Questions Related to Session #5
Regression and Correlation

Study

Forty four males and 44 females were randomly assigned to treatmill workouts which lasted from 306 to 976 seconds. VO_2 Max (maximum O_2 consumption normalized by body weight (ml/kg.min)) was the outcome measure.

Regression Model 1

The following common slope multiple linear regression model was estimated by least squares.

$E(VO_2\ Max_i | X) = \beta_o + \beta_1(\text{exercise duration}_i) + \beta_2(z_{2,i})$

where $z_{2,i} = 1$ if the i*th* participant was male, and 0 if i*th* participant was female.

Regression Analysis Summary

Table 1. The regression ANOVA table from the multiple regression analysis.

Parameter	DF	SS	MS	$F_{observed}$
Regression	2	6044.03		
Error	84	1335.60		
Total	86	7379.62		

Table 2. The regression parameter estimates.

Parameter	Estimate b	SE b	$t_{observed}$
Intercept	-1.360	2.220	
Duration	0.059	0.004	
Gender=male	3.396	1.016	

1) Utilize the information from Table 1 to compute the mean square regression (MSR), the mean square error (MSE) and the F-statistic ($F_{observed}$).

2) For a two-sided test with significance level α=0.05 we reject Ho: $\beta_1=\beta_2=0$, if $F_{observed} \geq F_{(2,84,.95)} = 3.105$. Do we reject?.

3) Utilizing the information from Table 1, compute the value of the coefficient of determination (R^2), and give a simple interpretation for the R^2 value you calculated.

4) Utilizing the information from Table 2, compute the *t*-statistic ($t_{observed}$) for the regression parameter related to exercise duration and for the regression parameter related to gender=male.

5) For a two-sided test with significance level 0.05 we reject Ho: $\beta_1=0$, and Ho: $\beta_2=0$ if $|t_{observed}| \geq t_{(84,.975)}=1.990$. Do we reject Ho: $\beta_1=0$?. Do we reject Ho: $\beta_2=0$?.

6) For females and males, write out the estimated regression equation for predicting the expected value VO_2 Max as a linear function of exercise duration.

7) What is the expected value of VO_2 Max for a female who spent 450 seconds on the treadmill?. What is the expected value of VO_2 Max for a male who spent 450 seconds on the treadmill.

Regression Model 2

The following separate slopes multiple linear regression model was fit to the same data by least squares.

$E(VO_2\ Max_i|\ X) = \beta_o + \beta_1(\text{exercise duration}_i) + \beta_2(z_{2,i}) + \beta_3(z_{2,i} \text{ x exercise duration}_i)$

where $z_{2,i}$ = 1 if the *ith* participant was male, and 0 if *ith* participant was female.

Regression Analysis Summary

Table 3. The regression ANOVA table from the multiple regression analysis.

Parameter	DF	SS	MS	$F_{observed}$
Regression	3	6089.35	2029.12	130.57
Error	83	1290.27	15.54	
Total	86	7379.62		

7) Utilizing the information from Table 1 and Table 3, compute the extra-sum of squares F-test for the null hypothesis Ho: $\beta_3 = 0$.

9) For a two-sided test with significance level $\alpha=0.05$ we reject Ho: $\beta_3=0$, if $F_{observed} \geq F_{(1,83,.95)} = 3.955$. Do we reject?.

10) We observe from a sample of 44 paired measurements a sample correlation $r = 0.35$. Based on this information compute the value of the one-sample t-Test ($t_{observed}$).

11) For a two-sided test with significance level $\alpha=0.05$ we reject Ho: $\rho=0$ if $|t_{observed}| \geq t_{(42,0.975)}= 2.08$. Do we reject?.