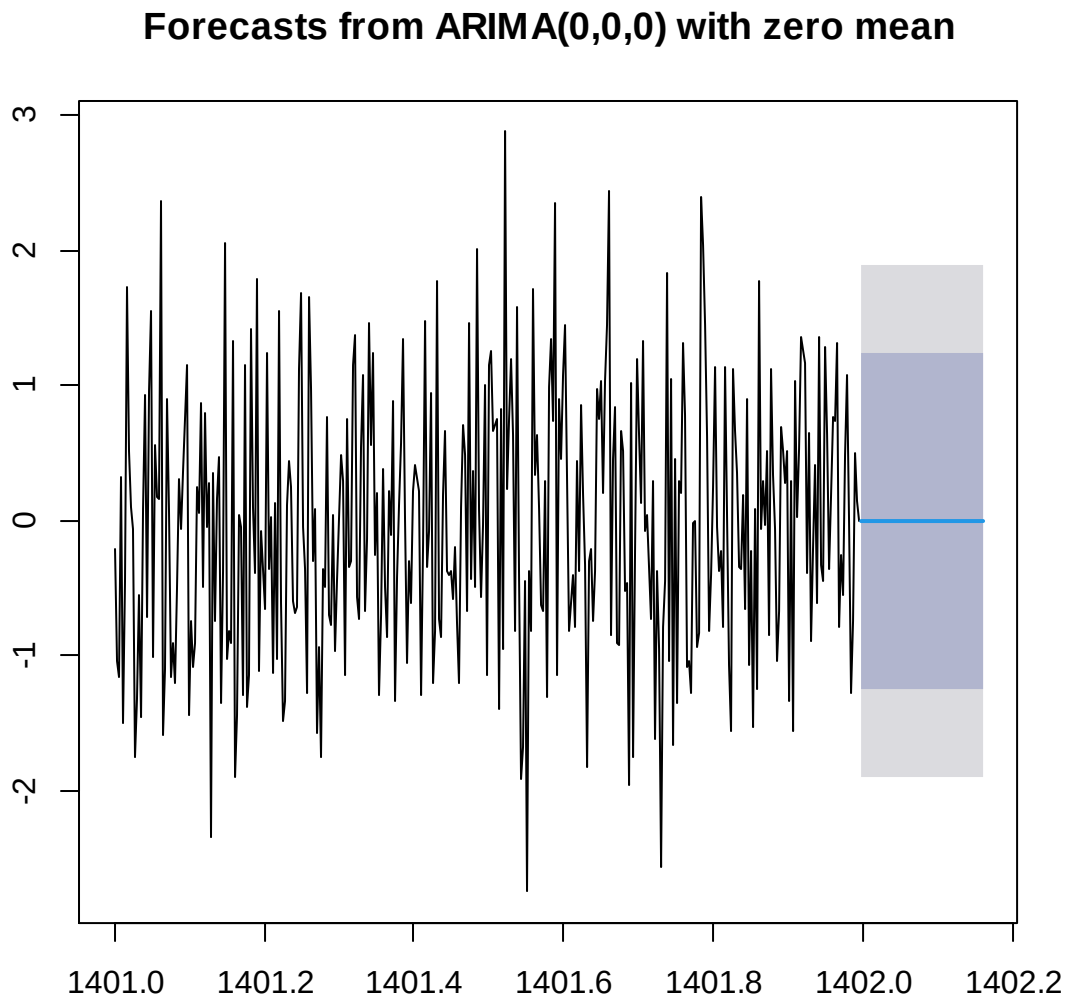
1401.2274	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2301	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2329	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2356	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2384	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2411	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2438	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2466	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2493	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2521	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2548	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2575	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2603	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2630	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2658	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2685	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2712	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2740	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2767	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2795	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2822	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2849	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2877	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2904	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2932	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2959	64.33333 49.84179 78.82488 42.17042 86.49624
1401.2986	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3014	64.33333 49.84179 78.82488 42.17042 86.49624

1401.3041	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3068	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3096	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3123	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3151	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3178	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3205	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3233	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3260	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3288	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3315	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3342	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3370	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3397	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3425	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3452	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3479	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3507	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3534	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3562	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3589	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3616	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3644	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3671	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3699	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3726	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3753	64.33333 49.84179 78.82488 42.17042 86.49624
1401.3781	64.33333 49.84179 78.82488 42.17042 86.49624

