

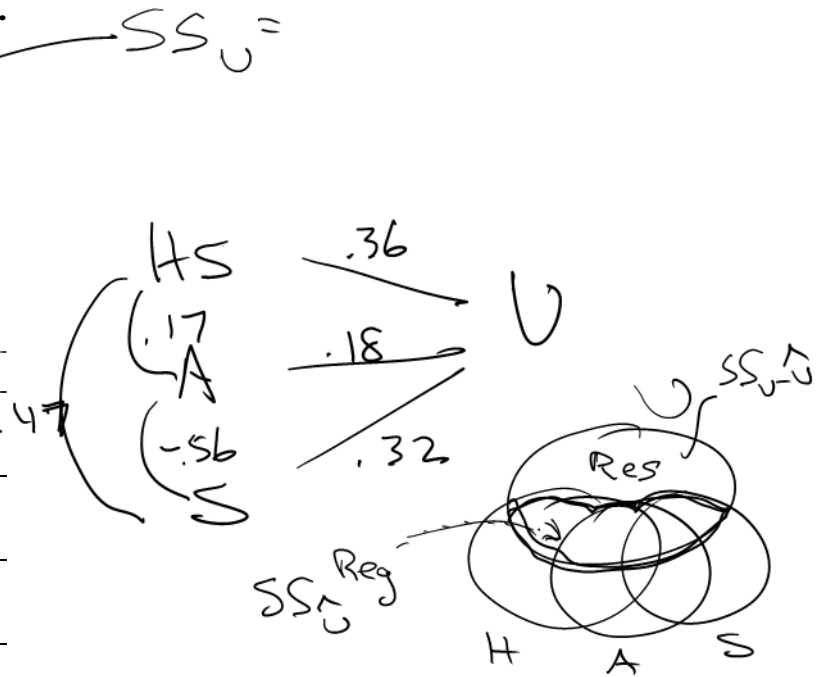
Ch7 Ex1: Prediction of University Grades (univ)

High School Grades (hs), Cognitive Ability (abil), and Study Skills (stdy)

CORR univ hs abil stdy /STAT = DESCR.

| | Mean | Std. Deviation | N |
|------|-------|----------------|----|
| univ | 65.72 | 7.444 | 36 |
| hs | 63.69 | 8.645 | 36 |
| abil | 98.89 | 13.382 | 36 |
| stdy | 20.42 | 5.056 | 36 |

| | univ | hs | abil |
|------|------|------|-------|
| hs | .360 | | |
| | .031 | | |
| abil | .180 | .174 | |
| | .292 | .310 | |
| stdy | .316 | .470 | -.564 |
| | .060 | .004 | .000 |



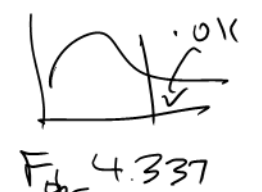
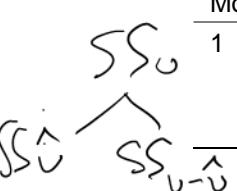
REGRESS /DEP = univ /ENTER hs abil stdy /SAVE PRED(prdu.has) RESID(resu.has).

| Model | R | R Square | Adjusted R Square |
|-------|------|----------|-------------------|
| 1 | .538 | .289 | .222 |

$$R^2 = \frac{SS_{\hat{U}}}{SS_U}$$

$$H_0: \sigma_{u, \text{has}}^2 = 0$$

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|-------------------|----|-------------|-------|------|
| 1 | Regression | SS _U | 3 | 186.855 | 4.337 | .011 |
| | Residual | SS _{U-U} | 32 | 43.083 | | |
| | Total | SS _U | 35 | | | |



