566 - HW1

```
library("readxl")
library("TSA")
```

```
##
## Attaching package: 'TSA'
```

```
## The following objects are masked from 'package:stats':
##
##     acf, arima
```

```
## The following object is masked from 'package:utils':
##
##     tar
```

Question 1

a: Import the data into R and create a time series object in R.

```
nhsales <- data.frame(read_excel("NewHomeSales.xls"))
nhsales_ts <- ts(nhsales[,2],start=c(1963,1),end=c(2017,9), frequency=12)

nhsales_ts
```

```
##      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 1963 42  35  44  52  58  48  62  56  49  44  39  31
## 1964 39  46  53  49  52  53  54  56  48  45  37  33
## 1965 38  44  53  49  54  57  51  58  48  44  42  37
## 1966 42  43  53  49  49  40  40  36  29  31  26  23
## 1967 29  32  41  44  49  47  46  47  43  45  34  31
## 1968 35  43  46  46  43  41  44  47  41  40  32  32
## 1969 34  40  43  42  43  44  39  40  33  32  31  28
## 1970 34  29  36  42  43  44  44  48  45  44  40  37
## 1971 45  49  62  62  58  59  64  62  50  52  50  44
## 1972 51  56  60  65  64  63  63  72  61  65  51  47
## 1973 55  60  68  63  65  61  54  52  46  42  37  30
## 1974 37  44  55  53  58  50  48  45  41  34  30  24
## 1975 29  34  44  54  57  51  51  53  46  46  46  39
## 1976 41  53  55  62  55  56  57  59  58  55  49  47
## 1977 57  68  84  81  78  74  64  74  71  63  55  51
## 1978 57  63  75  85  80  77  68  72  68  70  53  50
## 1979 53  58  73  72  68  63  64  68  60  54  41  35
```

```
## 1980 43  44  44  36  44  50  55  61  50  46  39  33
## 1981 37  40  49  44  45  38  36  34  28  29  27  29
## 1982 28  29  36  32  36  34  31  36  39  40  39  33
## 1983 44  46  57  59  64  59  51  50  48  51  45  48
## 1984 52  58  63  61  59  58  52  48  53  55  42  38
## 1985 48  55  67  60  65  65  63  61  54  52  51  47
## 1986 55  59  89  84  75  66  57  52  60  54  48  49
## 1987 53  59  73  72  62  58  55  56  52  52  43  37
## 1988 43  55  68  68  64  65  57  59  54  57  43  42
## 1989 52  51  58  60  61  58  62  61  49  51  47  40
## 1990 45  50  58  52  50  50  46  46  38  37  34  29
## 1991 30  40  51  50  47  47  43  46  37  41  39  36
## 1992 48  55  56  53  52  53  52  56  51  48  42  42
## 1993 44  50  60  66  58  59  55  57  57  56  53  51
## 1994 46  58  74  65  65  55  52  59  54  57  45  40
## 1995 47  47  60  58  63  64  64  63  54  54  46  45
## 1996 54  68  70  70  69  65  66  73  62  56  54  51
## 1997 61  69  81  70  71  71  69  72  67  62  61  51
## 1998 64  75  81  82  82  83  75  75  68  69  70  61
## 1999 67  76  84  86  80  82  78  78  65  67  61  57
## 2000 67  78  88  78  77  71  76  73  70  71  63  65
## 2001 72  85  94  84  80  79  76  74  66  66  67  66
## 2002 66  84  90  86  88  84  82  90  82  77  73  70
## 2003 76  82  98  91  101 107 99  105 90  88  76  75
## 2004 89  102 123 109 115 105 96  102 94  101 84  83
## 2005 92  109 127 116 120 115 117 110 99  105 86  87
## 2006 89  88  108 100 102 98  83  88  80  74  71  71
## 2007 66  68  80  83  79  73  68  60  53  57  45  44
## 2008 44  48  49  49  49  45  43  38  35  32  27  26
## 2009 24  29  31  32  34  37  38  36  30  33  26  24
## 2010 24  27  36  41  26  28  26  23  25  23  20  23
## 2011 21  22  28  30  28  28  27  25  24  25  23  24
## 2012 23  30  34  34  35  34  33  31  30  29  28  28
## 2013 32  36  41  43  40  43  33  31  31  36  32  31
## 2014 33  35  39  39  43  38  35  36  37  38  31  35
## 2015 39  45  46  48  47  44  43  41  35  39  36  38
## 2016 39  45  50  55  53  50  54  46  44  46  40  39
## 2017 45  51  61  56  57  56  50  45  52
```

