# Ch8-Ex1- University grades (univ) as a function of cognitive ability (abil) and study time (stdy).

See Ch7-Ex1
$SS_U = 1939.222$

1 - low Abil
2 - high Abil

***Categorical: C.**
**TTEST VARI = univ /GROUP = ab2.**

Ind t

| | ab2 | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| univ | 1 | 18 | 63.50 | 6.802 | 1.603 |
| | 2 | 18 | 67.94 | 7.573 | 1.785 |

$SS_1$, $SS_2$

$s_p^2 = \frac{SS_1 + SS_2}{n_1 + n_2 - 2}$

$\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

| | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| univ | -1.852 | 34 | .073 | -4.444 | 2.399 |

$H_0: \mu_1 = \mu_2$

$\frac{(\bar{Y}_1 - \bar{Y}_2) - 0}{SE}$

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

$j = 1, 2$

$\bar{Y}_j \quad \bar{Y}_j - \bar{Y}_G$

$\bar{Y}_1$ 63.50 −2.22
$\bar{Y}_2$ 67.94 +2.22
$\bar{Y}_G$ 65.72

**GLM univ BY ab2.**

ANOVA

$n_j\{(\bar{Y}_j - \bar{Y}_G)^2$

Dependent Variable: univ

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| ab2 | 177.778 | k-1 = 1 | 177.778 | 3.432 | .073 |
| Error | 1761.444 | 34 | 51.807 | | |
| Corrected Total | 1939.222 | 35 | | | |

$t^2$

$s_p^2$

**REGRESS /DEP = univ /ENTER ab2 /SAVE PRED(prdu.a) RESI(resu.a).**

| Model | R | R Square |
|---|---|---|
| 1 | .303 | .092 |

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 177.778 | 1 | 177.778 | 3.432 | .073 |
| | Residual | 1761.444 | 34 | 51.807 | | |
| | Total | 1939.222 | 35 | | | |

| | | Unstandardized Coefficients | | | |
|---|---|---|---|---|---|
| Model | | B | Std. Error | t | Sig. |
| 1 | (Constant) | 59.056 | 3.794 | 15.567 | .000 |
| | ab2 | 4.444 | 2.399 | 1.852 | .073 |

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

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Predicted Value | 65.72 | 2.254 | 36 |
| Residual | .000 | 7.094 | 36 |

```
 VARI LABEL prdu.a '' resu.a ''.
LIST.
SUBJ abil stdy hs univ ab2      prdu.a      resu.a
  1    69   26  50   59   1     63.50000    -4.50000
  2    75   30  70   63   1     63.50000     -.50000
  3    79   29  68   66   1     63.50000     2.50000
...
 19    97   23  60   67   2     67.94444     -.94444
 20    98   25  74   84   2     67.94444    16.05556
 21   100   21  60   59   2     67.94444    -8.94444
...
```

*Categorical: C N; groups diff on study time.

```
TTEST VARI = stdy /GROUP = ab2.
```

| | ab2 | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| stdy | 1 | 18 | 22.17 | 4.866 | 1.147 |
| | 2 | 18 | 18.67 | 4.740 | 1.117 |

| | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| stdy | 2.186 | 34 | .036 | 3.500 | 1.601 |