$F_{df} = 4.337$
IF H_0 true = Reg H_0

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|-------|------------|-----------------------------|------------|---------------------------|-------|------|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 18.180 | 13.832 | | 1.314 | .198 |
| | hs | -.034 | .182 | -.039 | -.186 | .854 |
| | abil | .306 | .126 | .551 | 2.438 | .021 |
| | stdy | .950 | .371 | .645 | 2.558 | .015 |

| | Mean | Std. Deviation | N |
|-----------------|-------|----------------|----|
| Predicted Value | 65.72 | 4.002 | 36 |
| Residual | .000 | 6.276 | 36 |

$$SS_{\hat{U}} = (36-1) \times 4.002^2$$

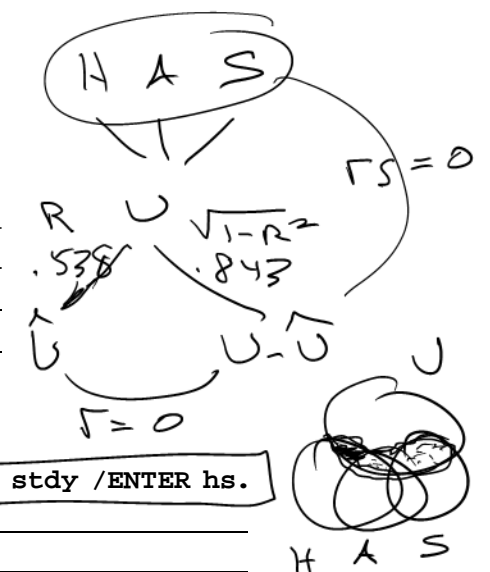
$$SS_{U-\hat{U}} = (36-1) \times 6.276^2$$

$$\hat{U} = 18.180 - .034H + .306A + .950S$$

VARI LABEL prdu.has '' resu.has ''.
 CORR univ hs abil stdy prdu.has resu.has.

| | univ | hs | abil | stdy | prdu.has |
|----------|------|------|------|------|----------|
| prdu.has | .538 | .669 | .336 | .588 | 1 |
| resu.has | .843 | .000 | .000 | .000 | .000 |

$R^2 = 1$



REGRESS /STAT = DEFAU ZPP CHANGE /DEP = univ /ENTER abil stdy /ENTER hs.

| Change Statistics | | | | | | | |
|-------------------|------|----------|-----------------|----------|-----|-----|---------------|
| Model | R | R Square | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .537 | .288361 | .288 | 6.684 | 2 | 33 | .004 |
| 2 | .538 | .289068 | .001 | .035 | 1 | 32 | .854 |

$R^2_{U.HAS} - R^2_{U.AS} = F^2_{U(HAS)} = .000767$

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|------|
| 1 | Regression | 559.079 | 2 | 279.540 | 6.684 | .004 |
| | Residual | 1380.143 | 33 | 41.823 | | |
| | Total | 1939.222 | 35 | | | |
| 2 | Regression | 560.566 | 3 | 186.855 | 4.337 | .011 |
| | Residual | 1378.656 | 32 | 43.083 | | |
| | Total | 1939.222 | 35 | | | |

Handwritten calculations:
 $SS_{U.HAS} = 560.566$
 $SS_{U.AS} = 559.079$
 $SS_{U.HAS} = 1.487$
 $r^2_{U(HAS)} = \frac{1.487}{1939.222} = .00075$
 $\sqrt{.00075} = .028$

| Model | | Unstandardized Coefficients | | | | Correlations | | |
|-------|------------|-----------------------------|------------|-------|------|--------------|---------|-------|
| | | B | Std. Error | t | Sig. | Zero-order | Partial | Part |
| 1 | (Constant) | 18.400 | 13.578 | 1.355 | .185 | | | |
| | abil | .292 | .099 | 2.956 | .006 | .180 | .458 | .434 |
| | stdy | .902 | .262 | 3.444 | .002 | .316 | .514 | .506 |
| 2 | (Constant) | 18.180 | 13.832 | 1.314 | .198 | | | |
| | abil | .306 | .126 | 2.438 | .021 | .180 | .396 | .363 |
| | stdy | .950 | .371 | 2.558 | .015 | .316 | .412 | .381 |
| | hs | -.034 | .182 | -.186 | .854 | .360 | -.033 | -.028 |

$H_0: \rho_{U(HAS)}^2 = 0$

$F = \frac{1.487/1}{43.083} = .035 = F_{\alpha}$
 $F = t^2 \sqrt{F} = 1.86$
 $P = .854 = P_t$

