Pairs of Data

Math 122

Some Data Comes in Pairs

- High School GPA -- College GPA
- Pre-Season "Maxes" -- Post-Season "Maxes"
- Height of Husband -- Height of Wife
- Age of Husband at Death -- Age of Wife at Death
- Days of school missed by first child -- Days of school missed by second child
- Predicted Temperature -- Actual Temperature

Claims About Matched Pairs

- The first number is greater than (or equal to) the second.

- The first number is less than (or equal to) the second.

- The first number is equal to the second.

- The first number is different from the second.

- There is a correlation between the numbers.

Differences

- Let μ_d be the average difference between the first number and the second.

- Matched Pairs addresses claims about how μ_d compares to 0.

- This is invisible on the online calculator – use the test matchedpairs

- On the TI...

Matched Pairs on the TI

- Enter the first list of data in L1

- Enter the second list in L2

- Enter L1-L2 in L3

- Perform a T-TEST from data in L3

Five people were asked their heights. After they responded, their heights were measured. Use the data below to test the claim:

There is a difference between the heights that people report and their actual heights.

Reported	68	71	63	70	71
Measured	67	69	65	68	70.5

- $\mu_1 =$
- $\mu_2 =$

- Claim:
- Opposite:
- H_0:
- H_1:
- P-value=
- Formal Conclusion:
- Conclusion:

Below are before and after 30m times for athletes in the fall track program. Test the claim:

The fall track program improves athletes' 30m times.

Before	4.53	4.67	4.34	4.57	4.48	4.38	4.64	4.92	4.61	4.07
After	4.31	4.56	4.29	4.31	4.43	4.34	4.60	4.95	4.46	4.00

- $\mu_1 =$
- $\mu_2 =$

- Claim:
- Opposite:
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- Police trainees were seated in a darkened room facing a projector screen. Ten different license planes were projected on the screen, one at a time, for 5 seconds each, separated by 15-second intervals.
- After the last 15-second interval, the lights were turned on and the police trainees were asked to write down as many of the 10 license plate numbers as possible, in any order at all.
- A random sample of 15 trainees who took this test where then given a week-long memory training course. They were then retested. The results are shown in the table on the next screen.
- **Test, at the 5% level of significance, that the memory course improved the ability of the trainees to correctly identify license plates.**

- **Test, at the 5% level of significance, that the memory course improved the ability of the trainees to correctly identify license plates.**

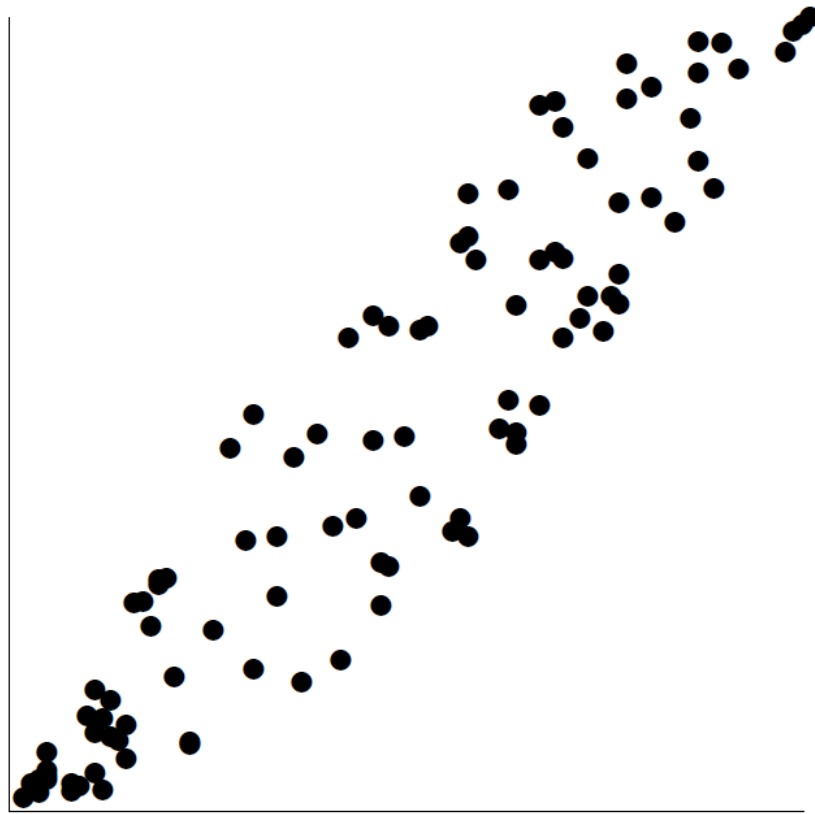| Before	After
6	6
5	8
6	6
5	7
7	9
5	8
4	9
6	6
7	7
8	5
4	9
5	8
4	6
6	8
7	6