1401.3808	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3836	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3863	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3890	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3918	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3945	64.33333	49.84179	78.82488	42.17042	86.49624
1401.3973	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4000	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4027	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4055	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4082	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4110	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4137	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4164	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4192	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4219	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4247	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4274	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4301	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4329	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4356	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4384	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4411	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4438	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4466	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4493	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4521	64.33333	49.84179	78.82488	42.17042	86.49624
1401.4548	64.33333	49.84179	78.82488	42.17042	86.49624

```
1401.4575       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4603       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4630       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4658       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4685       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4712       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4740       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4767       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4795       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4822       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4849       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4877       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4904       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4932       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4959       64.33333 49.84179 78.82488 42.17042 86.49624
1401.4986       64.33333 49.84179 78.82488 42.17042 86.49624
1401.5014       64.33333 49.84179 78.82488 42.17042 86.49624
1401.5041       64.33333 49.84179 78.82488 42.17042 86.49624
1401.5068       64.33333 49.84179 78.82488 42.17042 86.49624
1401.5096       64.33333 49.84179 78.82488 42.17042 86.49624
> ## Create a daily Date object - helps my work on dates
> inds <- seq(as.Date("1401/01/01"), as.Date("1401/12/30"), by = "day")
>
> ## Create a time series object
> set.seed(25)
> myts <- ts(rnorm(length(inds)),     # random data
+           start = c(1401, as.numeric(format(inds[1], "%j"))),
+           frequency = 365)
```

```
>
>
> as.numeric(format(inds[1], "%j"))
[1] 1
>
>
> ## use auto.arima to choose ARIMA terms
> fit <- auto.arima(myts)
> ## forecast for next 60 time points
> fore <- forecast(fit, h = 60)
> ## plot it
> plot(fore)
```

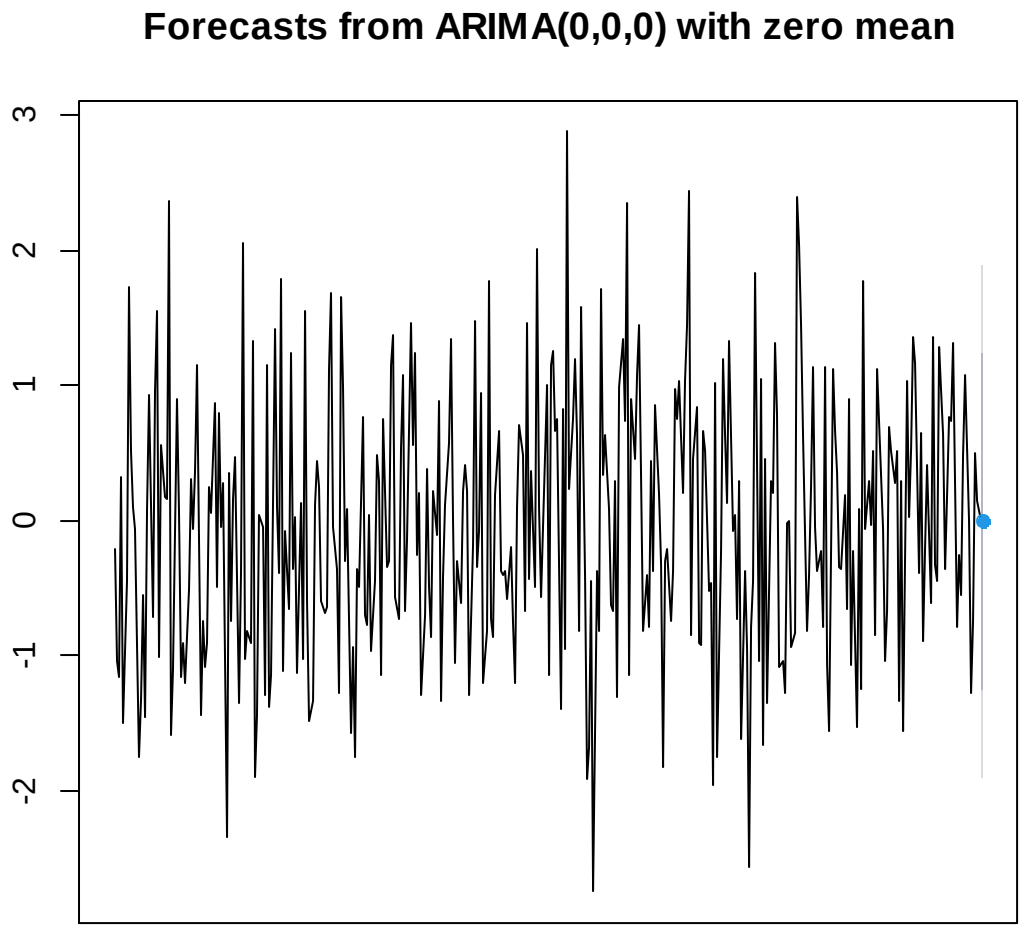



```
> set.seed(25)
> myzoo <- zoo(rnorm(length(inds)), inds)
Error in zoo(rnorm(length(inds)), inds) : could not find function "zoo"
> library(zoo)

Attaching package: ‘zoo’

The following objects are masked from ‘package:base’:
```