Handwritten calculations:
 $MS_{Res 2}$
 $SS_H (1 - R^2_{H.AS})$
 $2615.639 \times (1 - .503)$
 1299.689

REGRESS /DEP = hs /ENTER abil stdy /SAVE RESID(resh.as).

| Model | R | R Square |
|-------|------|----------|
| 1 | .709 | .503 |

$R^2_{H.AS}$

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|--------|------|
| 1 | Regression | 1315.970 | 2 | 657.985 | 16.707 | .000 |
| | Residual | 1299.669 | 33 | 39.384 | | |
| | Total | 2615.639 | 35 | | | |

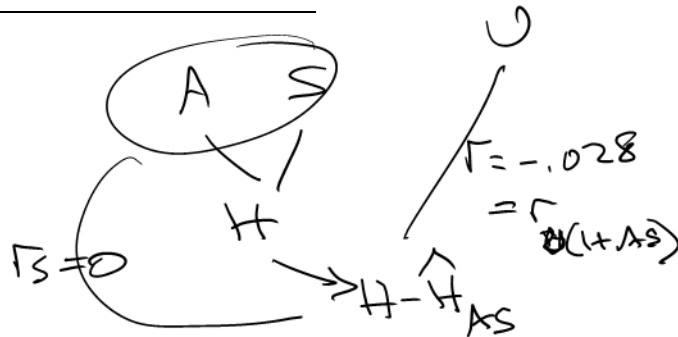
SS_H

$SS_H(1 - R^2_{H.AS})$

VARI LABEL resh.as ''.

CORR resh.as WITH univ abil stdy.

| | univ | abil | stdy |
|---------|-------|------|------|
| resh.as | -.028 | .000 | .000 |



REGRESS /DEP = univ /ENTER abil stdy /SAVE RESID(resu.as).

| Model | R | R Square |
|-------|------|----------|
| 1 | .537 | .288 |

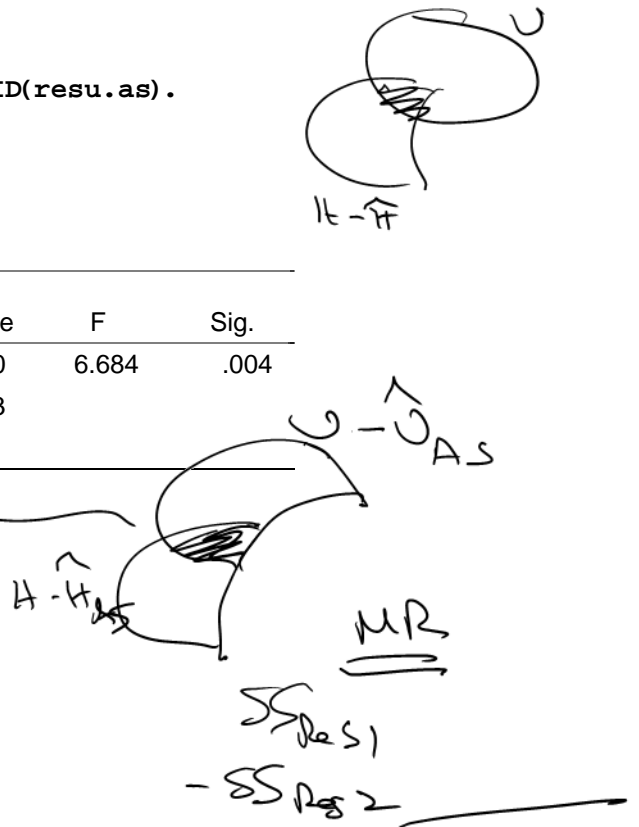
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|------|
| 1 | Regression | 559.079 | 2 | 279.540 | 6.684 | .004 |
| | Residual | 1380.143 | 33 | 41.823 | | |
| | Total | 1939.222 | 35 | | | |

SS_{res1} in MR

VARI LABEL resu.as ''.