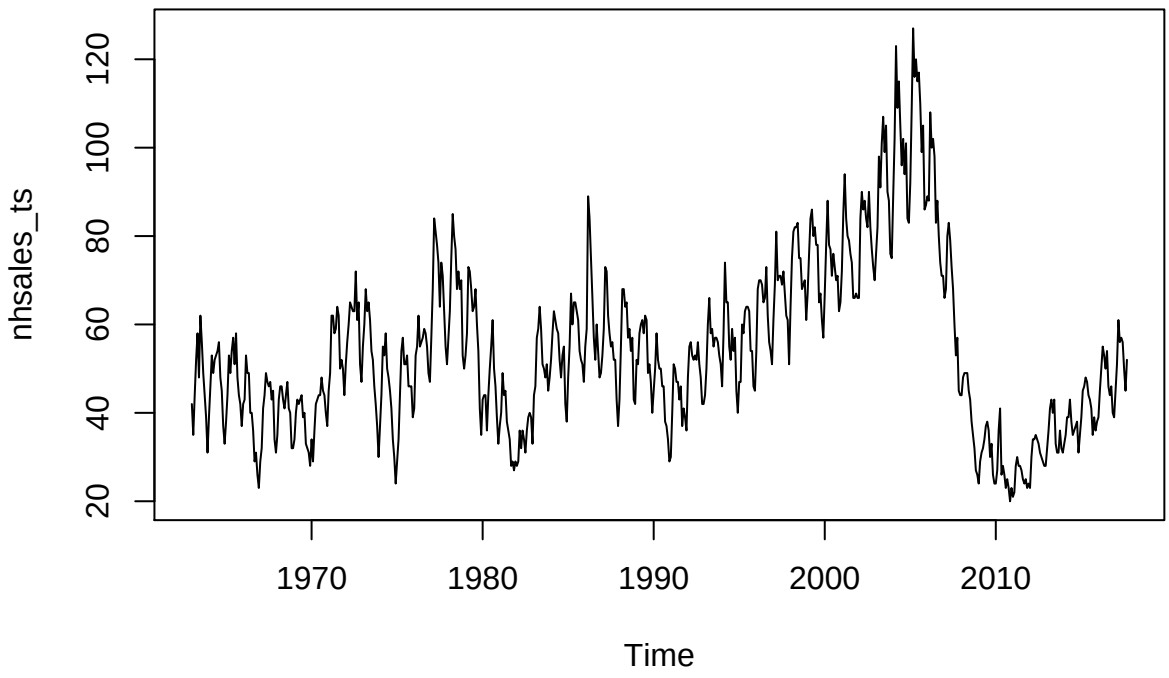
b: Print out the sales for first two years (24 observations).

```
head(nhsales_ts, n = 24)
```

```
##  [1] "42" "35" "44" "52" "58" "48" "62" "56" "49" "44" "39" "31" "39" "46" "53"
## [16] "49" "52" "53" "54" "56" "48" "45" "37" "33"
```

c: Give the time plot of the series.

```
plot(nhsales_ts)
```



d: Based on the time plot, comment on the main features of this series. For example, is there any trend or seasonality? Does the variance change over time? Is there any outlier in the series? Or is there is any abrupt change in the series?

The peaks appear to be during the summer months where people are more likely to be outside and willing to venture to new places while the dips appear to be during the winter months where people are less likely to go out and look at new houses. The large rise in sales are during the years approaching 2008 when the market crashed. So we can see the spike and fall of the stock market crash.

Question 2

a: Import the data in R and create a time series object in R.

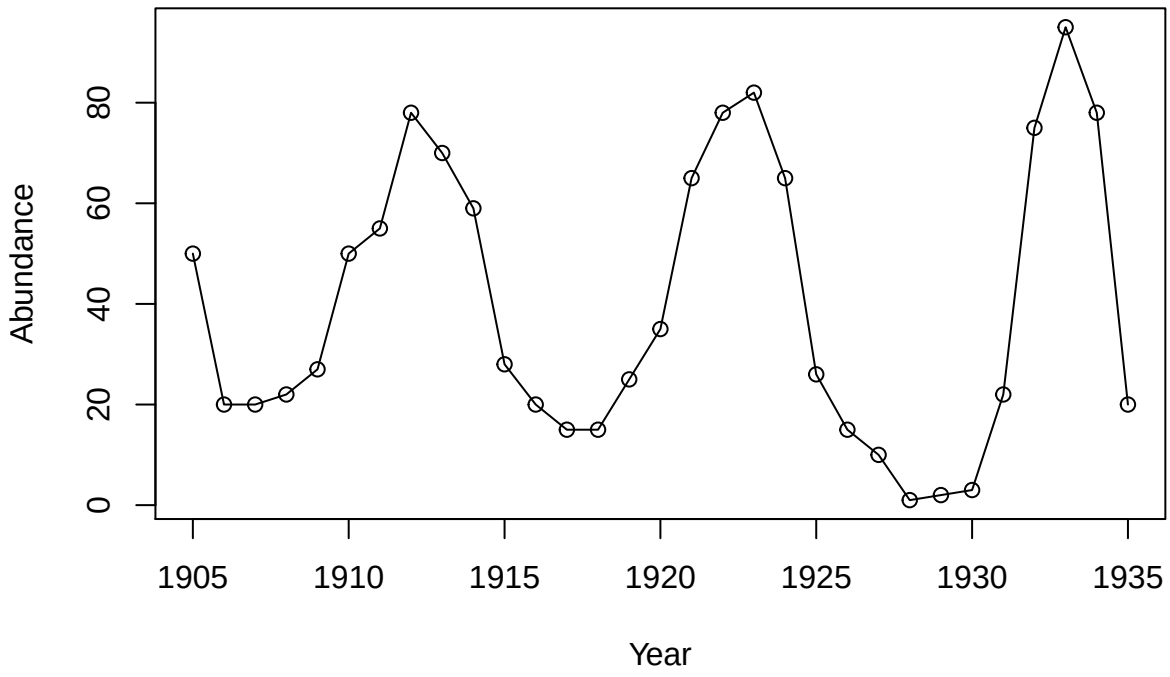
```
hare <- data.frame(read_excel("hare.xlsx"))
hare_ts <- ts(hare[,2],start=1905,end=1935, frequency=1)

hare_ts
```

```
## Time Series:
## Start = 1905
## End = 1935
## Frequency = 1
```

```
##  [1] 50 20 20 22 27 50 55 78 70 59 28 20 15 15 25 35 65 78 82 65 26 15 10  1  2
## [26]  3 22 75 95 78 20
```

