线性回归分析-第 1 周作业

2026 年 9 月 15 日

1.

Prob-1. Use the brothers data collected by Galton. Plot the points and explain the regression effect there.

Relative number of Brothers of various Heights to Men of various Heights, Families of Five Brothers and upwards being excluded.

Heights of the men in inches.	Heights of their brothers in inches.													Total cases.	Medians.
	Below 63	63·5	64·5	65·5	66·5	67·5	68·5	69·5	70·5	71·5	72·5	73·5	Above 74		
74 and above	1	1	..	..	..	..	..	1	1	..	5	3	12	24	
73·5.....	..	..	..	..	..	1	3	4	8	3	3	2	3	27	
72·5.....	..	..	..	..	1	1	6	5	9	9	8	3	5	47	71·1
71·5.....	..	1	..	1	2	8	11	18	14	20	9	4	..	88	70·2
70·5.....	..	..	1	1	7	19	30	45	36	14	9	8	1	171	69·6
69·5.....	..	1	2	1	11	20	36	55	44	17	5	4	2	198	69·5
68·5.....	..	1	5	9	18	38	46	36	30	11	6	3	..	203	68·7
67·5.....	2	4	8	26	35	38	38	20	18	8	1	1	..	199	67·7
66·5.....	4	3	10	33	28	35	20	12	7	2	1	..	..	155	67·0
65·5.....	3	3	15	18	33	36	8	2	1	1	..	..	..	110	66·5
64·5.....	3	8	12	15	10	8	5	2	1	..	..	..	..	64	65·6
63·5.....	5	2	8	3	3	4	1	1	..	1	..	..	1	20	
Below 63	5	5	3	3	4	2	..	..	..	..	..	..	1	28	
Totals	23	29	64	110	152	200	204	201	169	86	47	28	25	1329	

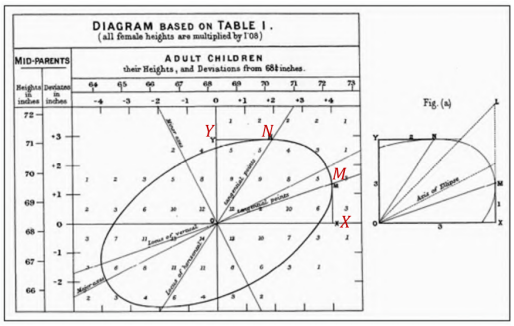
2.

Prob-2 (A). 请用 X，Y 等分别写出两条回归线的数学表达式：

OM, (the expected height of the mid-parent as a function of the child's height): [填空1]

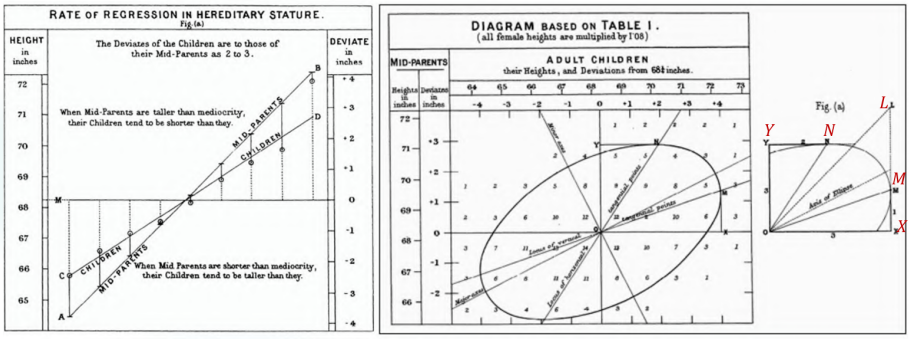
ON, (the expected height of the offspring as a function of the mid-parent's height): [填空2]

（提示：请注意字母的大小写。）



Prob-2 (B). 比较：左图中AB线对应右图的 [填空1]，

CD线对应右图的 [填空2].

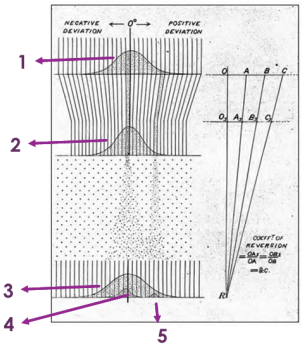


3.

Prob-3 (A). 此处我们看到若干个正态分布的形状(记为1~5)，其中：

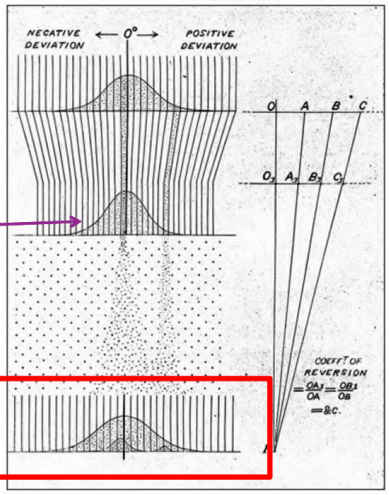
mid-parent population，对应 [填空1]；

each subgroup’s offspring as a normal distribution with the same dispersion，指的是 [填空2]。



Prob-3 (B).

Galton demonstrated that there was variability among each of the families, yet the families combined to produce a stable, normally distributed population.



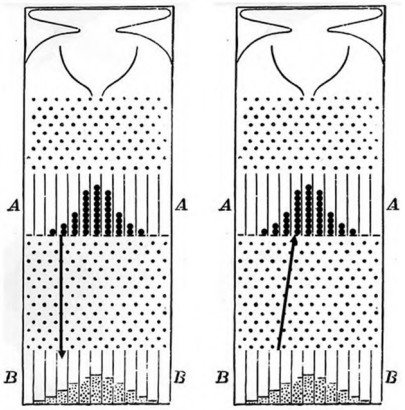
经过倾斜槽后仍为正态分布吗?

子代整体的分布为什么是正态分布?

注意底层红框中的三个正态分布，是否是小（局部）正态分布相加组成了大（整体）正态分布?

4.

▶ Prob-4. The left panel shows the average final position of shot released from an upper compartment; the right panel shows the average initial position of shot that arrived in a lower compartment. *(Galton 1889).* That is, if you were to release the shot in a single midlevel compartment, on average they would fall directly below. But if we look at a lower compartment on the left, and ask where the residents of that lower compartment were likely to have descended from, the answer is closer to the middle. Explain this paradox both mathematically and intuitively.



5.

- Prob-5. Suppose that the heights, in inches, of the women in a certain population follow the normal distribution with mean 65 inches and standard deviation 1 inch. The heights of men in this population follow the normal distribution with mean 68 inches and standard deviation 2 inches. One woman is selected at random and, independently, one man is selected at random. Find the probability that the woman will be taller than the man.