

WU #21 - Polynomials & Step Functions

Math 158 - Jo Hardin

Thursday 4/21/2022

Name: _____

Names of people you worked with: _____

Consider the following data (from NOAA) on wind temperature at noon as a function of the day of the year from a buoy off the coast of Santa Monica.

Step Functions Directly on the plot below, draw the estimated linear model.

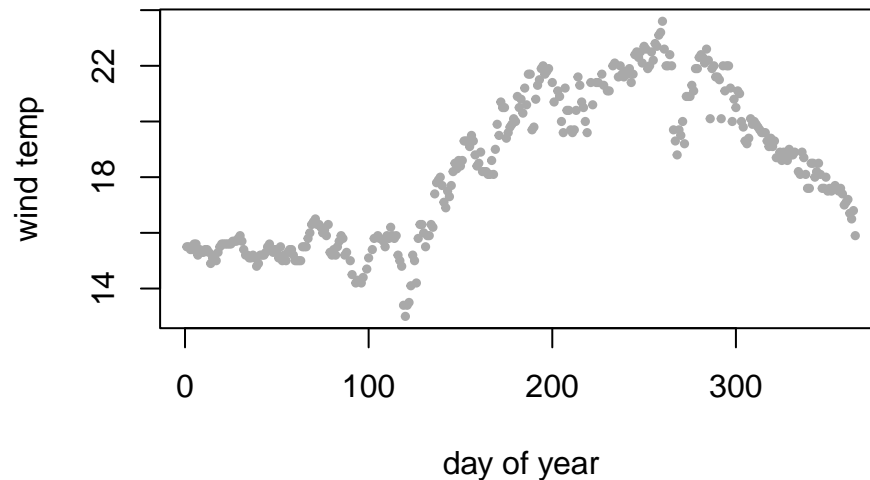
```
buoy_data %>%  
  summarize(cut(yearday, 4)) %>% table()
```

```
## .  
## (0.636,92] (92,183] (183,274] (274,365]  
##          90          86          83          90
```

```
lm(WTMP ~ cut(yearday, 4), data=buoy_data) %>%  
  tidy()
```

```
## # A tibble: 4 x 5  
##   term                estimate std.error statistic  p.value  
##   <chr>                <dbl>    <dbl>    <dbl>    <dbl>  
## 1 (Intercept)          15.4     0.153    101.    1.29e-258  
## 2 cut(yearday, 4)(92,183]  1.79     0.218     8.18  5.32e- 15  
## 3 cut(yearday, 4)(183,274]  5.83     0.220    26.5   4.86e- 85  
## 4 cut(yearday, 4)(274,365]  3.95     0.216    18.3   1.12e- 52
```

Step Function

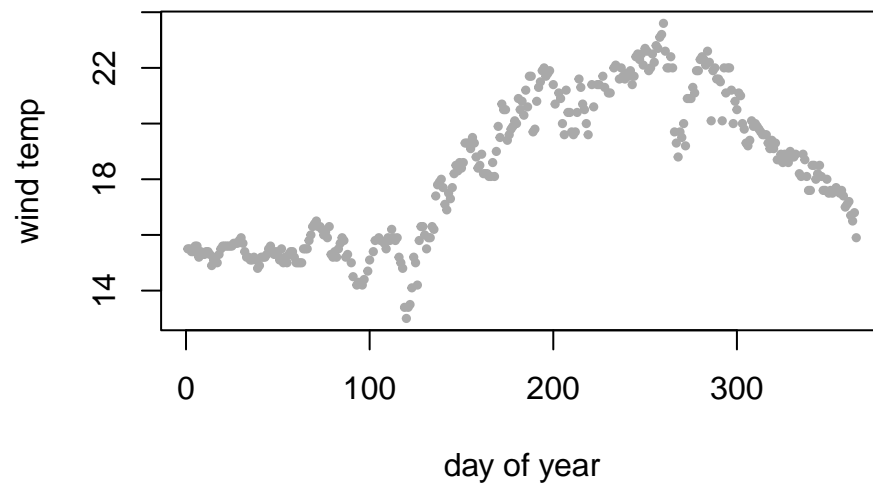


Cubic Function Directly on the plot below, sketch the estimated linear model (hint: connect a few fitted points).

