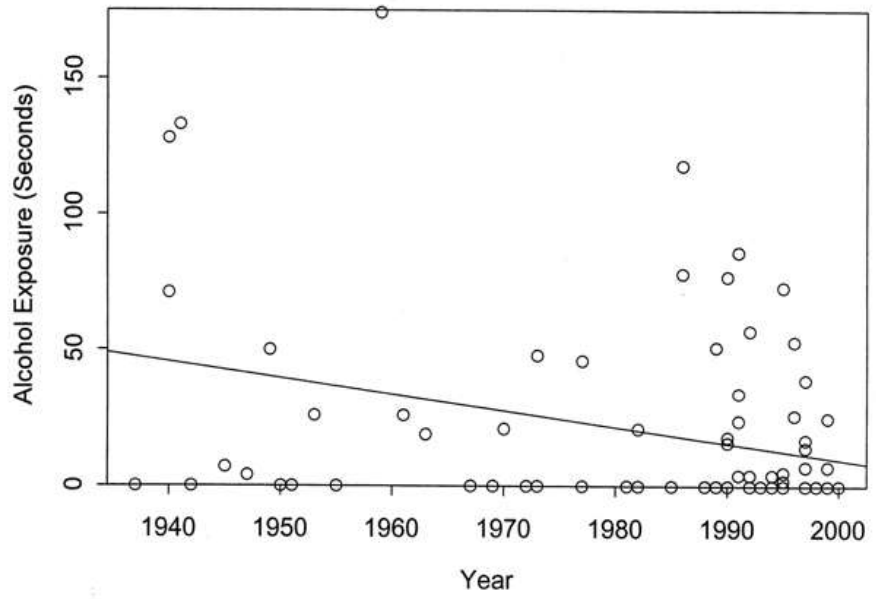
UNIT 8 HOMEWORK

Question 1:

The following scatter plot shows the relationship between year of release and alcohol exposure time (in seconds) for G-rated animated feature films released in the U.S. between 1937 and 2000. The authors fit a linear regression line to the data (displayed in the scatter plot).



Reproduced with permission from: Thompson K M , and Yokota F Pediatrics 2001;107:1369-1374.

What is the approximate equation of the linear regression line shown in the plot?

1. Exposure seconds = 49 – 1.0 * year
2. Exposure seconds = 49 – 0.6 * year since 1937
3. Exposure seconds = 49–0.6 * year
4. Exposure seconds = 49 + 1.0 * years since 1937

Question 2:

From the graphic in Question 1, what is a likely value for the Pearson's correlation coefficient (r) for this line?

1. +1.0

2. -0.7

3. +0.4

4. -0.3

5. -0.01

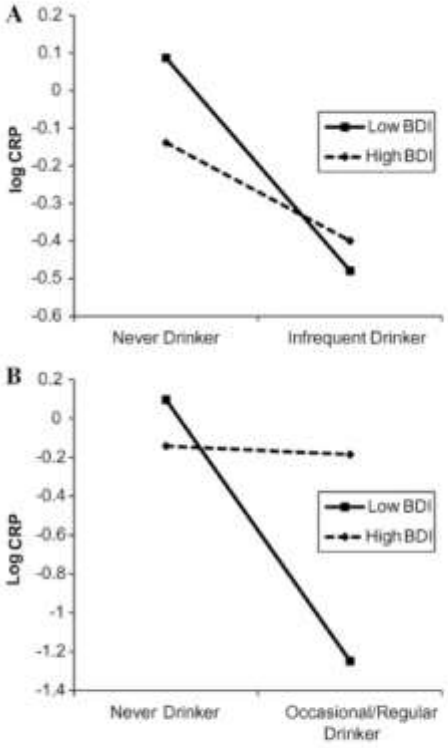
Question 3:

Do you think linear regression analysis is appropriate for these data?

1. Yes, because the outcome is a continuous variable.
2. No, the distribution of alcohol exposure appears highly non-normal and the variance is not homogenous in different years.
3. No, the observations are not independent.
4. Yes, linear regression is fine because the sample size is so large.
5. Yes, because the relationship is clearly linear.

Question 4:

The following figure comes from a study that was trying to determine whether depression reduces the health benefits of moderate alcohol consumption and physical activity. The figure shows the results from a linear regression model where logCRP (a measure of inflammation) is the outcome variable and drinking level is the categorical predictor (never, infrequent, occasional/regular). Solid lines indicate the regression model for those without depression (low BDI=Beck Depression Inventory score) and dashed lines represent the regression model for those with depression (high BDI).