- $\mu_1 =$
- $\mu_2 =$

- Claim:
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- Formal Conclusion:
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A scatter plot of matched pairs of data may show correlation between the data values
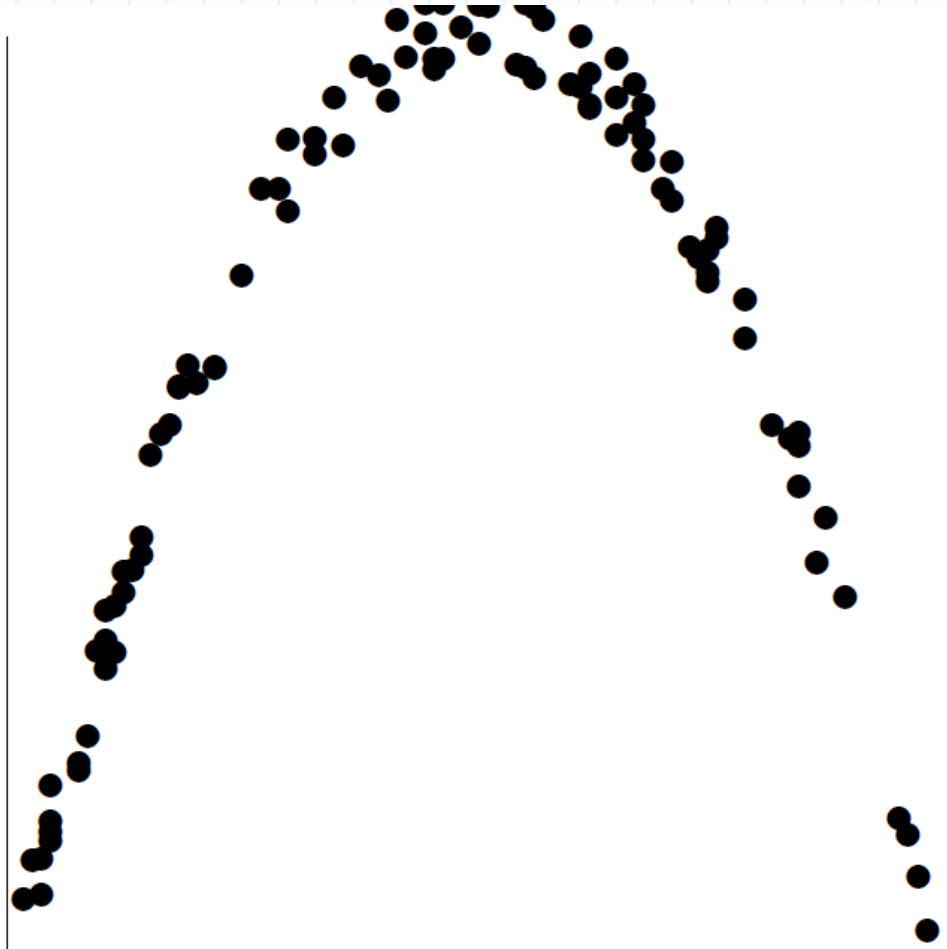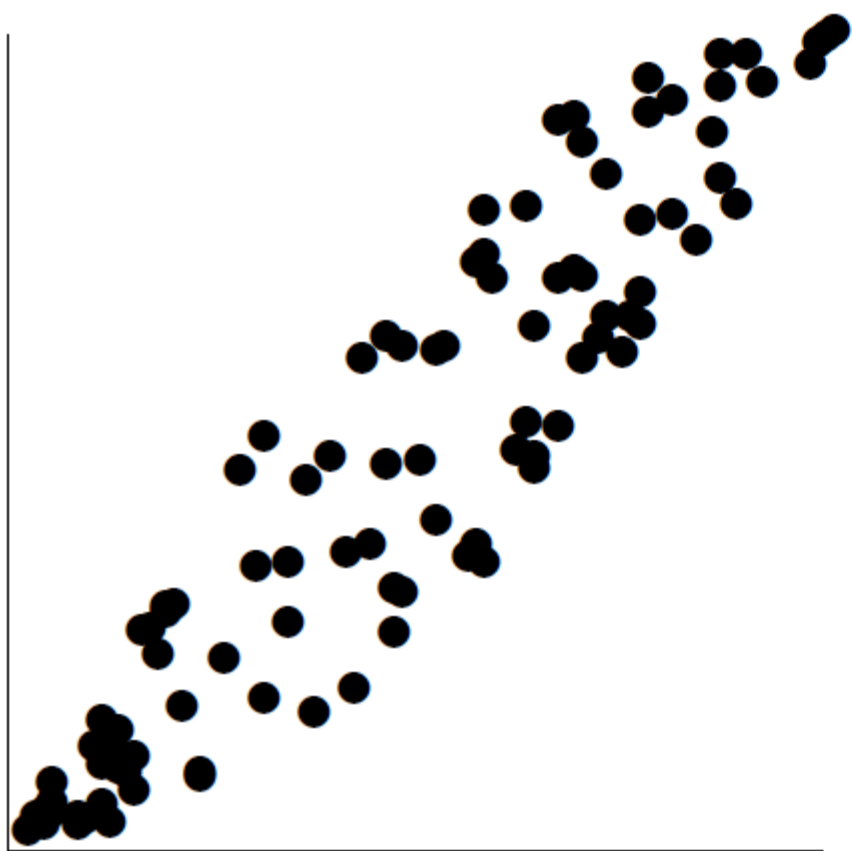
No Correlation

Strong Linear Correlation

Non-Linear Correlation

Positive Correlation   Negative Correlation

Terminology

- Line of best fit
- Regression line
- Least Squares line

- Regression equation

Linear Correlation Coefficient -- r

- If r is close to 1, then there is a positive linear correlation.

