PS 4

```
In [14]: library(ggplot2)
         library(MASS)
         library(broom)
         library(lattice)
         library(TeachingDemos)
         library(repr)
```

```
In [5]: movie_budgets = read.table(file.choose(),header = T)
```

```
In [6]: movie_budgets$log_budget = log10(movie_budgets$budget)
        head(movie_budgets)
```

title	year	length	budget	log_budget
'G' Men	1935	85	450000	5.653213
'Manos' the Hands of Fate	1966	74	19000	4.278754
'Til There Was You	1997	113	23000000	7.361728
.com for Murder	2002	96	5000000	6.698970
10 Things I Hate About You	1999	97	16000000	7.204120
100 Mile Rule	2002	98	1100000	6.041393

Q1

It can be clearly observed from the graph that there is a non linear trend between log(Budget) and year/length. Hence loess or rlm is appropriate to use.

Yes an interaction is needed between year and length.

There isn't a great trend between log(budget) and Year alone but the trend between log(budget) and length when split by year depicts a sharp increase in budget for all the movies above length of 150 units over the years.

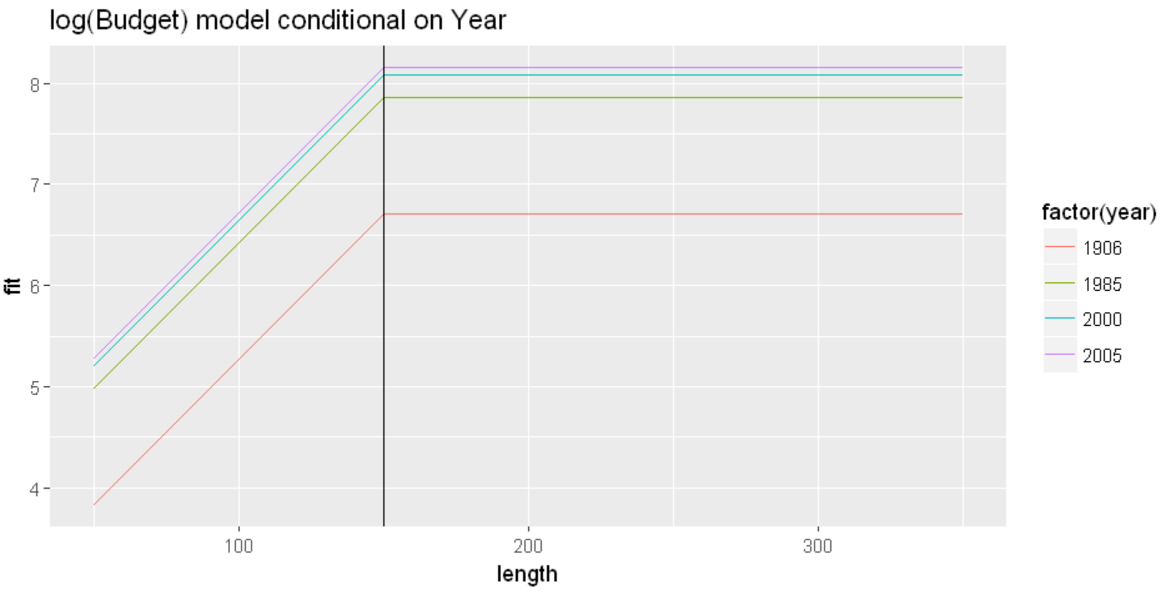
After observing various values, a span of 0.35 appears appropriate.

Robust fit is more apt for this data than Ordinary Least Squares since the curve is drastically impacted by a few outlier lengths above 150. Hence these outliers are appropriately tackled by rlm method without major impact to the curve.

Q2

In [46]:
```
length.bend = function(x) {
  return((x - 150) * (x < 150))
}
movie_budgets.rlm = rlm(log_budget ~ year + length.bend(length), data = movie_
budgets, psi = psi.bisquare)
movie_budgets.grid = expand.grid(year = c(1906, 1985, 2000, 2005), length = c(
50,150,250,350))
movie_budgets.grid.predict = predict(movie_budgets.rlm, newdata = movie_budget
s.grid)
```

In [42]:
```
options(repr.plot.width=8, repr.plot.height=4)
ggplot(data.frame(movie_budgets.grid, fit = as.vector(movie_budgets.grid.predi
ct)),
       aes(x = length,y = fit, group = year, color = factor(year)))+ geom_line
() + geom_vline(xintercept = 150) +
ggtitle("log(Budget) model conditional on Year")
```



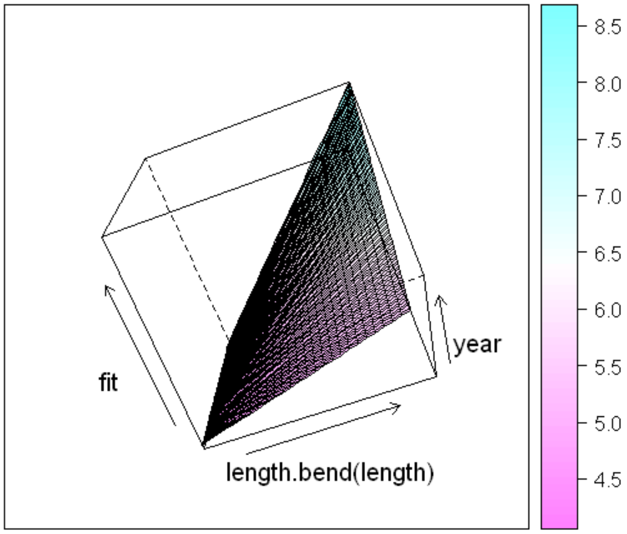
The log(Budget) increases steeply till the length of the movie is 150 units but beyond 150 it is constant for all the lengths.

Q3

In [39]:
```
mb.grid = expand.grid(year = seq(1906,2005,1), length = seq(25,400,5))
movie.budgets.rlm = rlm(log_budget ~ year * length.bend(length), data = movie_
budgets,
                         psi = psi.bisquare)
mb_pr = predict(movie.budgets.rlm, newdata = mb.grid)
mb_plot_df = data.frame(mb.grid, fit = as.vector(mb_pr))
```

In [45]:

```
#rotate.wireframe(fit ~ length.bend(length) * year, data = mb_plot_df, screen = list(z = 40, x = -60, y = -48), drape = TRUE)
wireframe(fit ~ length.bend(length) * year, data = mb_plot_df, screen = list(z = 40, x = -60, y = -48), drape = TRUE)
```



This graph projects that the log(Budget) varies more with year than with length. This variation is not clearly seen in the curve obtained in Q2.