Assignment 1

Instructor: Jiguo Cao

Instructions: It is due at 1:30pm, Monday, March 11, 2018.

1. Below is the melanoma data from the Connecticut Tumor Registry present age-adjusted numbers of melanoma skin-cancer incidences per 100,000 people in Connectict for the years from 1936 to 1972.

```
> library(fda)
> melanoma
year incidence
1  1936       0.9
2  1937       0.8
3  1938       0.8
4  1939       1.3
5  1940       1.4
6  1941       1.2
7  1942       1.7
8  1943       1.8
9  1944       1.6
10 1945       1.5
11 1946       1.5
12 1947       2.0
13 1948       2.5
14 1949       2.7
15 1950       2.9
16 1951       2.5
17 1952       3.1
18 1953       2.4
19 1954       2.2
20 1955       2.9
21 1956       2.5
22 1957       2.6
23 1958       3.2
24 1959       3.8
25 1960       4.2
26 1961       3.9
27 1962       3.7
28 1963       3.3
29 1964       3.7
30 1965       3.9
31 1966       4.1
32 1967       3.8
33 1968       4.7
34 1969       4.4
35 1970       4.8
36 1971       4.8
37 1972       4.8
```

   (a) (30') Please use the spline smoothing method without penalty to estimate the incidence function and the first and second derivative of the estimated incidence function.

      i. (10') Show how to choose the number of B-spline basis functions.

      ii. (10') Plot the estimated incidence function along with the original data.

      iii. (10') Plot the first and second derivative of the estimated incidence function.

(b) (30') Please use the spline smoothing method with a roughness penalty to estimate the incidence function and the first and second derivative of the estimated incidence function.

i. (10') Show how to choose the value for the smoothing parameter.

ii. (10') Plot the estimated incidence function along with the original data.

iii. (10') Plot the first and second derivative of the estimated incidence function.

Please organize the above estimation procedures, results, and your R codes in a single pdf report.