Reproduced with permission from Figure 1 of: Edward C. Suarez, Nicole L. Schramm-Sapyta, Tracey Vann Hawkins, Alaattin Erkanli. Depression inhibits the anti-inflammatory effects of leisure time physical activity and light to moderate alcohol consumption. *Brain, Behavior, and Immunity*, Available online 26 March 2013.

Which of the following best represents the linear regression model that the authors used?

1. $\log CRP = \alpha + \beta_{\text{drinking level}}$
2. $\log CRP = \alpha + \beta_{\text{never drinker}} + \beta_{\text{infrequent drinker}} + \beta_{\text{occasional/regular drinker}}$
3. $\log CRP = \alpha + \beta_{\text{infrequent drinker}} + \beta_{\text{occasional/regular drinker}}$
4. $\log CRP = \alpha + \beta_{\text{never drinker}} + \beta_{\text{occasional/regular drinker}}$

Question 5:

From the graphic, what is the approximate value of the beta-coefficient (slope) for occasional/regular drinker among people without depression (low BDI), in units of logCRP?

1. -1.2
2. +1.2
3. -1.1
4. -1.35
5.

Question 6:

From the graphic, what is the approximate intercept for the linear regression model for those without depression (low BDI)?

1. +.1
2. 0
3. -.1
4. -1.25

Question 7:

What general conclusions can we draw?

1. Alcohol drinking is associated with a bigger increase in inflammation (CRP levels) in depressed versus non-depressed people.
2. Alcohol drinking is associated with a smaller decrease in inflammation (CRP levels) in depressed versus non-depressed people.
3. Alcohol drinking is associated with no change in inflammation (CRP levels) in depressed and non-depressed people.

The following tables (Table 2 and Table 3) come from a paper that examined the relationship between feeding method (exclusive breastfeeding, partial breastfeeding, formula feed) and infant cognitive development, as well as the association between levels of certain fatty acids in breast milk and infant cognitive development.

Table 2. Results from linear regression models for the association between feeding method for the first four post-natal months and Mullen Scales of early Learning scores, PIN 2001-2006 [from PIN (1995-2006)] Babies Study

	Feeding method* (exclusively formula fed = reference, n=39)			
	Exclusively or almost exclusively breastfed (n=207)		Partially breastfed (n=112)	
Mullen Scales of Early Learning	β (CI) (unadjusted)	β (CI) (adjusted)**	β (CI) (unadjusted)	β (CI) (adjusted)**
Gross motor	1.7 (-2.4, 5.8)	0.9 (-3.5, 5.3)	0.9 (-3.5, 5.3)	0.6 (-3.7, 4.9)
Visual reception	4.4 (0.7, 8.2)	2.4 (-1.7, 6.5)	0.6 (-3.4, 4.7)	-0.2 (-4.2, 3.9)
Fine motor	4.6 (0.8, 8.3)	2.5 (-1.6, 6.5)	2.2 (-1.8, 6.3)	1.1 (-2.9, 5.1)
Receptive language	1.2 (-1.6, 3.9)	0.5 (-2.4, 3.5)	-1.2 (-4.1, 1.7)	-1.5 (-4.4, 1.4)
Expressive language	2.2 (-0.9, 5.3)	1.5 (-1.8, 4.9)	0.4 (-2.9, 3.7)	0.1 (-3.3, 3.3)
Composite	6.2 (1.6, 10.8)	3.7 (-1.3, 8.6)	1.0 (-4.0, 5.9)	-0.3 (-5.2, 4.6)

CI, confidence interval. *Infants who were breastfed for all feedings per day for the first four post-natal months were considered exclusively breastfed. Infants who were breastfed plus up to one formula feeding per day were considered almost exclusively breastfed. Infants who were fed infant formula for all daily feedings were considered exclusively formula fed. All other infants were partially breastfed. **Adjusted models include education, race and ethnicity, smoking, infant sex and preterm status.

Table 3. Results from linear regression models for the association between docosahexaenoic acid and arachidonic acid in breast milk and Mullen Scales of Early Learning scores among infants exclusively breastfed (n=183) for the first four post-natal months, PIN 2001-2006 [from PIN (1995-2006)] Babies Study

