例2 東大生の身長・体重データ(竹村彰通『統計』共立出版より)

(1) データ

(2)散布図

データ番号 身長 x	体重	V IV	の身長	`	2/版刊四				
7 万田 7 万尺 4	172	70 T	165						
1						散布図(身	長,体重)		
2	176	67	150	85 r					
3	170	70	170				_		
4	174	70	165			_	•	_	
5	170	62	163	80		•	_	• •	
6	167	50	165				•	•	
7	175	75	171	75			•		
8	179	80	156				• • _	_	
9	162	60	160	70				•	
10	169	80	165	(g 'v		•	• • •	-	
11	184	66	178	꽃			•	•	
12	170	55	172	(kg) (b) (b) (b)			• •	-	
13	167	52	163	4		•	• •		
14	165	56	163	60	•	•	•		
15	165	64	160						
	175	82	176	55		• . •	_		
16 17	180	70	176	00	•		•		
						• **			
18	175	75 50	170	50		•			
19	163	52	170						
20	175	75	172	45					
21	167	53	172	"					
22	172	62	173	40			1		
23	173	69	178	40				· ·	
24	173	62	175	15	5 160	165 176	0 175	180 185	190
25	165	65	160			=	身長(cm)		
26	170	70	170						
27	177	70	167	散布図は高	両者に正の相	関の存在を示	:唆している		
28	181	78	170						
29	170	56	165						
30	175	55	175		#/ /-	図(父の身長	. ユの色目\		
31	166	53	165	190 —	11八円	四 (Xの分支			
32	178	72	172	150					
33	170	60	166	105			_		
34	177	70	160	185			•	•	
35	169	68	168						
36	185	72	172	180		•	•		
37	158	55	160			•	• •		
38	173	60	168	1 1 175	•	-	•••	•	
39	177	78	160	⁷⁵				•	
40	170	60	160			.		•	
41	170	64	168	111 <u>1</u> 270			• •		
42	180	67	175	<u></u>		•	•		
43	181	80	167	965		• •	_		
44	177	73	165	'''		•	•		
				160					
45	173	64 57	164			•			
46	171		160	155					
47	168	55	160	100					
48	178	72	172	1.50					
49	170	56	165	150					
50	171	73	180						
平均	172.4	65.6	167.2	145		1	1		
標準偏差	5.64	8.67	6.22	140	150	160	170	180	190
				140	190			100	190
						父母	り身長 (cm)		

(3) 基本統計量の値

-				
		身長	体重	父の身長
	平均	172.4	65.6	167.2
	分散	31.8	75.1	38.7
	標準偏差	5.6	8.7	6.2

散布図は両者に正の相関の存在を示唆しているがやや弱いように見える

(4) 共分散と相関係数

(xi-xbar)(yi-ybar)		VI - Vha-	データ 丨
偏差の積	yi - ybar 体重の偏差	xi - xbar 身長の偏差	,一ァ 番号
-1.76	4.4	<u> </u>	爾·
5.04	1.4	3.6	2
-10.56	4.4	-2.4	3
7.04	4.4	1.6	4
8.64	-3.6	-2.4	5
84.24	-15.6	-5.4	6
24.44	9.4	2.6	7
95.04	14.4	6.6	8
58.24	-5.6	-10.4	9
-48.96	14.4	-3.4	10
4.64	0.4	11.6	11
25.44	-10.6	-2.4	12
73.44			
	-13.6	-5.4 7.4	13
71.04 11.84	-9.6 -1.6	-7.4 -7.4	14 15
	-1.6	-7.4	15
42.64	16.4	2.6	16
33.44	4.4	7.6	17
24.44	9.4	2.6	18
127.84	-13.6	-9.4	19
24.44	9.4	2.6	20
68.04	-12.6	-5.4	21
1.44	-3.6	-0.4	22
2.04	3.4	0.6	23
-2.16	-3.6	0.6	24
4.44	-0.6	-7.4	25
-10.56	4.4	-2.4	26
20.24	4.4	4.6	27
106.64	12.4	8.6	28
23.04	-9.6	-2.4	29
-27.56	-10.6	2.6	30
80.64	-12.6	-6.4	31
35.84	6.4	5.6	32
13.44	-5.6	-2.4	33
20.24	4.4	4.6	34 35
-8.16	2.4 6.4	-3.4 12.6	35 36
80.64 152.64	-10.6	-14.4	30
-3.36		0.6	38
-3.36 57.04	-5.6 12.4	4.6	38
13.44	-5.6	4.0 -2.4	40
0.64	-1.6	-2.4 -0.4	41
10.64	1.4	7.6	42
123.84	14.4	8.6	43
34.04	7.4	4.6	44
-0.96	-1.6	0.6	45
12.04	-8.6	-1.4	46
46.64	-10.6	-1.4 -4.4	40
35.84	6.4	-4.4 5.6	47
23.04	-9.6	-2.4	49
-10.36	-9.6 7.4	-2.4 -1.4	50
-10.30	0.00	0.00	平均

