Data Analysis Notes – Transformation

DATING OF ROCKS A PRACTICAL INVESTIGATION

Are the ages of millions of years accurate when it comes to radiometric dating of rocks?
Are there any assumptions made in the dating methods?
Do different methods give similar/the same dates of the rocks?
When ages of rocks are given, are we measuring time?

Distance (m) from Granite boundary	Apparent age of rock using K-Ar dating method (m.y.)
90	70
400	450
900	500
1200	800
2000	1000
3000	1050
4000	1100

Give answers, correct to **3 significant figures** unless otherwise stated.

Question 1 State the response variable and the explanatory variable (note, we are going to predict the apparent age from the distance).

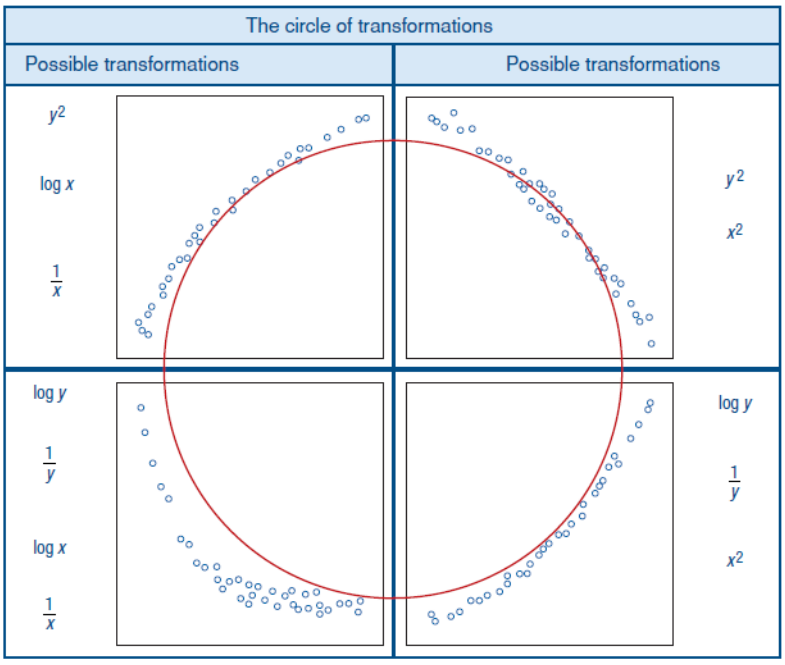
Question 2 Construct a scatterplot, for distance against apparent age and hence perform scatterplot analysis

*Sketch Scatterplot (Label axes with **variable names** and **units**)*		
*Direction (Key words: association, **variable names**)*		
Outliers		
Form – by observation		
Form – by residual plot	Residual plot	Interpretation of residual plot

Strength *State r = ____* *This means _____*	
Coefficient of determination *State r^2 = _____* *This means _____%* *….of RV (**variable name)** can be explained by EV **(variable name)***	
*Least-square regression line in correct **variable name*** *Interpret **a** (y-intercept)* *Interpret **b** slope coefficient*	
*Are the reports for **a, b, r** and **r^2** reliable? Why/ Why not? (check outliers and form)*	

Possible transformation and model name

Question 3 Compare the original scatterplot to the circle of transformation, state **all** the possible transformations.



Question 4 Perform and analyse each transformation

Original data

Distance (m) from Granite boundary	Apparent age of rock using K-Ar method (m.y.)
90	70
400	450
900	500
1200	800
2000	1000
3000	1050
4000	1100

Transformed data – Log *x* Transformation

Distance	Log (distance)	Apparent age (m.y.)
90		70
400		450
900		500
1200		800
2000		1000
3000		1050
4000		1100

Transformed scatterplot *Residual plot*	Transformed scatterplot and Residual plot Interpretation of residual plot
Strength *State r = ____* *This means _____*	
Coefficient of determination *State r^2 = _____* *This means _____%* *….of RV (**variable name)** can be explained by EV **(variable name)***	
*Least-square regression line in correct **variable name*** *Interpret **a** (y-intercept)* *Interpret **b** slope coefficient*	
*Are the reports for **a, b, r** and **r^2** reliable?* *Is this model better?*	

Question 5 Another method was used to determine the apparent age of the rock (Rb-Sr) and the measurements given.

Original data

Distance from Granite boundary	Apparent age of rock using Rb-Sr method (m.y)
7	190
15	300
90	550
400	820
900	900
1200	1050
2000	1100
3000	1150

Transformed data – Log *x* Transformation

Distance	Log (distance)	Apparent age (m.y.)
7		190
15		300
90		550
400		820
900		900
1200		1050
2000		1100
3000		1150

Transformed scatterplot *Residual plot*	Transformed scatterplot and Residual plot	Interpretation of residual plot
Strength *State r = ____* *This means _____*		
Coefficient of determination *State r^2 = _____* *This means _____%* *….of RV (**variable name)** can be explained by EV **(variable name)***		
*Least-square regression line in correct **variable name*** *Interpret **a** (y-intercept)* *Interpret **b** slope coefficient*		
*Are the reports for **a, b, r** and **r^2** reliable?*		

Question 6

(a) Given that the apparent age at distance 0m is dated at 54 m.y. comment on the accuracy of the y-intercept. (Use the data/information from question 5)

_____

_____

_____

(b) Comment on the accuracy of the two different methods of dating (K-Ar with Rb-Sr) by comparing the dates they give for the similar distances

_____

_____

_____

Question 7

(a) Using your transformed equation for the K-Ar method find the apparent age at 100 m.

(b) (i) Does your result seem reasonable? Why/Why not?

(ii) Is this interpolation or extrapolation?

(c) Using your transformed equation for the K-Ar method find the apparent age at 1m.

(d) (i) Does your result seem reasonable?

(ii) Is this interpolation or extrapolation?

Question 8

Go back to the questions at the top of the first page, comment with respect to:

1) Are the ages of millions of years accurate when it comes to radiometric dating of rocks?

2) Are there any assumptions made in the dating methods?

3) Do different methods give similar/the same dates of the rocks?

4) When ages of rocks are given, are we measuring time?

REFERENCES

http://www.icr.org/rate/ Go to the bottom of the page, and click on the free download 2.8MB PDF, pages 153-159.

•Scientists involved Dr. Steven A. Austin, Geologist, Institute for Creation Research, California • Dr. John R. Baumgardner, Geophysicist, Institute for Creation Research, California1 • Dr. Steven W. Boyd, Hebraist, The Master's College, California2 • Dr. Eugene F. Chaffin, Physicist, Bob Jones University, South Carolina3 • Dr. Donald B. DeYoung, Physicist, Grace College and Seminary, Indiana4 • Dr. D. Russell Humphreys, Physicist, Institute for Creation Research, California5 • Dr. Andrew A. Snelling, Geologist, Institute for Creation Research, California6 • Dr. Larry Vardiman, Atmospheric Scientist, Institute for Creation Research, California

https://www.youtube.com/watch?v=z1lBdLVyzzo

Interesting relevant parts to watch are 30-31 min and 39-39.5 minute mark for assumptions about the initial conditions

Relevant to our assignment are the 47.5 min to the 49 minute mark.