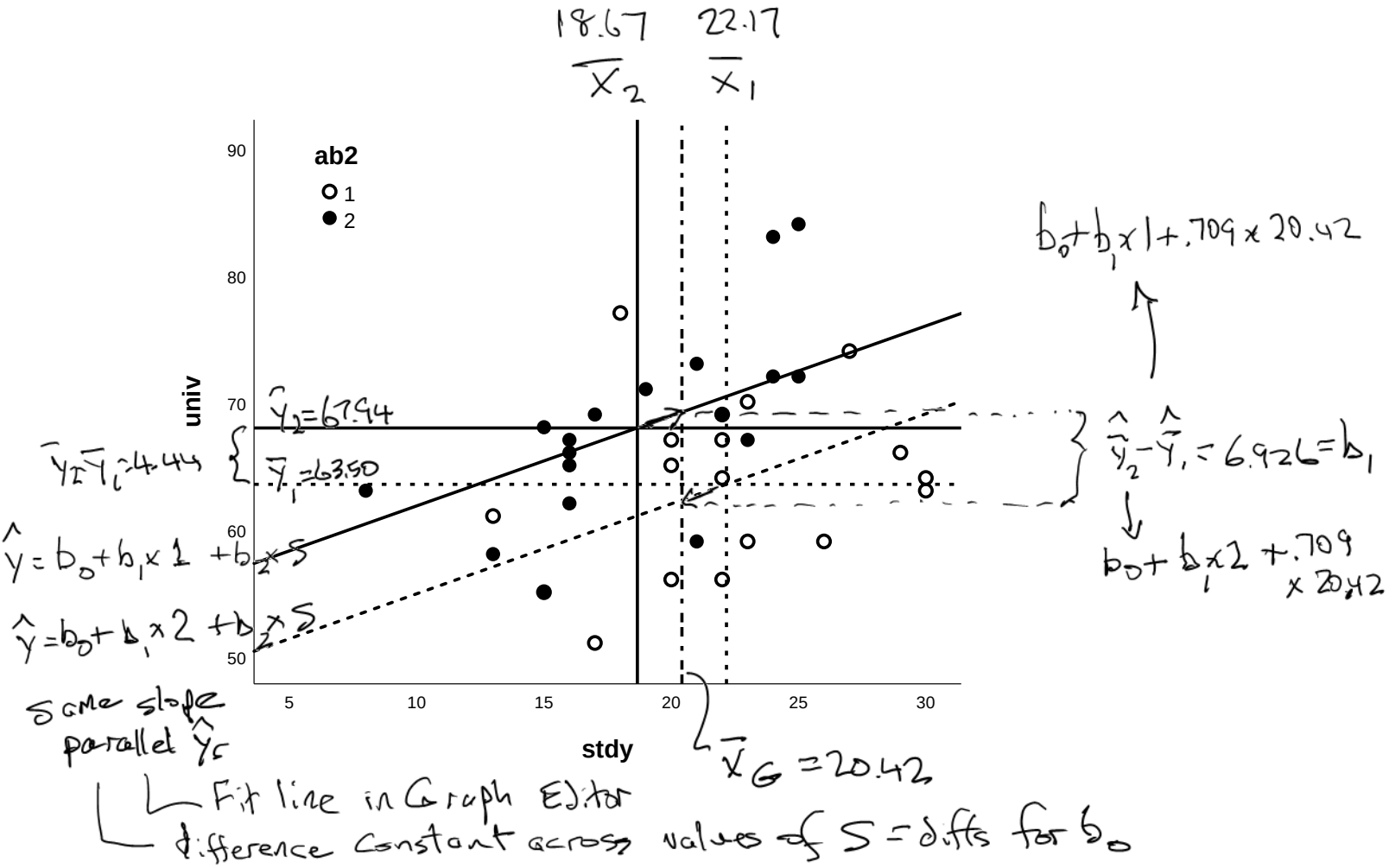
```
REGRESS /DEP = univ /ENTER ab2 stdy.
```

| Model | R | R Square |
|---|---|---|
| 1 | .543 | .295 |

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 572.069 | 2 | 286.034 | 6.904 | .003 |
| | Residual | 1367.153 | 33 | 41.429 | | |
| | Total | 1939.222 | 35 | | | |

| | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 40.859 | 6.804 | | 6.005 | .000 |
| | ab2 | 6.926 | 2.291 | .472 | 3.023 | .005 |
| | stdy | .709 | .230 | .482 | 3.085 | .004 |

```
GRAPH  /SCATTERPLOT(BIVAR)=stdy WITH univ BY ab2  /MISSING=LISTWISE.
```




```
*Categorical: C, C N, C N CxN.
COMPUTE axs = ab2*stdy.
REGRESS /DEP = univ /ENTER ab2 stdy axs.
```

| Model | R | R Square |
|---|---|---|
| 1 | .586 | .344 |

$R^2$

Rej $H_0: \rho_{Y.123} = 0$

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 666.232 | 3 | 222.077 | 5.583 | .003 |
| | Residual | 1272.990 | 32 | 39.781 | | |
| | Total | 1939.222 | 35 | | | |