CORR resu.as WITH resh.as abil stdsy.

| | resh.as | abil | stdy |
|---------|---------|------|------|
| resu.as | -.033 | .000 | .000 |



$$\sqrt{\frac{2}{1380.143}} = \frac{1.487}{1380.143}$$

REGRE /VARI = univ abil stdy hs /DEP = univ /FORWARD.

| Model | Variables Entered | Variables Removed | Method |
|-------|-------------------|-------------------|--|
| 1 | hs | . | Forward (Criterion: Probability-of-F-to-enter <= .050) |

| Model | R | R Square |
|-------|------|----------|
| 1 | .360 | .129 |

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|------|
| 1 | Regression | 250.803 | 1 | 250.803 | 5.050 | .031 |
| | Residual | 1688.419 | 34 | 49.659 | | |
| | Total | 1939.222 | 35 | | | |

| Model | | Unstandardized Coefficients | | | |
|-------|------------|-----------------------------|------------|-------|------|
| | | B | Std. Error | t | Sig. |
| 1 | (Constant) | 45.999 | 8.855 | 5.195 | .000 |
| | hs | .310 | .138 | 2.247 | .031 |

| Model | | Beta In | t | Sig. | Partial Correlation |
|-------|------|---------|-------|------|---------------------|
| 1 | abil | .121 | .743 | .463 | .128 |
| | stdy | .189 | 1.042 | .305 | .178 |

>.05

REGRE /VARI = univ abil stdy hs /DEP = univ /BACK.

| Model | Variables Entered | Variables Removed | Method |
|-------|-------------------|-------------------|---|
| 1 | hs, abil, stdy | . | Enter |
| 2 | . | hs | Backward (criterion: Probability of F-to-remove >= .100). |

| Model | R | R Square |
|-------|------|----------|
| 1 | .538 | .289 |
| 2 | .537 | .288 |

See
Com
Matrix

~~Excluded~~

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|------|
| 1 | Regression | 560.566 | 3 | 186.855 | 4.337 | .011 |
| | Residual | 1378.656 | 32 | 43.083 | | |
| | Total | 1939.222 | 35 | | | |
| 2 | Regression | 559.079 | 2 | 279.540 | 6.684 | .004 |
| | Residual | 1380.143 | 33 | 41.823 | | |
| | Total | 1939.222 | 35 | | | |

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|------------|-----------------------------|------------|---------------------------|--------|-------------------------|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 18.180 | 13.832 | | 1.314 | .198 |
| | abil | .306 | .126 | .551 | 2.438 | .021 |
| | stdy | .950 | .371 | .645 | 2.558 | .015 |
| | hs | -.034 | .182 | -.039 | -1.186 | .854 ^{>.10} |
| 2 | (Constant) | 18.400 | 13.578 | | 1.355 | .185 |
| | abil | .292 | .099 | .526 | 2.956 | .006 |
| | stdy | .902 | .262 | .612 | 3.444 | .002 |

| Model | | Beta In | t | Sig. | Partial Correlation |
|-------|----|---------|--------|-----------------------|---------------------|
| 2 | hs | -.039 | -1.186 | .854 ^{4+ABS} | -.033 |

STEP with default PIN & POUT
= FORWARD

>.305 for S in FORWARD

REGRE /VARI = univ abil stdy hs /CRITER = PIN(.31) POUT(.35) /DEP = univ /STEP WISE.

| Model | Variables Entered | Variables Removed | Method |
|-------|-------------------|-------------------|---|
| 1 | hs | . | Stepwise (Criteria: Probability-of-F-to-enter <= .310, Probability-of-F-to-remove >= .350). |
| 2 | stdy | . | |
| 3 | abil | . | |
| 4 | . | hs | |

| Model | R | R Square |
|-------|------|----------|
| 1 | .360 | .129 |
| 2 | .396 | .157 |
| 3 | .538 | .289 |
| 4 | .537 | .288 |

