

PSYCHOLOGY 3000-090 (STATS ONLINE)
MIDTERM FORM 1

Read each question carefully before you answer. Clearly write your answers on the back of the following pages, or use notebook paper or a blue book. Work at a steady pace, and you should have ample time to finish. Make sure your name is on this exam, blue book, or notebook paper before you turn in the exam.

1. A psychology professor believes that the as the number of hours children spend watching television increases, the number of hours they spend doing homework decreases. Five children are selected for the experiment. The children were asked to record the number of hours spent in each activity for a one week period. Shown below are the daily averages of time spent in each activity for the children:

Child	Daily TV hours (X)	Daily homework hours (Y)
1	8	1
2	1	4
3	4	3
4	3	3
5	5	2

Make sure that you show all your steps and calculations so we can give partial credit where appropriate.

- (a) What is the scientific hypothesis? (5 points)

There is a negative relationship between hours spent watching television and hours spent doing homework.

- (b) Is daily TV hours an IV, DV, predictor variable or criterion variable? Is daily homework hours an IV, DV, predictor variable or criterion variable? (5 points)

Daily TV hours = predictor

Daily homework hours = criterion

(c) Find the mean and standard deviation of both variables (daily TV hours and daily homework hours). (10 points)

$$M_x = \frac{\sum x}{n} = \frac{8+1+4+3+5}{5} = \frac{21}{5} = \boxed{4.2}$$

$$M_y = \frac{\sum y}{n} = \frac{1+4+3+3+2}{5} = \frac{13}{5} = \boxed{2.6}$$

$$S_x = \sqrt{\frac{\sum x^2}{n} - M_x^2} = \sqrt{\frac{64+1+16+9+25}{5} - 4.2^2}$$

$$= \sqrt{\frac{115}{5} - 17.64} = \sqrt{23 - 17.64}$$

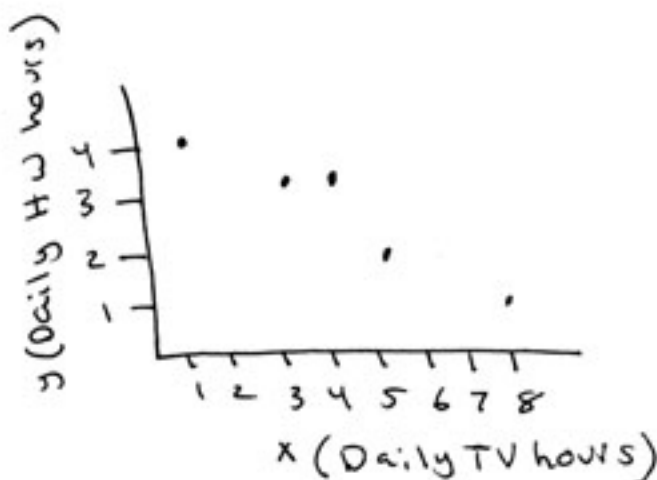
$$= \sqrt{5.36} = \boxed{2.3152}$$

$$S_y = \sqrt{\frac{\sum y^2}{n} - M_y^2} = \sqrt{\frac{1+16+9+9+4}{5} - 2.6^2}$$

$$= \sqrt{\frac{39}{5} - 6.76} = \sqrt{7.8 - 6.76}$$

$$= \sqrt{1.04} = \boxed{1.0198}$$

(d) Draw a scatterplot. Be sure and label the X and Y axes. (5 points)



(e) Find the correlation between daily TV hours and daily homework hours. (10 points)

$$r_{xy} = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{[N \sum x^2 - (\sum x)^2][N \sum y^2 - (\sum y)^2]}}$$

$$= \frac{5(43) - (21)(13)}{\sqrt{[5(115) - (21)^2][5(39) - (13)^2]}}$$

$$= \frac{215 - 273}{\sqrt{[575 - 441][195 - 169]}}$$

$$= \frac{-58}{\sqrt{(134)(26)}}$$

$$= \frac{-58}{\sqrt{3484}}$$

$$= \frac{-58}{59.0254}$$

$$= \boxed{-0.9826}$$

x	y	xy	x ²	y ²
8	1	8	64	1
1	4	4	1	16
4	3	12	16	9
3	3	9	9	9
5	2	10	25	4
Σ	21	43	115	39

(f) Find the regression line for predicting daily homework hours from daily TV hours.

