

An aerial night photograph of a city skyline, likely New York City, with numerous illuminated skyscrapers and a dark body of water in the foreground. A semi-transparent red rectangular box is overlaid on the right side of the image, containing white text.

The Makridakis Open Forecasting Center (MOFC)

Advancing the Theory and Practice of Forecasting

THE M COMPETITIONS

THE M CONFERENCES

THE M PUBLICATIONS

THE M COURSES



UNIVERSITY *of* NICOSIA

Why is the stock market booming during the coronavirus recession?

By business editor [Ian Verrender](#)

Posted 5h ago, updated 5h ago



US Congressional Report: November 19, 2020

Global Economic Effects of COVID-19

In the months since the COVID-19 outbreak was first diagnosed, it has spread to over 200 countries and all U.S. states. The pandemic has negatively affected global economic growth beyond anything experienced in nearly a century. Estimates so far indicate the virus could reduce global economic growth to an annualized rate of -4.5% to -6.0% in 2020, with a partial recovery of a rate of 2.5% to 5.2% in 2021. However, a resurgence in infectious cases in Europe, the United States, and various developing economies in September and October renewed calls for lockdowns and curfews and could weaken or delay an economic recovery. The economic fallout from the pandemic could also risk continued labor dislocations as a result of lingering high levels of unemployment not experienced since the Great Depression of the 1930s and high levels of debt among developing economies. The human costs in terms of lives lost will permanently affect global economic growth in addition to the cost of rising levels of poverty, lives upended, careers derailed, and increased social unrest. Some estimates indicate that 100 million to 110 million people globally could enter extreme poverty as a result of the contraction in the global economy. Global trade could fall by an annual amount of 9.2%, depending on the depth and extent of the global economic downturn, exacting an especially heavy economic toll on trade-dependent developing and emerging economies. The full impact will not be known until the effects of the pandemic peak. This report provides an overview of the global economic costs to date and the response by governments and international institutions to address these effects.

The Economic Situation and the Stock Market

- **Ballooning budget deficits**
- **Higher levels of unemployment since the Great Depression**
- **A lot of small business (e.g. restaurants/bars etc.) in the verge of bankruptcy**
- **Some industrial sectors (e.g. airlines, travel etc.) in grave financial situation**
- **On-line commerce firms (e.g. Amazon) doing extremely well**
- **Negative interest rates motivate stock market buying**

