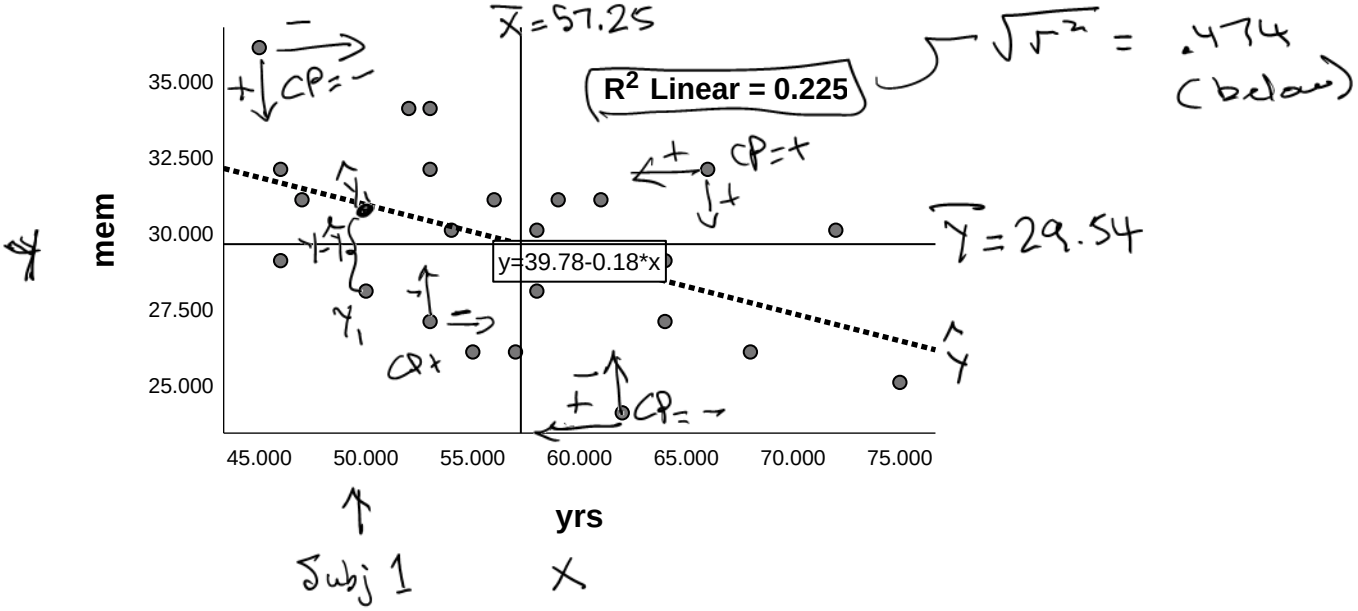
Ch3 - Ex1 - Age and Memory

```
 *Enter numerical age in years and memory score.
DATA LIST FREE / yrs mem.
BEGIN DATA
50 28  45 36  55 26  57 26  59 31  64 27  52 34  72 30  75 25  53 32  53 27  47 31
56 31  46 32  54 30  58 30  66 32  46 29  61 31  53 34  62 24  68 26  64 29  58 28
END DATA.

DESCR yrs mem.
```

	N	Mean	Std. Deviation
yrs	24	57.25000	8.120024
mem	24	29.54167	3.064228

```
 *Graph Menu: Graphs | Legacy | Scatter/Dot | Simple Scatter | mem --> y, age -->x | Ok.
GRAPH /SCATTERPLOT(BIVAR)=yrs WITH mem /MISSING=LISTWISE.
```




```
 * Options | Hide Grid Lines.
* Options | X Reference Line | Position mean age: 57.25.
* Options | Y Reference Line | Position mean mem 29.54.
* Elements | Fit Line at Total.

*Calculate SSyrs SSmem SCP.
COMPUTE yrsdev = yrs - 57.25.
COMPUTE memdev = mem - 29.64.
COMPUTE yrsdev2 = yrsdev**2.
COMPUTE memdev2 = memdev**2.
```

Cross product $(x-\bar{x})(y-\bar{y})$

```
COMPUTE cp = yrsdev*memdev.
DESCR yrsdev2 memdev2 cp /STAT = SUM.
```