- If r is close to -1, there is a negative linear correlation.

- If r is close to 0, there is no linear correlation.

- r^2 is the proportion of variation in the variables which can be explained by the correlation.

P-Values

- H_0 is that r=0 (there is no linear correlation)
- H_1 is that r≠0 (there is linear correlation)

- If P<0.05, reject H_0 – sample data indicates linear correlation
- If P>0.05, do not reject H_0 – sample data does not indicate linear correlation

Fall Track Testing

400m	30m	Fly 30m	Vert	St LJ	St TJ	Push ups	Sit ups	Triple Bound	Total Pts	Weight	Height
78.30	4.75	4.45	16	77	203	43	48	233	321	145.0	63.25
65.90	4.45	4.06	18	81.5	235.5	38	41	230	393	133.4	68
66.50	4.59	4.17	18.5	84	242	46	58	243	414	140.4	64.25
69.50	4.43	4.04	20	88	240	40	42	246	409	132.2	66.75
64.60	4.25	4.02	20.5	92	242	42	56	262	451	132.2	65.5
68.90	4.36	4.00	18	79	236	50	60	242	425	137.6	62.5
65.40	4.28	3.92	22	91.5	243.5	42	44	261	461	151.0	71.5
72.80	4.58	4.23	17	75	220.5	38	41	233	338	123.0	68.25
61.20	4.24	3.81	18	73	217	42	42	222	405	139.2	65.5
67.80	4.26	3.89	21.5	85	252.5	54	55	266	463	140.2	67
78.30	4.59	4.20	17.5	71.75	227	40	67	234	356	140.2	64.25
66.70	4.39	4.02	20	83	244	40	46	253	414	127.0	66.25
65.70	4.26	3.95	21	78.5	246	42	50	236	423	135.8	66.5
67.80	4.48	4.11	17.5	77	221	54	46	248	400	141.6	65.75
64.40	4.36	3.93	23	81	240	50	60	255	466	164.6	67
64.90	4.37	3.88	21	94.5	264.75	49	61	254	477	111.8	63.5
66.90	4.27	3.92	18.5	83	250	36	33	245	397	114.8	63.5
73.40	4.69	4.04	17	76	213.5	54	60	236	357	113.2	57.75
67.20	4.35	4.04	20	84.5	243	38	51	256	420	141.8	67
62.80	4.15	3.76	23.5	92	252.5	48	57	284	496	118.2	66.25

Is there a linear correlation between Vertical Jump and Standing Long Jump?

Vert	St LJ
16	77
18	81.5
18.5	84
20	88
20.5	92
18	79
22	91.5
17	75
18	73
21.5	85
17.5	71.75
20	83
21	78.5
17.5	77
23	81
21	94.5
18.5	83
17	76
20	84.5
23.5	92

Using the Regression Equation

- Use the linear correlation between Vertical jump and Standing Long Jump to estimate the Standing Long Jump of an athlete with a vertical jump of 24 inches.

$y=mx+b$
$m=2.220795$
$b=39.223552$
$r=0.709182$
$t=4.267648$
$P=0.000463$

Using the Regression Equation

- Use the linear correlation between Vertical jump and Standing Long Jump to estimate the Vertical Jump of an athlete with a Standing Long Jump of 90 inches.

$$y=mx+b$$
$$m=2.220795$$
$$b=39.223552$$
$$r=0.709182$$
$$t=4.267648$$
$$P=0.000463$$

Which is a better predictor of an athlete's 400m time, height or the number of sit-ups she can do in one minute?

400m	Sit ups	Height
78.30	48	63.25
65.90	41	68
66.50	58	64.25
69.50	42	66.75
64.60	56	65.5
68.90	60	62.5
65.40	44	71.5
72.80	41	68.25
61.20	42	65.5
67.80	55	67
78.30	67	64.25
66.70	46	66.25
65.70	50	66.5
67.80	46	65.75
64.40	60	67
64.90	61	63.5
66.90	33	63.5
73.40	60	57.75
67.20	51	67
62.80	57	66.25

Correlation with 400m time

	R	R^2
30m	0.82	0.67
Fly 30m	0.81	0.66
Vert	-0.65	0.42
St TJ	-0.59	0.35
St LJ	-0.52	0.27
Triple Bound	-0.41	0.16
Height	-0.38	0.14
Sit ups	0.18	0.03
Push ups	-0.06	0.00
Weight	-0.01	0.00