S&P 500: Feb. 19 to Nov. 24

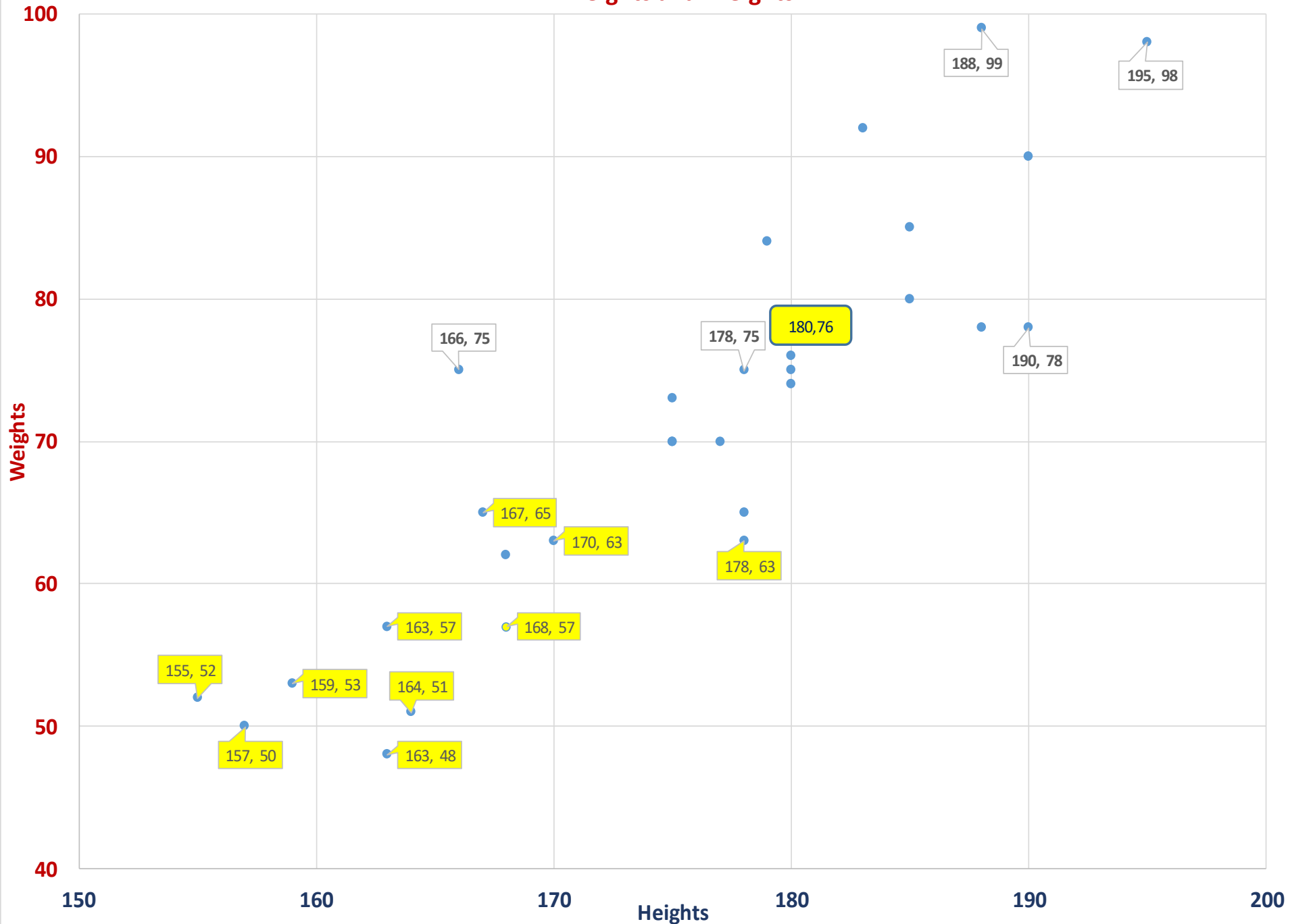


Applied Forecasting Course: Identifying and Estimating Relationships

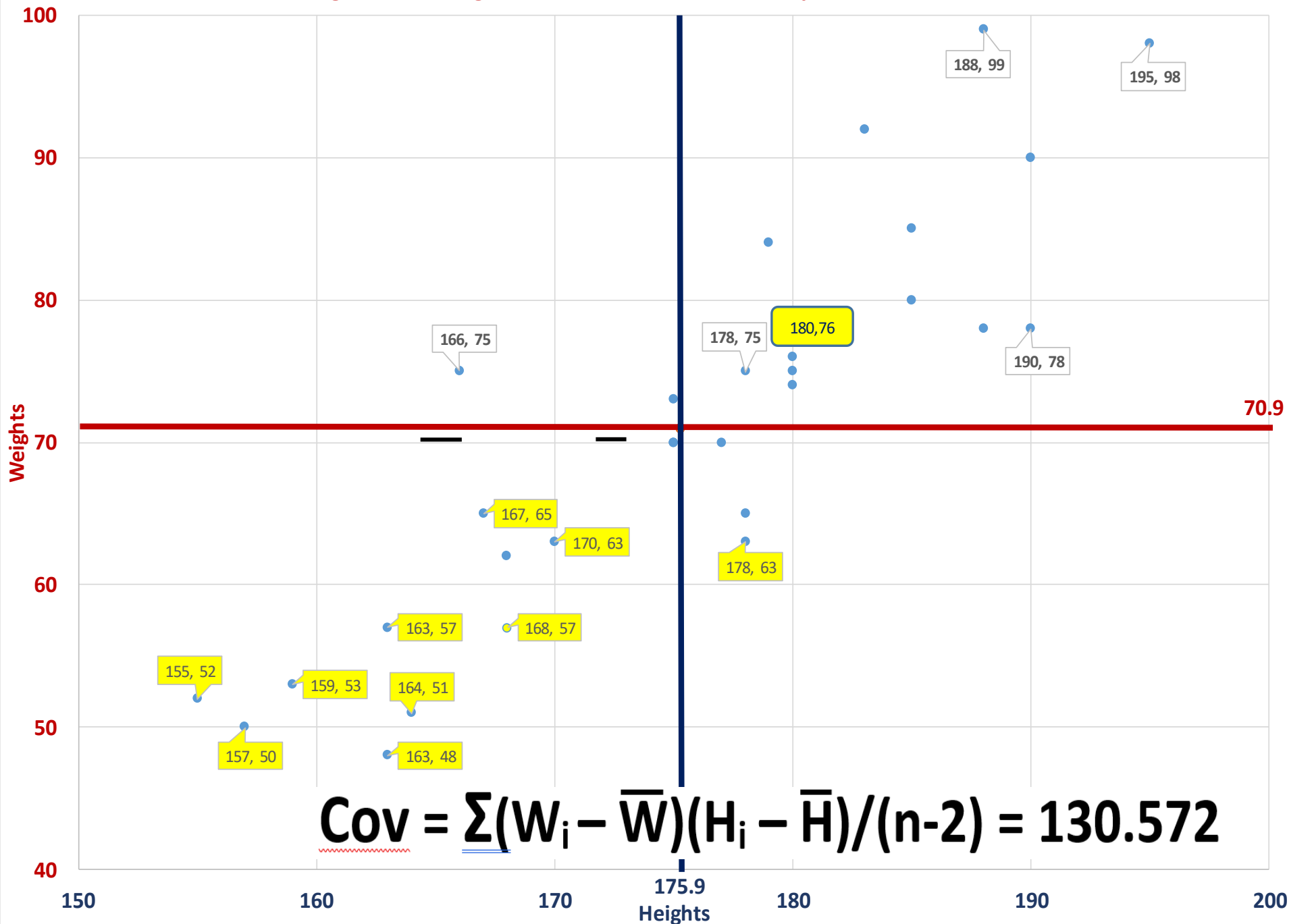
- **Simple Linear Regression**
 - ❑ **Weight = A + BHeight + u**
 - ❑ **Estimate A and B with data Weight=a+bHeight +e**
- **Multiple Linear Regression**
 - ❑ **Weight = a + b₁Height + b₂Sex +e**
- **Identifying and Estimating the Factors Affecting Sales**
- **Simple Correlations, t-tests, R², R² Adjusted**
- **Uncertainty: Standard error of Regression, S_e**