	N	Sum
yrsdev2	24	1516.500
memdev2	24	216.190
cp	24	-271.250

SS_x SS_y SCP negative

```
CORRELATION yrs mem /STAT /MISS = LIST.
```

Descriptive Statistics

	Mean	Std. Deviation	N
yrs	57.25000	8.120024	24
mem	29.54167	3.064228	24

Correlations[a]

		yrs	mem
yrs	Pearson Correlation	1	-.474
	Sig. (2-tailed)		.019
mem	Pearson Correlation	-.474	1
	Sig. (2-tailed)	.019	

a. Listwise N=24

$r = \frac{SCP}{\sqrt{SS_x SS_y}} = \frac{-271.250}{\sqrt{1516.5 \times 216.19}} = -.474$

$r^2 = .225$ (Graph)

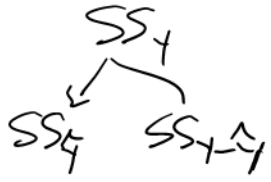
```
REGRESSION /DEPEND = mem /ENTER yrs /SAVE PRED(prd) RESI(res).
```

Model Summary

Model	R	R Square
1	.474	.225

$\sqrt{.225}$

$r^2 = \frac{48.517}{215.958} = .225$



ANOVA

SS/df

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	48.517	1	48.517	6.375	.019
	Residual	167.441	22	7.611		
	Total	215.958	23			

$SS_{\hat{y}}$ $SS_{y-\hat{y}}$ SS_y $n-2$

$F = \frac{48.517}{7.611} = t^2$

$df = 1, 22$ $F_\alpha = 4.30$ Reject H_0

$F = t_\alpha^2$

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	39.782	4.095		9.715	.000
	yrs	-.179	.071	-.474	-2.525	.019

t_r, t_{b_1} $= p_F$

$b_1 = \frac{SCP}{SS_x} = \frac{-271.25}{1516.5} = -.179$

$b_0 = \bar{Y} - b_1\bar{X}$
$= 29.5417 - (-.179)57.25$
$= 39.789$

Residuals Statistics

	Mean	Std. Deviation	N
Predicted Value	29.54167	1.452395	24
Residual	.000000	2.698155	24

$\hat{Y} = \bar{Y}$ $\quad \bar{Y - \hat{Y}} = 0$

$SS_{\hat{Y}} = (24-1)1.45239^2 =$

$SS_{Y-\hat{Y}} = (24-1)2.69816 =$

$SS_Y =$

```
VARIABLE LABEL prd '' res ''.
LIST yrs mem prd res /CASES FROM 1 TO 5.
```

yrs (X)	mem (Y)	prd ($\hat{Y}$)	res ($Y-\hat{Y}$)
50.000	28.000	30.83844	-2.83844
45.000	36.000	31.73277	4.26723
55.000	26.000	29.94411	-3.94411
57.000	26.000	29.58638	-3.58638
59.000	31.000	29.22865	1.77135
...			

SS_Y $SS_{\hat{Y}}$ $SS_{Y-\hat{Y}}$

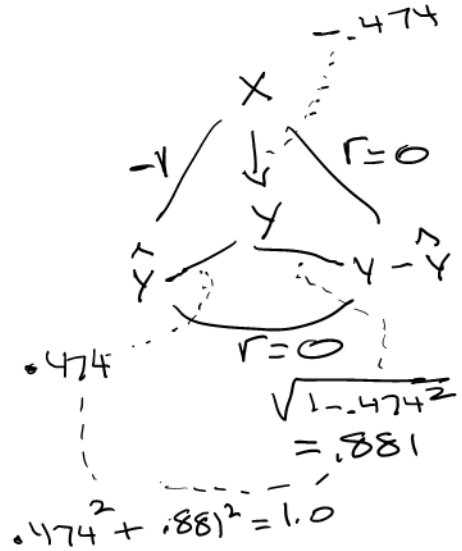
$\hat{Y}_1 = 39.782 - .179 \times 50$
$= 30.832$