as.Date, as.Date.numeric

Warning message:
package ‘zoo’ was built under R version 4.2.2

```
> ## create the zoo object as before
> set.seed(25)
> myzoo <- zoo(rnorm(length(inds)), inds)
>
>
> ## use auto.arima to choose ARIMA terms
> fit <- auto.arima(myts)
> ## forecast for next 60 time points
> fore <- forecast(fit, h = 1)
>
>
>
> ## plot it
> plot(fore, xaxt = "n")    # no x-axis
> Axis(inds, side = 1)
>
```



>

plot(fore)

> set.seed(25)

> myzoo <- zoo(rnorm(length(inds)), inds)

Error in zoo(rnorm(length(inds)), inds) : could not find function "zoo"

> library(zoo)

Attaching package: ‘zoo’

The following objects are masked from ‘package:base’:

```
    as.Date, as.Date.numeric


Warning message:
package ‘zoo’ was built under R version 4.2.2
> ## create the zoo object as before
> set.seed(25)
> myzoo <- zoo(rnorm(length(inds)), inds)
>
>
> ## use auto.arima to choose ARIMA terms
> fit <- auto.arima(myts)
> ## forecast for next 60 time points
> fore <- forecast(fit, h = 1)
>
>
>
> ## plot it
> plot(fore, xaxt = "n")    # no x-axis
> Axis(inds, side = 1)
> plot(fore, xaxt = "n")    # no x-axis
> Axis(inds, side = 1,
+      at = seq(inds[1], tail(inds, 1) + 60, by = "3 months"),
+      format = "%b %Y")
>
>
> library(zoo)
> zoo(data$AQI, seq(from = as.Date("1401/07/01"), to = as.Date("1401/12/30"), by = 1))
```