**Professor Spyros Makridakis,
Director, Institute For the Future (IFF)
and the MOFC, University of Nicosia**

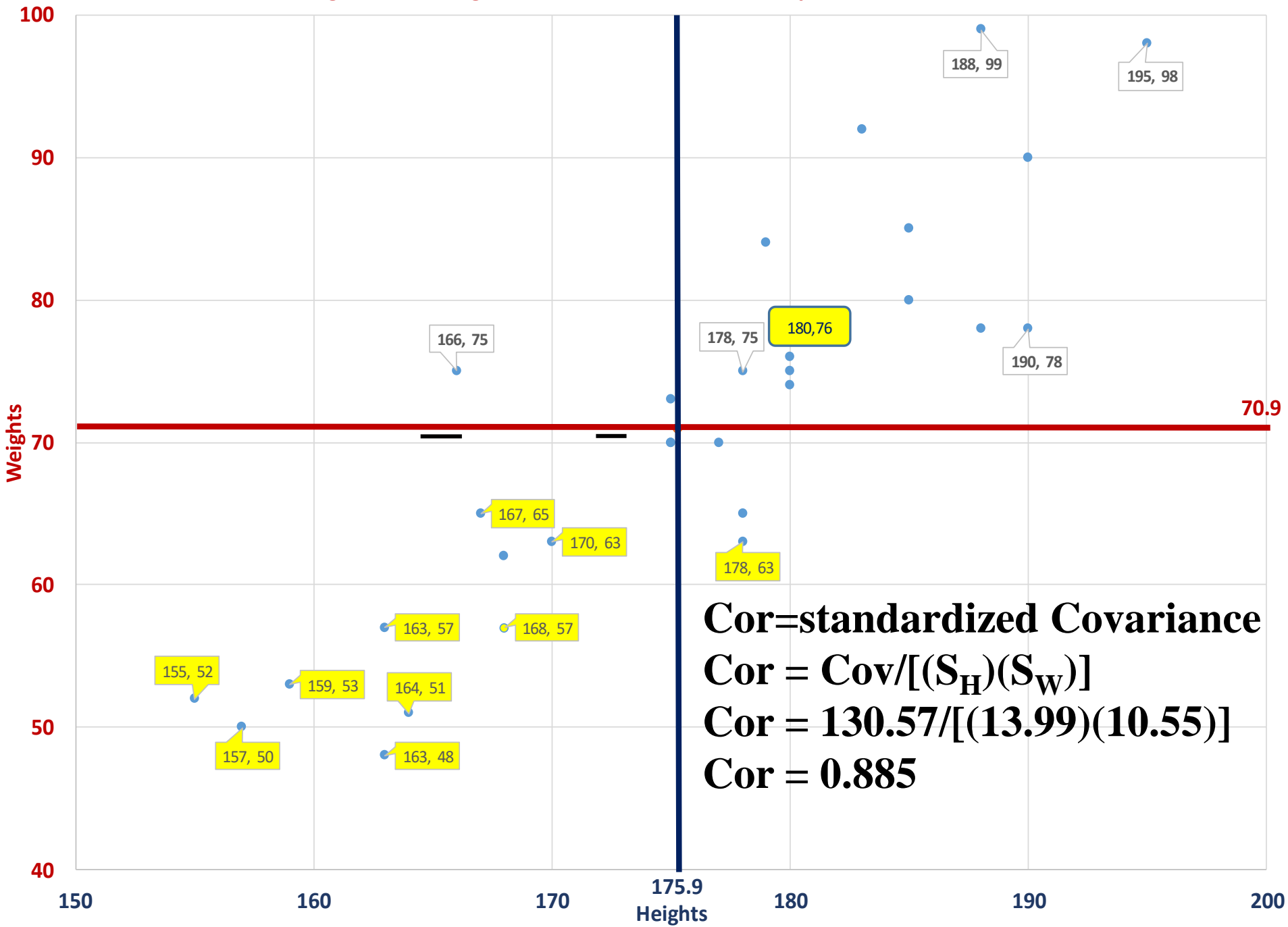
Heights and Weights



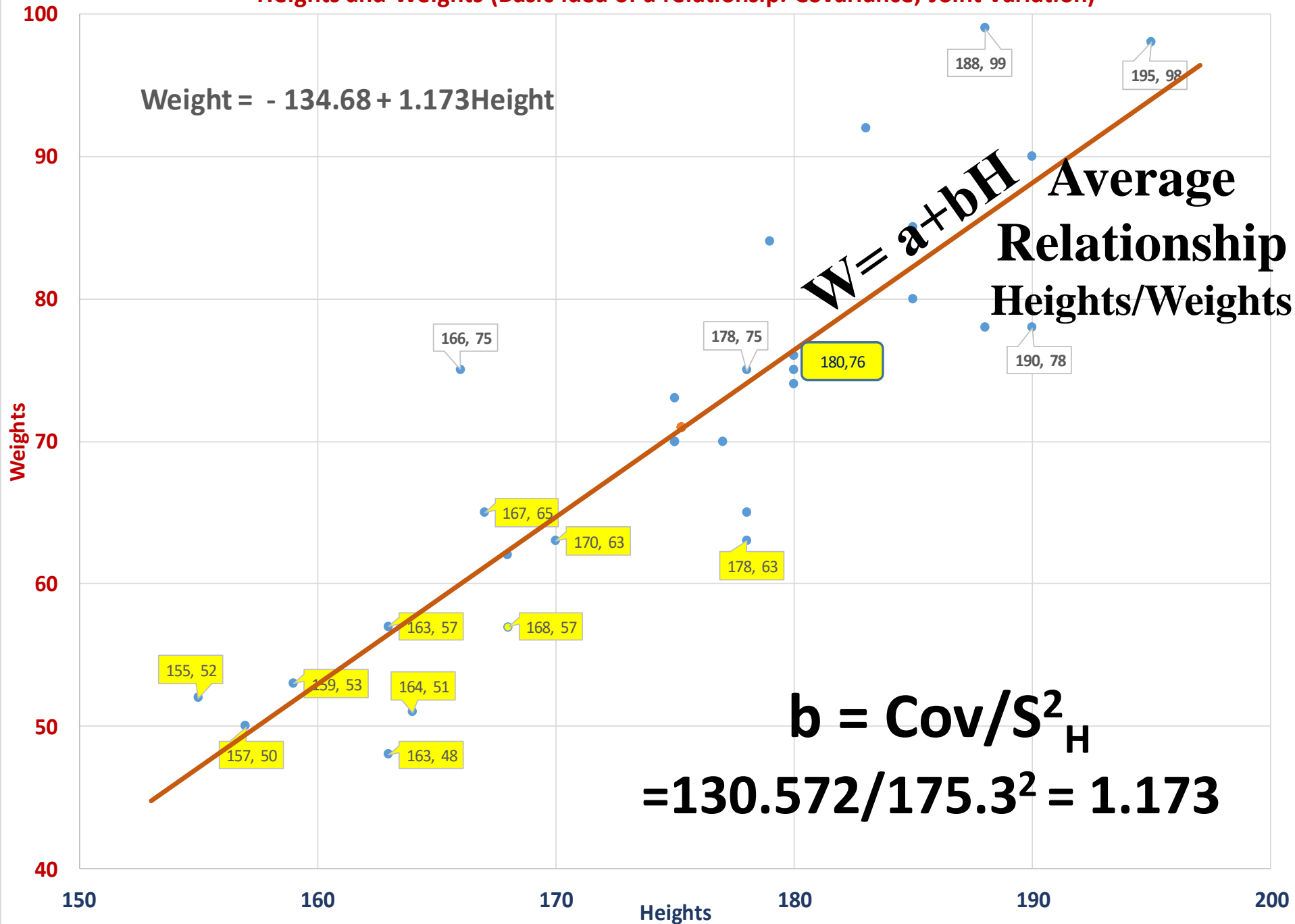
Heights and Weights (Basic idea of a relationship: Covariance, Joint Variation)