$Y_1 - \hat{Y}_1 = 28 - 30.838$
$= -2.838$ (See note 1 on graph)

```
CORR yrs mem prd res /MISS = LIST.
```

	yrs (X)	mem (Y)	prd ($\hat{Y}$)
mem	-.474		
prd	-1.000	.474	
res	.000	.881	.000

Y, $\hat{Y}$, $Y-\hat{Y}$




```
*Significance: t(r), t(b1), F.
```

$H_0: \rho = 0$
$H_a: \rho \neq 0$

$t_r = \frac{-.474 - 0}{\sqrt{\frac{1 - -.474^2}{24-2}}}$

$= \frac{-.474}{.188}$

$= -2.525$

$H_0: \beta_1 = 0$
$H_a: \beta_1 \neq 0$

$t_{b_1} = \frac{-.179}{\sqrt{\frac{7.611}{1516.5}}}$

$= \frac{-.179}{SE \to .071}$

$= -2.525$

$t^2 = 6.376 = F$

$df = 22$ $t_\alpha = 2.074$ Rej H_0

n=24

100,000 r_s $\rho=0$

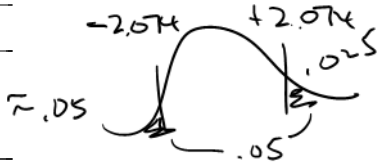
```
*simulation rho = 0, Commands omitted.
...
COMPUTE r = scp/SQRT(ssy*ssm).
COMPUTE t = (r-0)/SQRT((1-r**2)/22).

COMPUTE pnon = ABS(t) GE 2.074.
COMPUTE pdir = t LE -1.717.
COMPUTE pobs = ABS(r) GE .474.
MEAN pnon pdir pobs.
```