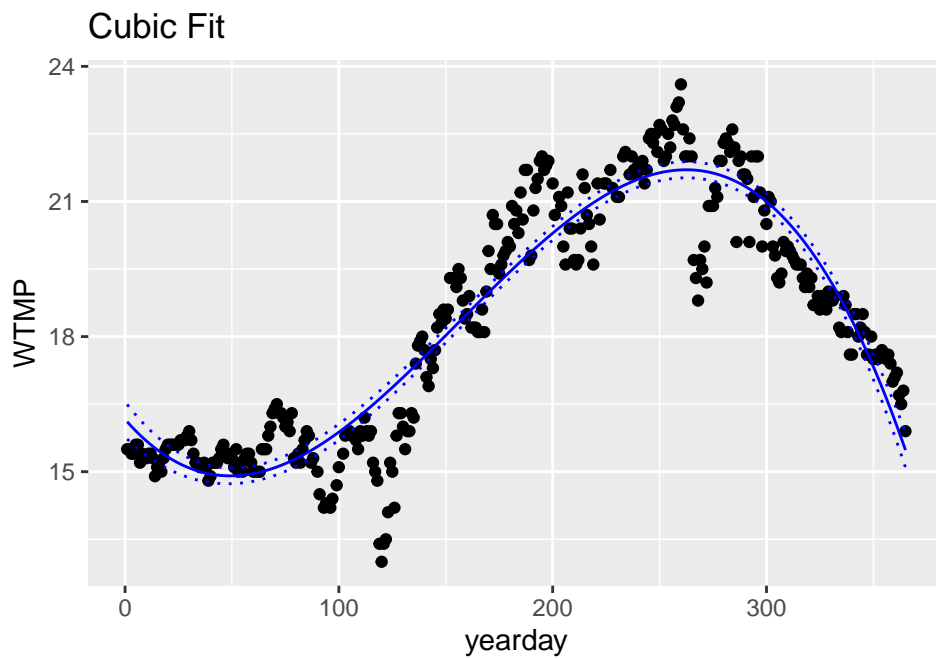
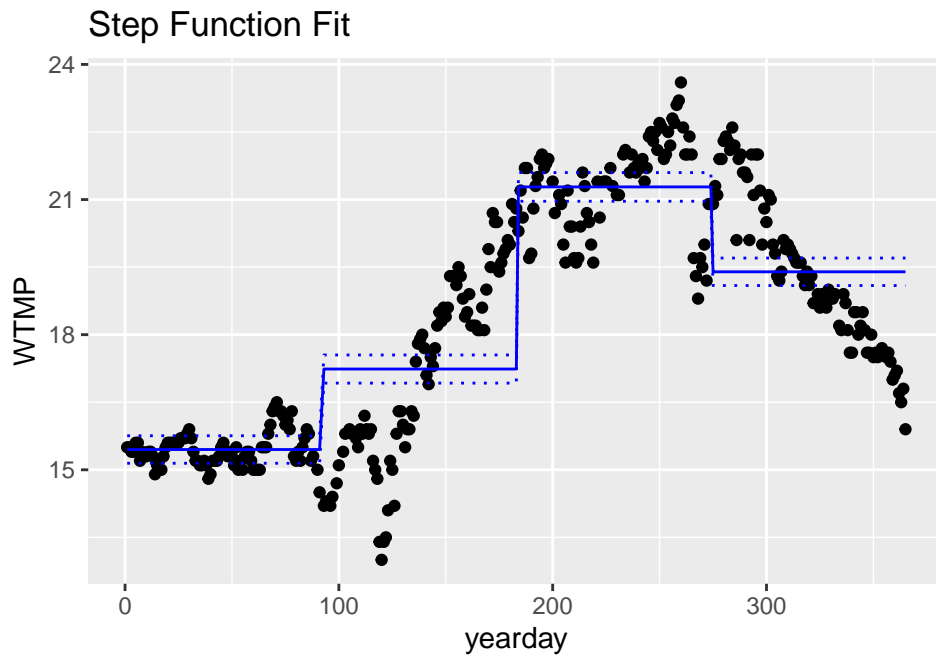
```
lm(WTMP ~ poly(yearday,3, raw=TRUE), data=buoy_data) %>%  
  tidy()
```

```
## # A tibble: 4 x 5  
##   term                estimate std.error statistic  p.value  
##   <chr>                <dbl>    <dbl>    <dbl>    <dbl>  
## 1 (Intercept)          1.62e+1  1.96e-1    82.3 6.55e-229  
## 2 poly(yearday, 3, raw = ~ -5.44e-2  4.70e-3   -11.6 2.16e- 26  
## 3 poly(yearday, 3, raw = ~  6.55e-4  2.99e-5    21.9 3.17e- 67  
## 4 poly(yearday, 3, raw = ~ -1.40e-6  5.39e-8   -26.0 2.14e- 83
```

Cubic Fit



Solution



Note that the quadratic fit is:

$$\widehat{\text{WTMP}} = 16.16 - 0.0543 \cdot \text{day} + 0.000655 \cdot \text{day}^2 - 0.00000140 \cdot \text{day}^3$$