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|-------|------|
| 1 | Regression | 250.803 | 1 | 250.803 | 5.050 | .031 |
| | Residual | 1688.419 | 34 | 49.659 | | |
| | Total | 1939.222 | 35 | | | |
| 2 | Regression | 304.582 | 2 | 152.291 | 3.074 | .060 |
| | Residual | 1634.640 | 33 | 49.535 | | |
| | Total | 1939.222 | 35 | | | |
| 3 | Regression | 560.566 | 3 | 186.855 | 4.337 | .011 |
| | Residual | 1378.656 | 32 | 43.083 | | |
| | Total | 1939.222 | 35 | | | |
| 4 | Regression | 559.079 | 2 | 279.540 | 6.684 | .004 |
| | Residual | 1380.143 | 33 | 41.823 | | |
| | Total | 1939.222 | 35 | | | |

| Model | | Unstandardized Coefficients | | Standardized | t | Sig. |
|-------|------------|-----------------------------|------------|--------------|--------|------|
| | | B | Std. Error | Coefficients | | |
| 1 | (Constant) | 45.999 | 8.855 | | 5.195 | .000 |
| | hs | .310 | .138 | .360 | 2.247 | .031 |
| 2 | (Constant) | 45.189 | 8.878 | | 5.090 | .000 |
| | hs | .233 | .156 | .271 | 1.497 | .144 |
| | stdy | .278 | .267 | .189 | 1.042 | .305 |
| 3 | (Constant) | 18.180 | 13.832 | | 1.314 | .198 |
| | hs | -.034 | .182 | -.039 | -1.186 | .235 |
| | stdy | .950 | .371 | .645 | 2.558 | .015 |
| | abil | .306 | .126 | .551 | 2.438 | .021 |
| 4 | (Constant) | 18.400 | 13.578 | | 1.355 | .185 |
| | stdy | .902 | .262 | .612 | 3.444 | .002 |
| | abil | .292 | .099 | .526 | 2.956 | .006 |

| Model | | Beta In | t | Sig. | Partial Correlation |
|-------|------|---------|--------|------|---------------------|
| 1 | abil | .121 | .743 | .463 | .128 |
| | stdy | .189 | 1.042 | .305 | .178 |
| 2 | abil | .551 | 2.438 | .021 | .396 |
| 4 | hs | -.039 | -1.186 | .235 | -.033 |

FORMAT prdu.has TO resu.as (F8.3).

LIST.

| SUBJ | abil | stdy | hs | univ | prdu.has | resu.has | resh.as | resu.as |
|------|------|------|----|------|----------|----------|---------|---------|
| 1 | 104 | 24 | 71 | 72 | 70.445 | 1.555 | .079 | 1.553 |
| 2 | 83 | 22 | 66 | 64 | 62.278 | 1.722 | 6.657 | 1.497 |
| 3 | 89 | 30 | 72 | 64 | 71.512 | -7.512 | -1.226 | -7.470 |
| 4 | 79 | 29 | 68 | 66 | 67.632 | -1.632 | .355 | -1.644 |
| 5 | 90 | 20 | 55 | 65 | 62.896 | 2.104 | -4.406 | 2.253 |
| 6 | 96 | 15 | 53 | 55 | 60.055 | -5.055 | -1.782 | -4.994 |
| 7 | 102 | 22 | 60 | 69 | 68.304 | .696 | -7.242 | .941 |
| 8 | 97 | 23 | 63 | 70 | 67.620 | 2.380 | -3.587 | 2.501 |
| 9 | 100 | 21 | 60 | 59 | 66.742 | -7.742 | -4.987 | -7.573 |
| 10 | 126 | 8 | 55 | 63 | 62.533 | .467 | -2.290 | .544 |
| 11 | 100 | 15 | 67 | 68 | 60.807 | 7.193 | 10.555 | 6.836 |
| 12 | 94 | 20 | 72 | 56 | 63.547 | -7.547 | 10.931 | -7.917 |
| 13 | 96 | 17 | 69 | 51 | 61.413 | -10.413 | 11.371 | -10.797 |
| 14 | 69 | 26 | 50 | 59 | 62.328 | -3.328 | -9.216 | -3.016 |
| 15 | 113 | 16 | 57 | 66 | 66.079 | -.079 | -6.274 | .133 |
| 16 | 110 | 16 | 58 | 62 | 65.126 | -3.126 | -4.026 | -2.990 |
| 17 | 103 | 17 | 56 | 69 | 63.998 | 5.002 | -4.540 | 5.156 |

$$\hat{U} = U - U$$

$$\hat{U} = 18.180 - 034H + .306A + .951S$$

\swarrow 69.0 - 63.998
 $\times 56$ $\times 103$ $\times 17$