(xi - xbar)/S x (yi - ybar)/S y 体重の偏差 (xi - xbar)(yi - ybar)/(S x S y) 偏差の積 (xi - xbar)(yi - ybar)/(S x S y) 偏差の積 (xi - xbar)(yi - ybar)/(S x S y) 偏差の積 (xi - xbar)(yi - ybar)/(S x S y) (xi - xbar)(yi - xbar) (xi - xbar)(yi - ybar)/(S x S y) (xi - xbar)(xi - xbar) (xi - xbar)(xi - xbar) (xi - xbar)(x - xbar) (xi - xbar)(xi - xbar) (xi - xbar)(xi - xbar)(xi - xbar) (xi - xbar)(xi - xbar)(xi - xbar) (xi - xbar) (xi - xbar)(xi - xbar) (xi - xbar)(xi - xbar) (xi - xbar) (xi - xbar) (xi - xbar)(xi - xbar) (xi - xbar) (xi - xbar) (xi - xbar) (xi - xbar)(xi - xbar) (x		基準化変量	
今長の偏差 体重の偏差 偏差の積	(vi = vbar)/\$ v		(vi-ybar)(vi-ybar)/(\$ v\$ y)
-0.071 0.508 -0.036 0.639 0.162 0.103 -0.426 0.508 -0.216 0.284 0.508 0.144 -0.426 -0.415 0.177 -0.958 -1.800 1.725 0.461 1.085 0.500 1.171 1.661 1.946 -1.845 -0.646 1.192 -0.603 1.661 -1.002 2.058 0.046 0.095 -0.426 -1.223 0.521 -0.958 -1.569 1.504 -0.426 -1.223 0.521 -0.958 -1.569 1.504 -1.313 -0.185 0.242 0.461 1.882 0.873 1.349 0.508 0.685 0.461 1.085 0.500 -1.668 -1.569 2.617 0.461 1.085 0.500 -0.958 -1.454 1.393 -0.071 -0.415 -0.041	· : : . .		
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0.00 0.00 0.640	0.00	0.00	0.640

共分散	31.28
相関係数	0.640

Excel での共分散と相関係数の計算の仕方は次の通り。 データxは、A1からA5のセルに入力されており、データyはB1からB5のセルに入力されているとする。 共分散は =COVAR(A1:A5,B1:B5) 相関係数は =CORREL(A1:A5,B1:B5)

<u>(5) Excel</u>による回帰分析 (「データ」→「データ分析」→「回帰分析」と進む)

回帰統計	
重相関 R	0.343
重決定 R2	0.118
補正 R2	0.099
標準誤差	5.403
観測数	50

分散分析表

73 13773 1713	^				
	自由度	変動	分散	観測された分散比	有意 F
回帰	1	186.89	186.89	6.4025	0.0147
残差	48	1401.11	29.19		
合計	49	1588.00			

	係数	標準誤差	t	P−値	下限 95%	上限 95%
切片	120.45	20.54	5.863	0.000	79.15	161.76
父の身長	0.311	0.123	2.530	0.015	0.064	0.557

残差出力		
観測値	予測値	残差
1	171.71	0.29
2	167.05	8.95
3	173.26	-3.26
4	171.71	2.29
5	171.09	-1.09
6	171.71	-4.71
7	173.57	1.43
8	168.91	10.09
9	170.16	-8.16
10	171.71	-2.71
11	175.75	8.25
12	173.88	-3.88
13	171.09	-4.09
14	171.09	-6.09
15	170.16	-5.16
16	175.13	-0.13
17	174.82	5.18
18	173.26	1.74
19	173.26	-10.26
20	173.88	1.12
21	173.88	-6.88
22	174.20	-2.20
23	175.75	-2.75
24	174.82	-1.82
25	170.16	-5.16
26	173.26	-3.26
27	172.33	4.67
28	173.26	7.74
29	171.71	-1.71
30	174.82	0.18
31	171.71	-5.71
32	173.88	4.12
33	172.02	-2.02
34	170.16	6.84
35	172.64	-3.64
36	173.88	11.12
37	170.16	-12.16
38	172.64	0.36
39	170.16	6.84
40	170.16	-0.16
41	172.64	-0.64
42	174.82	5.18
43	172.33	8.67
44	171.71	5.29
45	171.40	1.60
46	170.16	0.84
47	170.16	-2.16
48	173.88	4.12
49	171.71	-1.71 5.07
50	176.37	-5.37