	pnon	pdir	pobs
Mean	.04908	.04914	.01920

```
FREQ pnon pdir pobs.
```

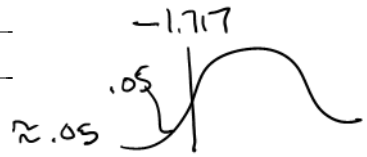
pnon $H_0: \rho \neq 0$

		Frequency	Percent
Valid	.000	95092	95.1
	1.000	4908	4.9
	Total	100000	100.0



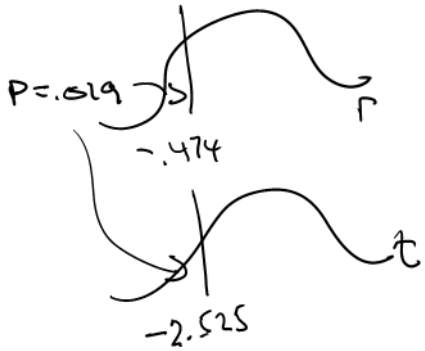
pdir $H_0: \rho < 0$

		Frequency	Percent
Valid	.000	95086	95.1
	1.000	4914	4.9
	Total	100000	100.0

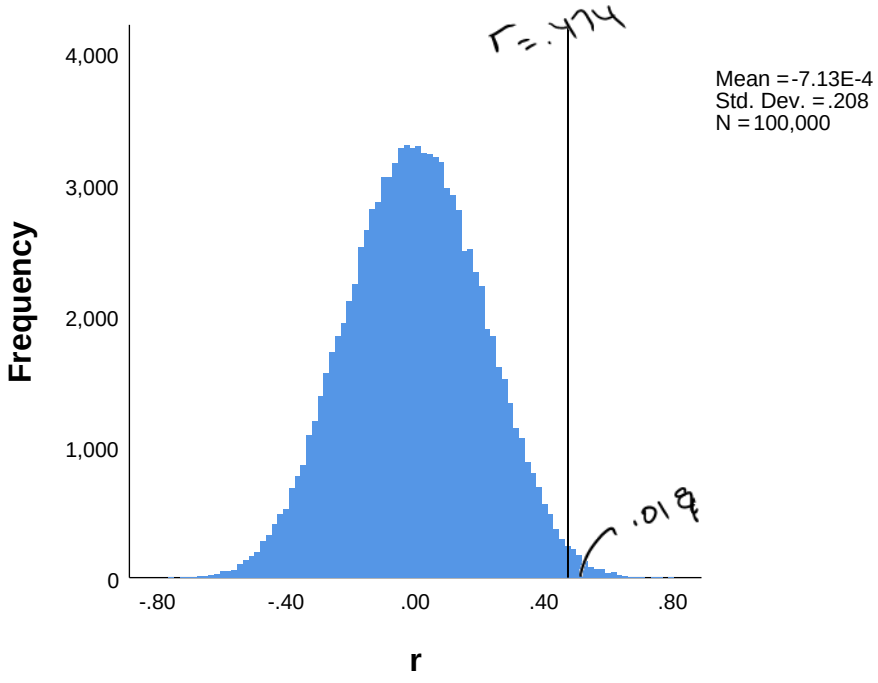


pobs

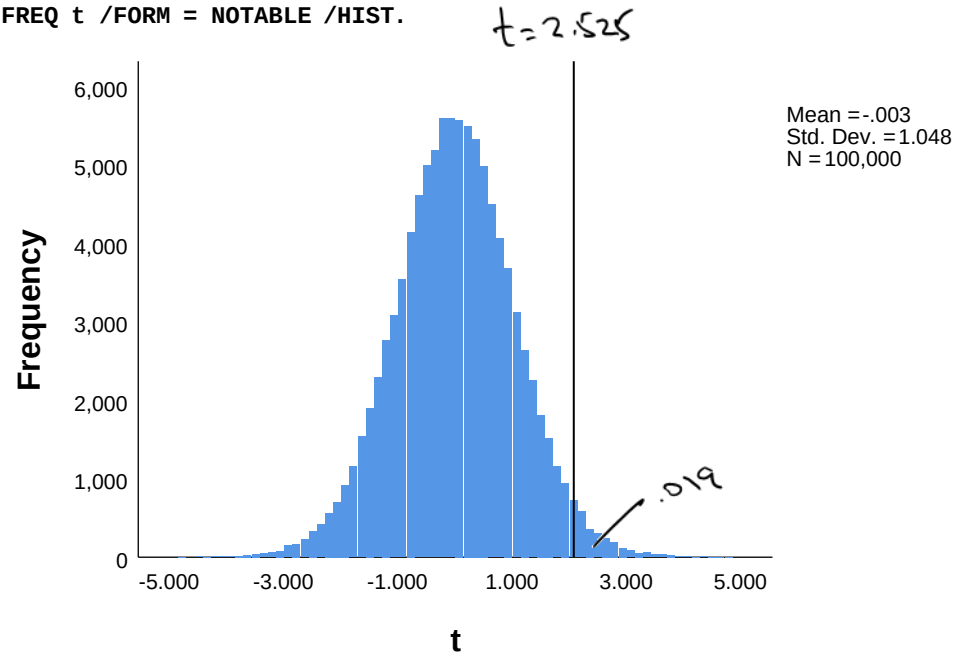
		Frequency	Percent
Valid	.000	98080	98.1
	1.000	1920	1.9
	Total	100000	100.0



```
FREQ r /FORM = NOTABLE /HIST.
```




```
FREQ t /FORM = NOTABLE /HIST.
```



```
*Independent t-test. Ch 2-Ex1, Young (age = 1) vs Old (age = 2).
DATA LIST FREE / age mem.
BEGIN DATA
1 36 1 32 1 29 1 31 1 28 1 34 1 32 1 27 1 34 1 30 1 26 1 31
2 26 2 30 2 28 2 31 2 31 2 24 2 27 2 29 2 32 2 26 2 30 2 25
END DATA.

TTEST /GROUP = age /VARI = mem.
```

$H_0: \mu_1 = \mu_2$
$H_a: \mu_1 \neq \mu_2$

$$t = \frac{(\bar{Y}_1 - \bar{Y}_2) - 0}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Independent Samples Test

		t-test for Equality of Means				
		t	df (n_1+n_2-2)	Sig. (2-tailed)	Mean Difference ($\bar{Y}_1 - \bar{Y}_2$)	Std. Error Difference
mem	Equal variances assumed	2.238	22	.036	2.583333	1.154427