1) Find the slope, b . (5 points)

$$\begin{aligned}b_y &= r_{xy} \left(\frac{s_y}{s_x} \right) \\&= -0.9826 \left(\frac{1.0198}{2.3152} \right) \\&= -0.9826 (0.4405) \\&= -0.4328\end{aligned}$$

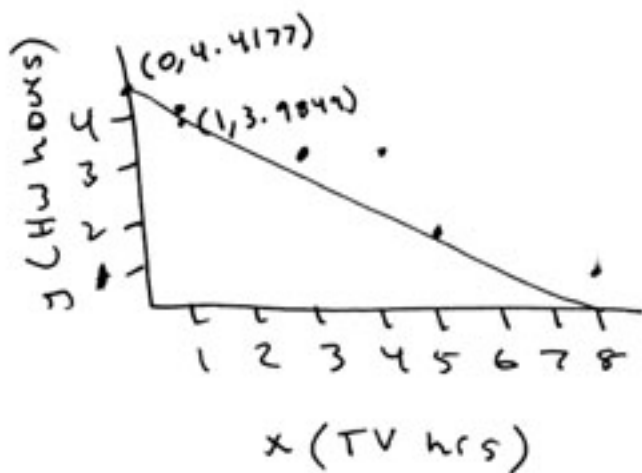
2) Find the intercept, a . (5 points)

$$\begin{aligned}a_y &= M_y - b_y M_x \\&= 2.6 - (-0.4328)(4.2) \\&= 2.6 - (-1.8177) \\&= 4.4177\end{aligned}$$

3) Write the regression equation and Draw this on your scatterplot. (5 points)

$$\begin{aligned}y' &= a_y + b_y x \\&= 4.4177 - 0.4328x\end{aligned}$$

x	y'
0	4.4177
1	3.9849



- (g) Calculate the total variance in daily homework hours. Also calculate the explained and unexplained variance in daily homework hours. (15 points)

$$\text{Total variance} = s_y^2 = \boxed{1.04}$$

$$\text{Explained} = r^2 s_y^2$$

$$= (-0.9826)^2 (1.04) = \boxed{1.0041}$$

$$\text{Unexplained} = (1-r^2) s_y^2$$

$$= [1 - (-0.9826)^2] (1.04) = \boxed{0.0359}$$

- (h) If a student received a score of 5 on daily TV hours, what would you predict that the student's daily homework hours would be? (10 points)

$$\begin{aligned} y' &= 4.4177 - 0.4328(5) \\ &= 4.4177 - 2.164 \\ &= \boxed{2.2537} \end{aligned}$$

- (i) What is the Z-Score for daily homework hours for student 2? (10 points)

$$z = \frac{x - M_y}{s_y} = \frac{1 - 2.6}{1.0198} = \boxed{-1.5689}$$

- (j) Estimate the population s and the Standard Error of the Mean (SEM) for daily homework hours (5 points).

$$s = S \sqrt{\frac{n}{n-1}} = 1.0198 \sqrt{\frac{5}{4}} = \boxed{1.1402}$$

$$SEM = \frac{1.0198}{\sqrt{n-1}} = \frac{1.0198}{\sqrt{4}} = \frac{1.0198}{2} = \boxed{0.5099}$$

2. There are four suits: hearts, diamonds, clubs, and spades. There are 13 cards in each suit. Three cards in each suit are face cards. Two of the suits are black; two of the suits are red. You shuffle a standard deck of cards and randomly draw one card from the deck, make a record of the first card, and then replace the card back into the deck. Next, you shuffle the deck and draw a second card and make a record of the second card drawn. What is the probability of drawing a face card on the first card and either a 4 or an 8 on the second card? That is, what is the $P(\text{face and } 4 \text{ or } 8)$? (10 points)

END OF EXAM (written 1/01)

$$\begin{aligned} P(\text{face and (four or eight)}) &= P(\text{face})P(\text{four or eight}) \\ &= \left(\frac{3}{13}\right)\left(\frac{2}{13}\right) = 0.0355 \end{aligned}$$

$$\left(\frac{12}{52}\right)\left(\frac{8}{52}\right) = \frac{96}{204} = 0.0355$$