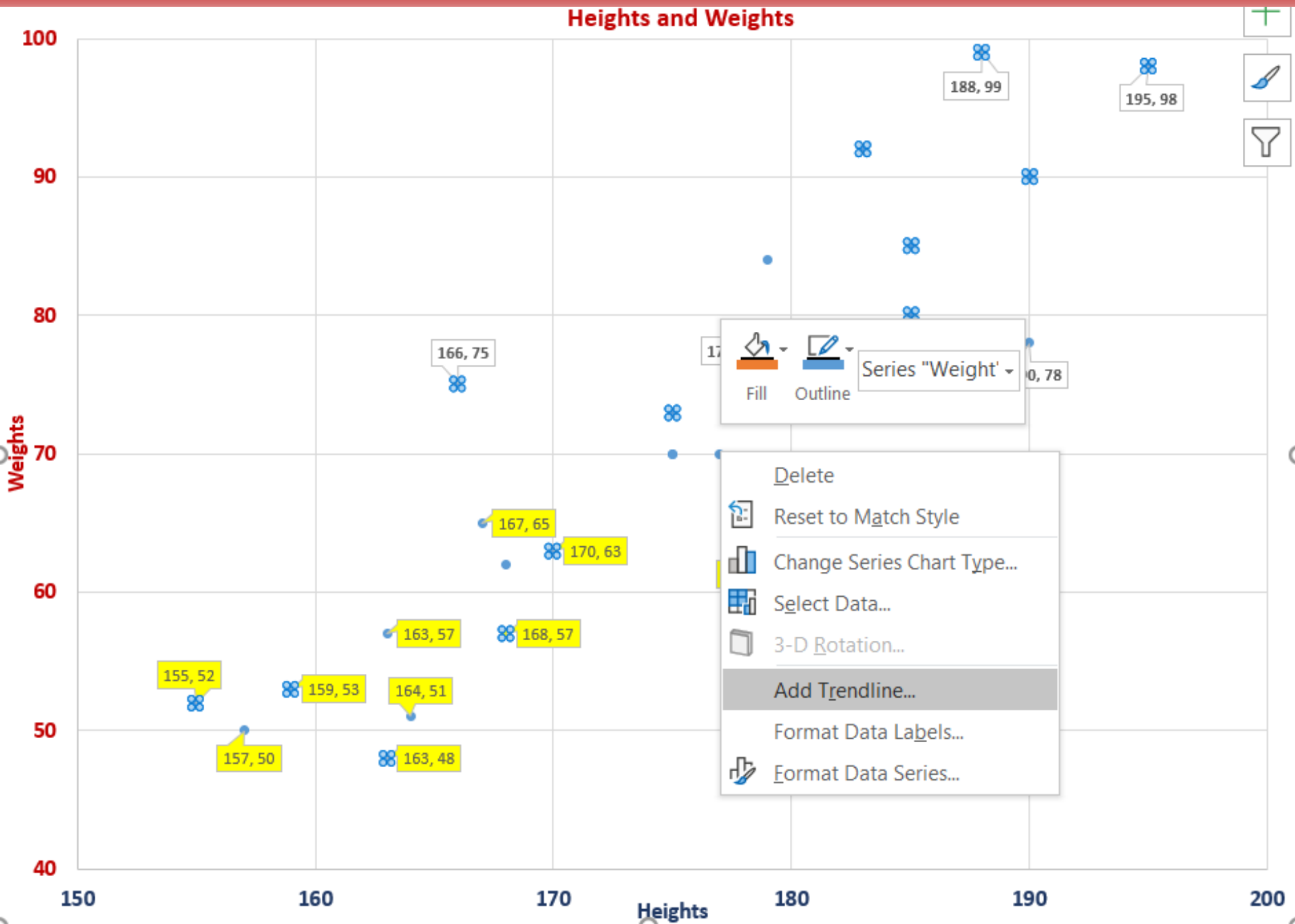


Heights and Weights (Basic idea of a relationship: Covariance, Joint Variation)