b: Provide R code to reproduce the following graph.

```
plot(hare_ts, xlab = "Year", ylab = "Abundance", type='o')
```

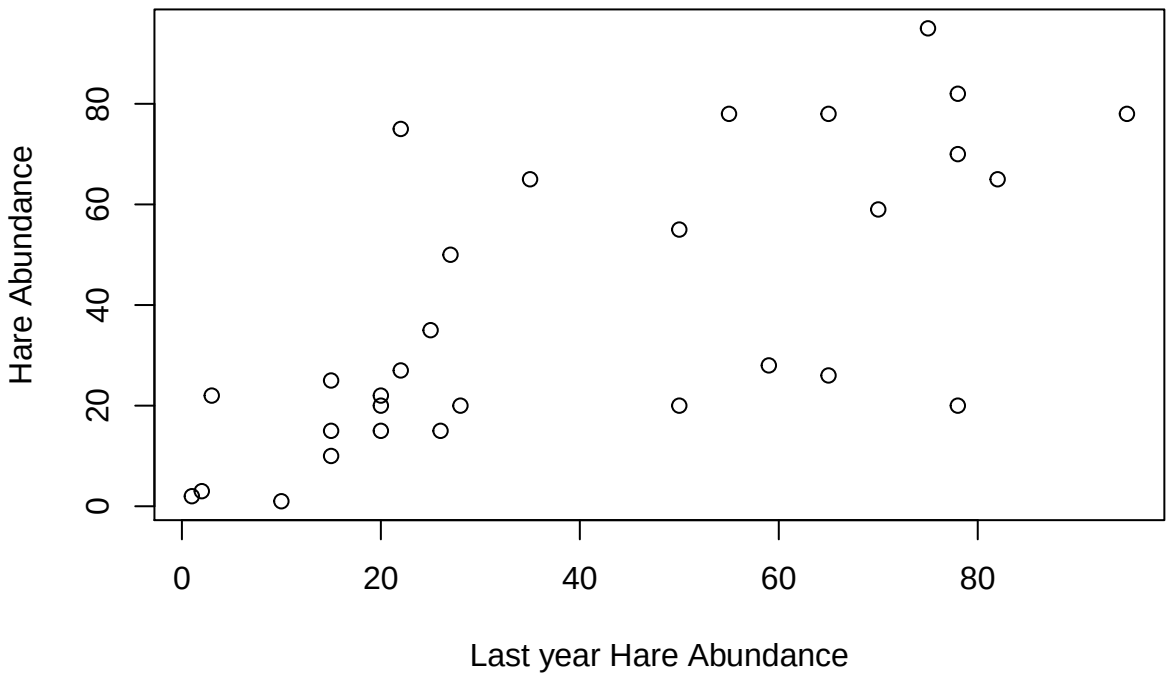


c: Based on the time plot, comment on the main features of this series.

There appears to be at the beginning of every decade that gradually decline until the next spike. The trapping of the hares appears to become more and more common/they trap more due to the almost 0 abundace in 1927-1930 with a large spike and then the greatest decrease 1934-1935.

d: Provide a scatter plot of the hare abundance against previous year's hare abundance. Provide comments on the observations you make on the scatter plot.

```
lag1 <- zlag(hare_ts, d=1)
plot(lag1, hare_ts, xlab="Last year Hare Abundance", ylab="Hare Abundance")
```




```
cor(lag1[2:31],hare_ts[2:31])
```

```
## [1] 0.7025777
```

After calculating it appears that there is a .70 correlation. It is hard to see in the plot but there does seem to be a linear relationship within the scatter plot when looking closely. It would make sense that the linear relationship, espeically closer to 0, would produce the cor() output it did. The plot does lose correlation with the larger abundance but that may be because of the large spikes and fall in the later years that we see in the plot in part (b) which were relatively different from the earlier years.