.036 / 2

-2.238 + 2.238

```
GLM mem BY age.
```

Dependent Variable: mem

Source	Type III Sum of Squares	df	Mean Square	F ($= t^2$)	Sig. ($= P_t$)
age	40.042	1	40.042	5.008	.036
Error	175.917	22	7.996		
Corrected Total	215.958	23			

s_p^2

```
REGRESS /DEP = mem /ENTER age /SAVE PRED(prd2) RESI(res2).
```

Model	R	R Square
1	.431	.185

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression ($SS_{\hat{Y}}$)	40.042	1	40.042	5.008	.036
	Residual ($SS_{Y-\hat{Y}}$)	175.917	22	7.996		
	Total	215.958	23			

F_{ANOVA}

Model		Unstandardized Coefficients B	Std. Error	t	Sig.
1	(Constant)	33.417	1.825	18.307	.000
	age	-2.583	1.154	-2.238	.036

$\bar{Y}_2 - \bar{Y}_1$

Ind t

	Mean	Std. Deviation
Predicted Value	29.54167	1.319448
Residual	.000000	2.765601

```
 VARIABLE LABEL prd2 '' res2 ''.
LIST age mem prd2 res2.
```

$\hat{Y} = \bar{Y}_j$ $\quad Y - \hat{Y} = Y - \bar{Y}_j$

age	mem	prd2	res2
1.000	36.000	30.83333	5.16667
1.000	32.000	30.83333	1.16667
1.000	29.000	30.83333	-1.83333
1.000	31.000	30.83333	.16667
1.000	28.000	30.83333	-2.83333
1.000	34.000	30.83333	3.16667
1.000	32.000	30.83333	1.16667
1.000	27.000	30.83333	-3.83333
1.000	34.000	30.83333	3.16667
1.000	30.000	30.83333	-.83333
1.000	26.000	30.83333	-4.83333
1.000	31.000	30.83333	.16667
2.000	26.000	28.25000	-2.25000
2.000	30.000	28.25000	1.75000
2.000	28.000	28.25000	-.25000
2.000	31.000	28.25000	2.75000
2.000	31.000	28.25000	2.75000
2.000	24.000	28.25000	-4.25000
2.000	27.000	28.25000	-1.25000
2.000	29.000	28.25000	.75000
2.000	32.000	28.25000	3.75000
2.000	26.000	28.25000	-2.25000
2.000	30.000	28.25000	1.75000
2.000	25.000	28.25000	-3.25000

$n_1 = 12$ $\quad n_2 = 12$

```
 *Correlated scores, e.g., same people young & old.
DATA LIST FREE / memyng memold.
BEGIN DATA
28 26  36 29  26 27  34 32  32 28  27 25  31 31  31 30  30 26  32 30  29  24  34 31
END DATA.
```

	MY	MO
1.	28	26
2.	36	29
	⋮	

```
CORR memyng memold /STAT /MISS = LIST.
```

	Mean	Std. Deviation	N
memyng	30.83333	3.010084	12
memold	28.25000	2.632835	12

	memyng	memold
memold	.705	1

Single sample $t = \frac{\bar{Y} - 0}{s/\sqrt{n}}$

$H_0: \mu_D = 0$

$t = \frac{\bar{D} - 0}{s_D/\sqrt{n_D}}$

```
COMPUTE diff = memyng - memold.
TTEST /TESTVALU = 0 /VARI = diff.
```

	N	Mean	Std. Deviation	Std. Error Mean
diff	12	2.58333	2.193309	.633154

	Test Value = 0			
	t	df	Sig. (2-tailed)	Mean Difference
diff	4.080	11	.002	2.583333

$> t_{ind}$ ✓ $< df_{ind}$ × $< p_{(yd)}$ ✓ same

```
TTEST PAIRED memyng memold.
```

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	memyng	30.83333	12	3.010084	.868936
	memold	28.25000	12	2.632835	.760034

		N	Correlation	Sig.
Pair 1	memyng & memold	12	.705	.010

		Paired Differences					
		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	memyng - memold	2.583333	2.193309	.633154	4.080	11	.002