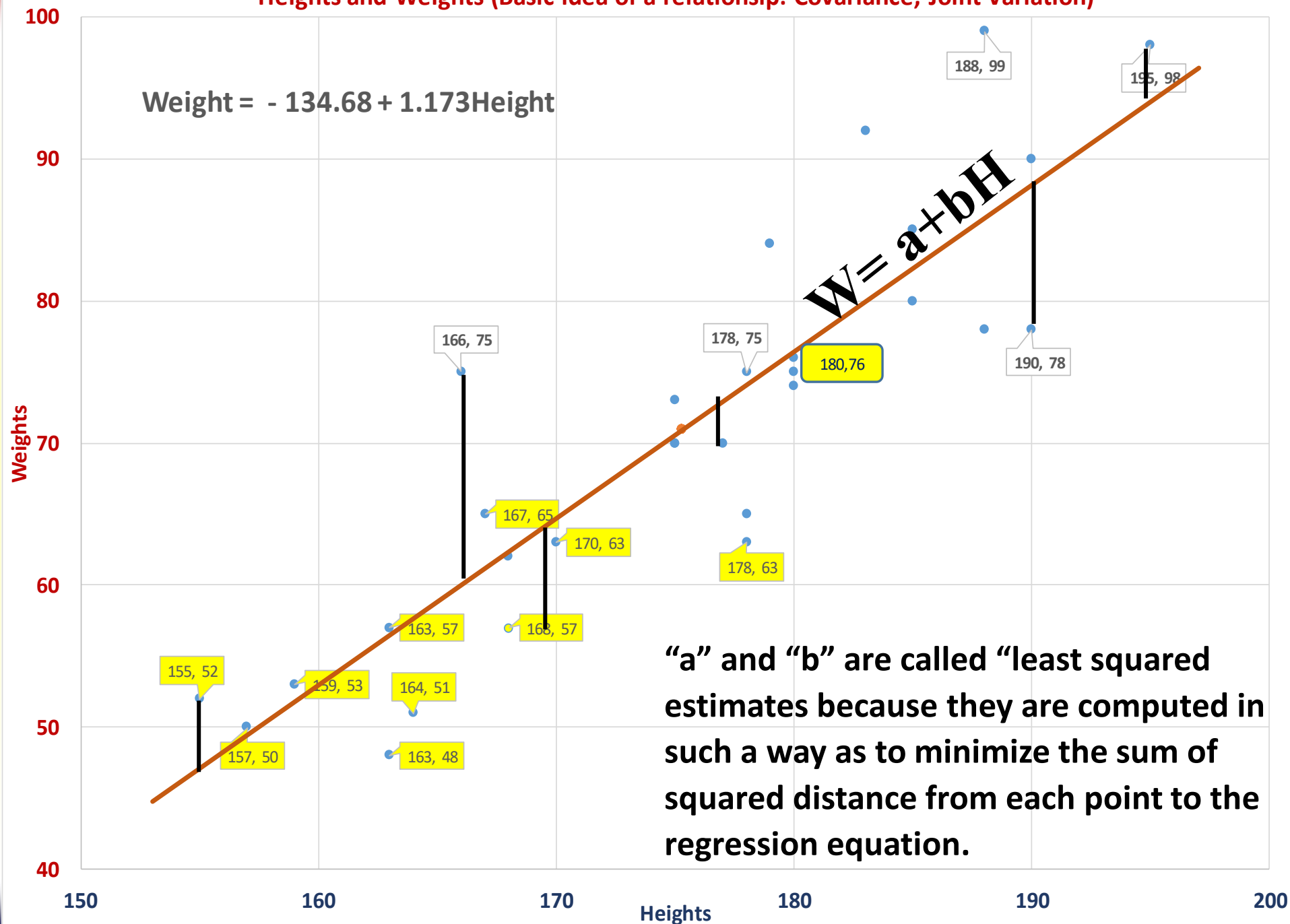


Heights and Weights (Basic idea of a relationship: Covariance, Joint Variation)