1401-07-01 1401-07-02 1401-07-03 1401-07-04 1401-07-05 1401-07-06 1401-07-07

66 69 63 76 69 43 46

1401-07-08 1401-07-09 1401-07-10 1401-07-11 1401-07-12 1401-07-13 1401-07-14

50 60 71 78 53 74 83

1401-07-15 1401-07-16 1401-07-17 1401-07-18 1401-07-19 1401-07-20 1401-07-21

67 74 94 64 150 174 150

1401-07-22 1401-07-23 1401-07-24 1401-07-25 1401-07-26 1401-07-27 1401-07-28

104 79 96 74 78 58 81

1401-07-29 1401-07-30 1401-07-31 1401-08-01 1401-08-02 1401-08-03 1401-08-04

62 62 103 95 83 70 68

1401-08-05 1401-08-06 1401-08-07 1401-08-08 1401-08-09 1401-08-10 1401-08-11

126 88 123 66 77 90 76

1401-08-12 1401-08-13 1401-08-14 1401-08-15 1401-08-16 1401-08-17 1401-08-18

93 63 71 78 98 156 102

1401-08-19 1401-08-20 1401-08-21 1401-08-22 1401-08-23 1401-08-24 1401-08-25

69 64 93 83 54 62 103

1401-08-26 1401-08-27 1401-08-28 1401-08-29 1401-08-30 1401-08-31 1401-09-01

174 157 86 80 92 102 95

1401-09-02 1401-09-03 1401-09-04 1401-09-05 1401-09-06 1401-09-07 1401-09-08

457 126 69 101 75 85 98

1401-09-09 1401-09-10 1401-09-11 1401-09-12 1401-09-13 1401-09-14 1401-09-15

84 86 88 122 150 85 57

1401-09-16 1401-09-17 1401-09-18 1401-09-19 1401-09-20 1401-09-21 1401-09-22

81 89 66 76 85 95 78

1401-09-23 1401-09-24 1401-09-25 1401-09-26 1401-09-27 1401-09-28 1401-09-29

71 65 80 100 106 107 91

1401-09-30 1401-10-01 1401-10-02 1401-10-03 1401-10-04 1401-10-05 1401-10-06

81 95 91 87 113 102 88

1401-10-07 1401-10-08 1401-10-09 1401-10-10 1401-10-11 1401-10-12 1401-10-13

104 160 102 110 192 104 96

1401-10-14 1401-10-15 1401-10-16 1401-10-17 1401-10-18 1401-10-19 1401-10-20

80 82 107 91 110 102 85

1401-10-21 1401-10-22 1401-10-23 1401-10-24 1401-10-25 1401-10-26 1401-10-27

100 139 159 140 112 121 113

1401-10-28 1401-10-29 1401-10-30 1401-10-31 1401-11-01 1401-11-02 1401-11-03

99 91 102 134 100 123 127

1401-11-04 1401-11-05 1401-11-06 1401-11-07 1401-11-08 1401-11-09 1401-11-10

83 67 70 72 71 169 106

1401-11-11 1401-11-12 1401-11-13 1401-11-14 1401-11-15 1401-11-16 1401-11-17

87 100 76 122 129 83 74

1401-11-18 1401-11-19 1401-11-20 1401-11-21 1401-11-22 1401-11-23 1401-11-24

121 86 119 101 126 158 99

1401-11-25 1401-11-26 1401-11-27 1401-11-28 1401-11-29 1401-11-30 1401-12-01

101 127 95 100 86 77 75

1401-12-02 1401-12-03 1401-12-04 1401-12-05 1401-12-06 1401-12-07 1401-12-08

84 84 99 86 90 97 139

1401-12-09 1401-12-10 1401-12-11 1401-12-12 1401-12-13 1401-12-14 1401-12-15

93 96 90 107 93 81 74

1401-12-16 1401-12-17 1401-12-18 1401-12-19 1401-12-20 1401-12-21 1401-12-22

100 77 71 70 94 98 77

1401-12-23 1401-12-24 1401-12-25 1401-12-26 1401-12-27 1401-12-28 1401-12-29

71 92 98 93 96 66 69

1401-12-30

63

>

>

```
> library(lubridate)

Attaching package: ‘lubridate’

The following objects are masked from ‘package:base’:

    date, intersect, setdiff, union

> set.seed(42)
> minday = as.Date("1401/07/01")
> maxday = as.Date("1401/12/30")
> dates <- seq(minday, maxday, "days")
> dates <- dates[sample(1:length(dates),length(dates)/4)] # create some holes
> df <- data.frame(date=sort(dates), val=sin(seq(from=0, to=2*pi, length=length(dates))))
> df
         date          val
1  1401-07-03  0.000000e+00
2  1401-07-04  1.423148e-01
3  1401-07-05  2.817326e-01
4  1401-07-06  4.154150e-01
5  1401-07-20  5.406408e-01
6  1401-07-24  6.548607e-01
7  1401-07-27  7.557496e-01
8  1401-08-05  8.412535e-01
9  1401-08-10  9.096320e-01
10 1401-08-11  9.594930e-01
11 1401-08-12  9.898214e-01
12 1401-08-16  1.000000e+00
```

13 1401-08-18 9.898214e-01

14 1401-08-27 9.594930e-01

15 1401-09-03 9.096320e-01

16 1401-09-06 8.412535e-01

17 1401-09-09 7.557496e-01

18 1401-09-12 6.548607e-01

19 1401-09-27 5.406408e-01

20 1401-09-30 4.154150e-01

21 1401-10-07 2.817326e-01

22 1401-10-08 1.423148e-01

23 1401-10-12 1.224606e-16

24 1401-10-17 -1.423148e-01

25 1401-10-18 -2.817326e-01

26 1401-10-19 -4.154150e-01

27 1401-10-22 -5.406408e-01

28 1401-10-30 -6.548607e-01

29 1401-11-05 -7.557496e-01

30 1401-11-08 -8.412535e-01

31 1401-11-11 -9.096320e-01

32 1401-11-13 -9.594930e-01

33 1401-11-20 -9.898214e-01

34 1401-11-23 -1.000000e+00

35 1401-11-27 -9.898214e-01

36 1401-11-30 -9.594930e-01

37 1401-12-01 -9.096320e-01

38 1401-12-02 -8.412535e-01

39 1401-12-05 -7.557496e-01

40 1401-12-07 -6.548607e-01

41 1401-12-12 -5.406408e-01

42 1401-12-13 -4.154150e-01

43 1401-12-18 -2.817326e-01

44 1401-12-21 -1.423148e-01

45 1401-12-30 -2.449213e-16