	Breast milk DHA (continuous)		Breast milk AA (continuous)	
Mullen Scales of Early Learning	β (CI) (unadjusted)*	β (CI) (adjusted)**	β (CI) (unadjusted)*	β (CI) (adjusted)**
Gross motor	5.6 (-2.8, 13.9)	3.9 (-4.6, 12.4)	10.6 (0.5, 20.7)	9.0 (-1.0, 19.0)
Visual reception	-3.5 (-11.1, 4.1)	-2.7 (-10.5, 5.1)	4.3 (-4.7, 13.3)	4.4 (-4.6, 13.3)
Fine motor	2.8 (-4.8, 10.5)	2.3 (-5.2, 9.9)	3.8 (-5.3, 12.8)	1.7 (-7.0, 10.4)
Receptive language	0.7 (-4.5, 5.9)	-.07 (-5.9, 4.5)	3.5 (-2.8, 9.8)	2.2 (-4.0, 8.5)
Expressive language	-0.4 (-6.3, 5.6)	-1.6 (-7.6, 4.4)	4.7 (-2.4, 11.9)	3.6 (-3.6, 10.8)
Composite	-0.3 (-9.5, 8.8)	-1.3 (-10.3, 7.7)	8.2 (-2.6, 19.1)	6.1 (-4.3, 16.5)

AA, arachidonic acid; CI, confidence interval; DHA, docosahexaenoic acid. *Unadjusted models include a variable for laboratory. Beta coefficient represents a change in fatty acid concentration of 1.0%. **Adjusted models include laboratory, infant sex, parity, smoking and preterm status.

Reproduced with permission from: Keim, SA et al. Breastfeeding and long-chain polyunsaturated fatty acid intake in the first 4 post-natal months and infant cognitive development; an observational study. *Maternal & child Nutrition* 2011; 8: 1740-8709.

Question 8:

Referring to Table 2, the unadjusted beta coefficient for exclusive/near exclusive breast feeding for visual reception is 4.4 (0.7, 8.2). What model was used to generate this beta coefficient?

1. visual reception score= $\alpha+\beta_{\text{breastfeeding}}$
2. visual reception score = $\alpha+\beta_{\text{exclusive breastfeeding}} + \beta_{\text{partial breastfeeding}} + \beta_{\text{formula feeding}}$
3. breastfeeding score = $\alpha+\beta_{\text{visual reception}}$
4. visual reception score = $\alpha+\beta_{\text{exclusive breastfeeding}} + \beta_{\text{partial breastfeeding}}$

Question 9:

Referring to Table 2, the unadjusted beta coefficient for exclusive/near exclusive breast feeding for visual reception is 4.4 (0.7, 8.2). How would we interpret this beta coefficient?

1. On average, exclusively breast-fed babies score 4.4 points higher in visual reception compared with partially breast-fed babies; and this difference is statistically significant.
2. On average, exclusively breast-fed babies score 4.4 points higher in visual reception compared with formula-fed babies; and this difference is statistically significant.
3. On average, exclusively breast-fed babies score 4.4 points higher in visual reception compared with partially breast-fed babies; and this difference is NOT statistically significant.
4. On average, exclusively breast-fed babies score 4.4 points higher in visual reception compared with formula-fed babies; and this difference is NOT statistically significant.

Question 10:

Referring to Table 2, the adjusted beta coefficient for exclusive/near exclusive breast feeding for visual reception is 2.4 (-1.7, 6.5), whereas the unadjusted coefficient is 4.4 (0.7, 8.2). How should we interpret these results?

1. Much of the apparent relationship between exclusive breastfeeding and infant visual reception was due to confounding by other variables (such as maternal education).
2. After adjusting for confounders, we can definitively conclude that breastfeeding has no relationship with infant visual reception.
3. Confounders played no role here, because the regression coefficient changes by less than 10 percent.

4. By putting too many variables in the regression model, the authors have obscured an important relationship between breastfeeding and infant visual reception.

Question 11:

Referring to Table 3, breast milk DHA was treated as what type of variable in the linear regression models?

1. continuous
2. binary
3. categorical
4. ordinal
5. time-to-event

Question 12:

Referring to Table 3, the unadjusted beta coefficient for breast milk DHA for visual reception score is -3.5 (-11.1, 4.1). How should we interpret these results?

1. On average, babies with a high DHA level score 3.5 points lower in visual reception compared with babies with a low DHA level; and this difference is NOT statistically significant.
2. On average, every 1% increase in DHA concentration in the breast milk is associated with a 3.5 point increase in infant visual reception scores; and this difference is statistically significant.
3. On average, every 1% increase in DHA concentration in the breast milk is associated with a 3.5 point decrease in infant visual reception scores; but this difference is NOT statistically significant.
4. On average, every 1% increase in DHA concentration in the breast milk is associated with an 11.1 point decrease in infant visual reception scores; but this difference is NOT statistically significant.

Question 13:

TRUE or FALSE. In this example, confounders played a stronger role in the relationship between feeding method and infant cognitive function than in the relationship between breast milk DHA concentration and infant cognitive function.

1. True
2. False