**迴歸分析 作業2**

**Due date: 10月16日**

1. Which of the following functions are simultaneously linear in all $β\_{i}$?

(a)$ μ\_{Y}\left(x\right)=β\_{0}+β\_{1}\frac{x}{1+x}$

(b)$ μ\_{Y}\left(x\_{1},x\_{2}\right)=β\_{0}^{2}+β\_{1}x\_{1}+β\_{2}x\_{2}$

(c)$ μ\_{Y}\left(x\_{1},x\_{2}\right)=β\_{0}+β\_{1}x\_{1}+β\_{2}x\_{2}+β\_{3}x\_{1}x\_{2}$

(d)$ μ\_{Y}\left(x\_{1},x\_{2},x\_{3}\right)=β\_{0}x\_{1}^{β\_{1}}x\_{2}^{β\_{2}}x\_{3}^{β\_{3}}$

2. Identify the predictor variable $x$ and the response variable $y$ in each of the following situations.

(a)The carbon monoxide level in the blood is to be related to the number of cigarettes a person smokes per day.

(b) A market analyst wishes to relate local advertising expenses with product sales in several areas of the state.

3. Given the 5 pairs of $(x,y)$ values

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| $$x\_{i}$$ | 0 | 1 | 6 | 3 | 5 |
| $$y\_{i}$$ | 4 | 3 | 0 | 2 | 1 |

1. Construct a scatter diagram
2. Calculate $\overline{x}=\frac{\sum\_{i=1}^{n}x\_{i}}{n}$, $\overline{y}=\frac{\sum\_{i=1}^{n}y\_{i}}{n}$, $\sum\_{i=1}^{n}(x\_{i}-\overline{x})^{2}$, $\sum\_{i=1}^{n}(y\_{i}-\overline{y})^{2}$,

 $\sum\_{i=1}^{n}(x\_{i}-\overline{x})(y\_{i}-\overline{y})$

4.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| midterm | 82 | 73 | 95 | 66 | 84 | 89 | 51 | 82 | 75 | 90 | 60 | 81 | 34 | 49 | 87 |
| final average | 76 | 83 | 89 | 76 | 79 | 73 | 62 | 89 | 77 | 85 | 48 | 69 | 51 | 25 | 74 |

The data in above table show the grades for 15 students on the midterm examinations and the final average in a statistics course.

1. Calculate the least squares estimated of the coefficients of the regression line
2. Calculate the residuals
3. Calculate the estimate of $σ^{2}$