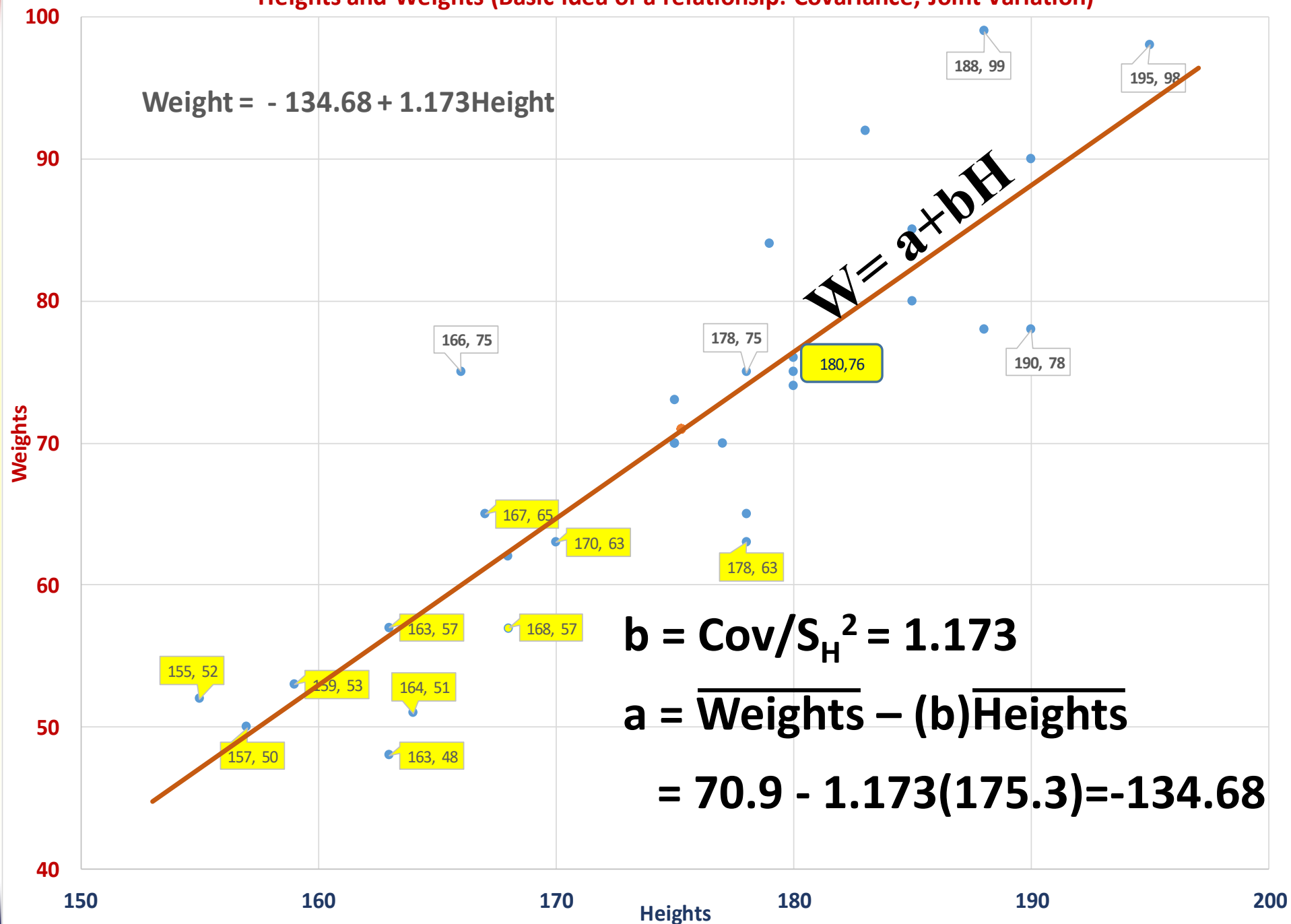




Heights and Weights (Basic idea of a relationship: Covariance, Joint Variation)



Heights and Weights (Basic idea of a relationship: Covariance, Joint Variation)



In Excel: **File** (then)
Bottom, Left: **Options**
Bottom, Left: **Add-ins**
Bottom Manage [Excel Add-ins]

Name	Location	Type
Active Application Add-ins		
Analysis ToolPak	C:\...t\Office16\Library\Analysis\ANALYS32.XLL	Excel Add-in
Analysis ToolPak - VBA	C:\...ffice16\Library\Analysis\ATPVBAEN.XLAM	Excel Add-in
Inactive Application Add-ins		
Date (XML)	C:\...s\Microsoft Shared\Smart Tag\MOFL.DLL	Action
Euro Currency Tools	C:\...e\root\Office16\Library\EUROTOOL.XLAM	Excel Add-in
Microsoft Actions Pane 3		XML Expansion Pack
Microsoft Power Map for Excel	C:\...ap Excel Add-in\EXCELPLUGINSHELL.DLL	COM Add-in
Solver Add-in	C:\...t\Office16\Library\SOLVER\SOLVER.XLAM	Excel Add-in
Document Related Add-ins		

Heights-Weights - Excel

File Home Insert Page Layout Formulas **Data** Review View Add-ins Help Tell me what you want to do

Get External Data New Query From Table Recent Sources Get & Transform

Refresh All Properties Edit Links Connections

Stocks Geography Data Types

Sort Filter Sort & Filter

Flash Fill Remove Duplicates Data Validation Relationships Data Tools

What-If Analysis Forecast Sheet Forecast

Group Ungroup Subtotal Outline

Data Analysis

Data Analysis Tools
Tools for financial and data analysis

Compatibility: no compatibility information available
Location: C:\Program Files (x86)\Microsoft Office\root\Office16\Library\Analysis\ANALYS32.XLL
Description: Provides data analysis tools for statistical and engineering analysis

Manage: Excel Add-ins Go...

In Data Analysis:
Select: **Regression**

Data Analysis

Analysis Tools

- Descriptive Statistics
- Exponential Smoothing
- F-Test Two-Sample for Variances
- Fourier Analysis
- Histogram
- Moving Average
- Random Number Generation
- Rank and Percentile
- Regression**
- Sampling

OK Cancel Help

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.885							
R Square	0.783							
Adjusted R Square	0.775							
Standard Error	6.640							
Observations	30							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	4441.452021	4441.452	100.745	8.8675E-11			
Residual	28	1234.414645	44.08624					
Total	29	5675.866667						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-134.683	20.521	-6.563	0.000	-176.719	-92.647	-176.719	-92.647
Height	1.173	0.117	10.037	0.000	0.934	1.412	0.934	1.412

$$\text{Weight} = a + b\text{Height} + e$$

$$\text{Weight} = -134.68 + 1.173\text{Height} + e$$

$$e = \pm 1.96(S_e) \quad 95\% \text{ PI}$$

$$e = \pm 1.96(6.64) = 13.01$$

$$\text{Height} = 168$$

$$\text{Weight} = -134.68 + 1.173(168) \pm 13.01$$

$$\text{Weight} = 62.38 \pm 13.01$$

$$49.93 < \text{Weight} < 74.83$$

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.8990367							
R Square	0.8082671							
Adjusted R Square	0.7940646							
Standard Error	6.3486672							
Observations	30							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	2	4587.616121	2293.81	56.9104	2.1E-10			
Residual	27	1088.250545	40.3056					
Total	29	5675.866667						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-96.242336	28.15118943	-3.419	0.00201	-154	-38.481	-154	-38.480866
Height	0.967	0.155504001	6.218	1.2E-06	0.64792	1.28606	0.64792	1.286056
Sex	-6.375	3.347464609	-1.904	0.06758	-13.243	0.49382	-13.243	0.4938176