$r_{YA} = .303$
$r_{YS} = .316$
$r_{YX} = .563$

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 62.461 | 15.543 | | 4.019 | .000 |
| G | ab2 | -7.194 | 9.448 | -.490 | -.761 | .452 |
| P | stdy | -.322 | .707 | -.219 | -.455 | .652 |
| CxN | axs | .693 | .451 | .996 | 1.539 | .134 |

No unique

$r_{AS} = -.351$
$r_{Ax} = .719$
$r_{Sx} = .364$

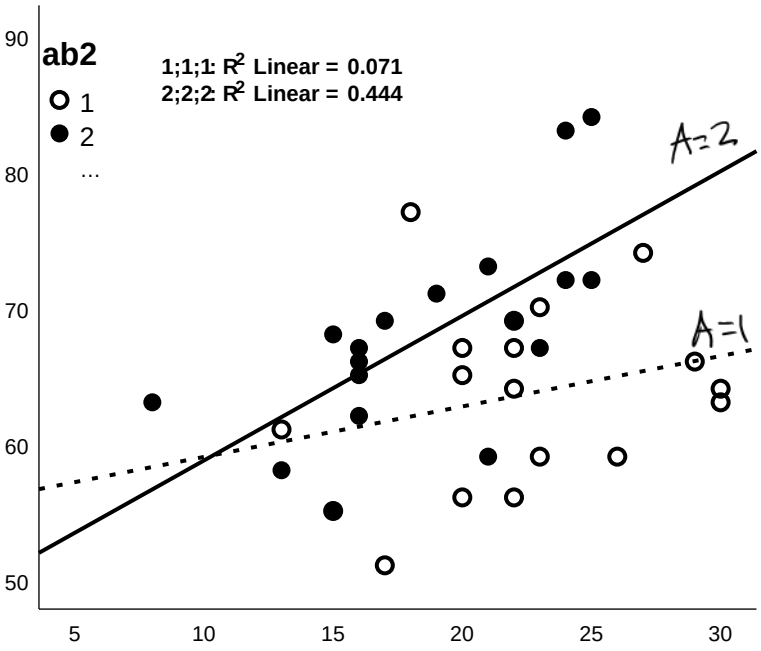
```
GRAPH  /SCATTERPLOT(BIVAR)=stdy WITH univ BY ab2  /MISSING=LISTWISE.
```

$\hat{y} = 62.461 - 7.194A - .322S + .693AxS$

Lines fitted by Graph Editor

$\hat{y} = 62.461 - 7.194A - .322S + .693AS$

$+(-.322+.693A)S$



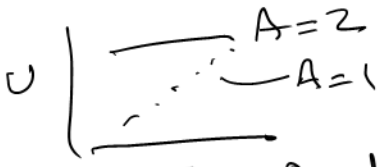

$\hat{y}_2 = 48.073 + 1.064S$ ($-.322+.693\times 2$)

$\hat{y}_1 = 55.267 + .371S$ ($-.322+.693\times 1$)

Not parallel

Who benefits more from studying??

vs.




diffs in $b_0$ NOT equal diffs across values of S

```
SPLIT FILE BY ab2.
REGRESS /DEP = univ /ENTER stdy.
```

| ab2 | Model | R | R Square |
|---|---|---|---|
| 1 | 1 | .266 | .071 |
| 2 | 1 | .666 | .444 |

| ab2 | Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| 1 | 1 | Regression | 55.529 | 1 | 55.529 | 1.215 | .287 |
| | | Residual | 730.971 | 16 | 45.686 | | |
| | | Total | 786.500 | 17 | | | |
| 2 | 1 | Regression | 432.926 | 1 | 432.926 | 12.780 | .003 |
| | | Residual | 542.018 | 16 | 33.876 | | |
| | | Total | 974.944 | 17 | | | |

| | | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|---|
| ab2 | Model | | B | Std. Error | Beta | t | Sig. |
| 1 | 1 | (Constant) | 55.267 | 7.636 | | 7.238 | .000 |
| | | stdy | .371 | .337 | .266 | 1.102 | .287 |
| 2 | 1 | (Constant) | 48.072 | 5.726 | | 8.396 | .000 |
| | | stdy | 1.065 | .298 | .666 | 3.575 | .003 |

$.371 - 1.064 = -.692$ = reg. coeff for AxS

```
SPLIT FILE OFF.
```