$$\text{Weight} = a + b_1\text{Height} + b_2\text{Sex} + e$$

$$\text{Weight} = -96.24 + 0.967\text{Height} + \text{Sex} + e$$

$$e = \pm 1.96(s_e) \quad 95\% \text{ PI}$$

$$e = \pm 1.96(6.35) = 12.45$$

$$\text{Height} = 168 \quad \text{Sex} = 1 \quad \text{Female}$$

$$\text{Weight} = -96.24 + 0.967(168) + 1(-6.375) + e$$

$$\text{Weight} = 59.841 \pm 12.45$$

$$47.39 < \text{Weight} < 72.29$$

$$\text{Height} = 168 \quad \text{Sex} = 0 \quad \text{Male}$$

$$53.77 < \text{Weight} < 78.67$$

The Simple Correlation Matrix

	<i>Age</i>	<i>Height</i>	<i>Sex</i>	<i>ShoeSize</i>	<i>Weight</i>
Age	1				
Height	0.528	1			
Sex	-0.229	-0.695	1		
ShoeSize	0.428	0.895	-0.706	1	
Weight	0.344	0.885	-0.731	0.807	1

$$\text{Cor} = \text{Cov} / s_w s_H = 130.572 / (13.99)(10.55) = 0.885$$

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.8990367							
R Square	0.8082671	←						
Adjusted R Square	0.7940646	←						
Standard Error	6.3486672	←						
Observations	30							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	2	4587.616121	2293.81	56.9104	2.072E-10			
Residual	27	1088.250545	40.3056					
Total	29	5675.866667						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	-96.242	28.151	-3.419	0.002	-154.004	-38.481	-154.004	-38.481
Height	0.967	0.156	6.218	0.000	0.648	1.286	0.648	1.286
Sex	-6.375	3.347	-1.904	0.068	-13.243	0.494	-13.243	0.494

Running the Weight, Height Data in R: Reading the Data and Specifying the Model

```
dataset <- read.csv("z:/Heights-Weights.csv", stringsAsFactors = F)
model <- lm(Weight ~ Height+Sex+ShoeSize+Age, data=dataset)
plot(dataset$Height, dataset$Weight, ylab = "Height", xlab = "Weight")
abline(model)
summary(model)
```

Observ.	Age	Height	Sex	ShoeSize	Weight
1	27	195	0	48	98
2	26	178	0	42	75
3	28	167	1	39	65
4	25	183	0	40	92
5	28	178	0	42	65
6	29	163	1	38	48
7	32	180	0	41	74
8	27	185	0	45	85
9	28	180	0	42	75
10	25	155	1	36	52
11	32	190	0	46	78
12	31	188	0	43	78
13	27	163	1	38	57
14	24	166	0	42	75
15	27	168	0	42	62
16	30	175	0	42	73
17	27	159	1	37	53
18	26	164	1	37	51
19	31	190	0	46	90
20	30	179	0	44	84
21	28	170	1	38	63
22	30	175	0	41	70
23	32	185	0	45	80
24	25	157	1	36	50
25	30	168	1	40	57
26	32	177	0	41	70
27	28	178	1	43	63
28	32	180	1	42	76
29	33	188	0	43	99
30	25	175	0	41	70

```
> dataset <- read.csv("z:/Heights-Weights.csv", stringsAsFactors = F)
> model <- lm(Weight ~ Height+Sex+ShoeSize+Age, data=dataset)
> plot(dataset$Height, dataset$Weight, ylab = "Height", xlab = "Weight")
> abline(model)
Warning message:
In abline(model) : only using the first two of 5 regression coefficients
> summary(model)
```

```
Call:
lm(formula = Weight ~ Height + Sex + ShoeSize + Age, data = dataset)
```

Residuals:

	Min	1Q	Median	3Q	Max
	-11.2632	-3.6385	-0.4664	2.9141	15.2248

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-98.0959	28.3677	-3.458	0.00196	**
Height	1.1317	0.2797	4.046	0.00044	***
Sex	-5.4968	3.5571	-1.545	0.13484	
ShoeSize	-0.1585	0.9034	-0.175	0.86211	
Age	-0.7292	0.5494	-1.327	0.19642	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.376 on 25 degrees of freedom

Multiple R-squared: 0.8209, Adjusted R-squared: 0.7923

F-statistic: 28.66 on 4 and 25 DF, p-value: 5.175e-09

Multiple R-squared: 0.8209, Adjusted R-squared: 0.7923
F-statistic: 28.66 on 4 and 25 DF, p-value: 5.175e-09

```
>  
>  
> dataset <- read.csv("z:/Heights-Weights.csv", stringsAsFactors = F)  
> model <- lm(Weight ~ Height+Sex, data=dataset)  
> plot(dataset$Height, dataset$Weight, ylab = "Height", xlab = "Weight")  
> abline(model)  
Warning message:  
In abline(model) : only using the first two of 3 regression coefficients  
> summary(model)
```

Call:
lm(formula = Weight ~ Height + Sex, data = dataset)

Residuals:

Min	1Q	Median	3Q	Max
-10.8816	-4.1126	-0.4311	4.0480	13.4486

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-96.2423	28.1512	-3.419	0.00201	**
Height	0.9670	0.1555	6.218	1.19e-06	***
Sex	-6.3746	3.3475	-1.904	0.06758	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.349 on 27 degrees of freedom
Multiple R-squared: 0.8083, Adjusted R-squared: 0.7941
F-statistic: 56.91 on 2 and 27 DF, p-value: 2.072e-10

Sales = f(Independent variables)

	The Simple Correlation Matrix								
	PDI	DEALS	PRICE	RANDD	INVEST	AD	EXPENSE	TOTINDAD	SALES
PDI	1.000	-0.052	0.582	0.163	0.107	0.206	0.902	-0.056	0.730
DEALS	-0.052	1.000	0.044	0.008	-0.100	-0.110	-0.041	-0.153	0.012
PRICE	0.582	0.044	1.000	0.437	-0.089	0.276	0.639	-0.214	0.295
RANDD	0.163	0.008	0.437	1.000	0.167	0.127	0.363	-0.129	0.042
INVEST	0.107	-0.100	-0.089	0.167	1.000	0.238	0.196	-0.101	0.424
AD	0.206	-0.110	0.276	0.127	0.238	1.000	0.144	-0.199	0.531
EXPENSE	0.902	-0.041	0.639	0.363	0.196	0.144	1.000	-0.041	0.668
TOTINDAD	-0.056	-0.153	-0.214	-0.129	-0.101	-0.199	-0.041	1.000	-0.180
SALES	0.730	0.012	0.295	0.042	0.424	0.531	0.668	-0.180	1.000
	Personal Disposal Income	Dealers Allowences	Price	R & D Spending	Tot. Cap. Invest.	Advert- ising	Sales Expenses	Tot. Industry Advert.	Sales

Residuals:

Min	1Q	Median	3Q	Max
-512.94	-138.23	-13.27	181.87	492.53

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	3393.6119	589.0195	5.761	2.17e-06	***
PDI	2.7939	1.4885	1.877	0.0697	.
DEALS	4.2661	3.2123	1.328	0.1936	
PRICE	-25.1683	7.3450	-3.427	0.0017	**
RANDD	-8.3285	6.3769	-1.306	0.2008	
AD	9.4991	1.6707	5.686	2.70e-06	***
EXPENSE	6.3252	2.5418	2.489	0.0182	*
TOTINDAD	-0.5712	0.3854	-1.482	0.1481	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 250.8 on 32 degrees of freedom
Multiple R-squared: 0.804, Adjusted R-squared: 0.7611
F-statistic: 18.75 on 7 and 32 DF, p-value: 1.14e-09

Residuals:

Min	1Q	Median	3Q	Max
-580.45	-160.17	39.51	170.40	474.11

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	3399.4241	595.2676	5.711	2.26e-06	***
PDI	3.6540	1.3491	2.708	0.01063	*
DEALS	4.3428	3.2459	1.338	0.19007	
PRICE	-27.8113	7.1358	-3.897	0.00045	***
AD	9.3104	1.6822	5.535	3.80e-06	***
EXPENSE	4.8552	2.3032	2.108	0.04271	*
TOTINDAD	-0.5345	0.3885	-1.376	0.17812	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 253.5 on 33 degrees of freedom

Multiple R-squared: 0.7935, Adjusted R-squared: 0.756

F-statistic: 21.14 on 6 and 33 DF, p-value: 5.212e-10

Residuals:

Min	1Q	Median	3Q	Max
-573.26	-155.91	5.18	178.13	422.21

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	3068.010	551.461	5.563	3.18e-06	***
PDI	3.690	1.366	2.700	0.010717	*
DEALS	5.054	3.246	1.557	0.128732	
PRICE	-25.946	7.097	-3.656	0.000858	***
AD	9.680	1.682	5.754	1.80e-06	***
EXPENSE	4.622	2.327	1.986	0.055099	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 256.8 on 34 degrees of freedom

Multiple R-squared: 0.7817, Adjusted R-squared: 0.7496

F-statistic: 24.34 on 5 and 34 DF, p-value: 2.415e-10

Residuals:

Min	1Q	Median	3Q	Max
-702.54	-135.85	-8.28	146.33	499.82

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	3692.913	385.805	9.572	2.63e-11	***
PDI	3.661	1.394	2.627	0.01271	*
PRICE	-24.612	7.187	-3.424	0.00159	**
AD	9.347	1.702	5.491	3.62e-06	***
EXPENSE	4.480	2.372	1.889	0.06721	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 262 on 35 degrees of freedom

Multiple R-squared: 0.7661, Adjusted R-squared: 0.7394

F-statistic: 28.66 on 4 and 35 DF, p-value: 1.308e-10

Residuals:

Min	1Q	Median	3Q	Max
-573.26	-155.91	5.18	178.13	422.21

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	3068.010	551.461	5.563	3.18e-06	***
PDI	3.690	1.366	2.700	0.010717	*
DEALS	5.054	3.246	1.557	0.128732	
PRICE	-25.946	7.097	-3.656	0.000858	***
AD	9.680	1.682	5.754	1.80e-06	***
EXPENSE	4.622	2.327	1.986	0.055099	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 256.8 on 34 degrees of freedom

Multiple R-squared: 0.7817, Adjusted R-squared: 0.7496

F-statistic: 24.34 on 5 and 34 DF, p-value: 2.415e-10

No of Ind. Variables	7	6	5	4
R-Square	0.804	0.794	0.782	0.766
R-Square Adjusted	0.761	0.756	0.750	0.739
Standard Error	250.8	253.5	256.8	262.0



UNIVERSITY *of* NICOSIA

Thank you

Vangelis will now Continue