Practice Problem Solutions

	Low Protein Diet	High Protein Diet	Row Total
Raised alone	$\sum X = 332$ $\sum X^2 = 22{,}082$	$\sum X = 182$ $\sum X^2 = 6{,}710$	$\sum X_{r_1} = 514$ $\sum X_{r_1}^2 = 28{,}792$
Raised in a colony	$\sum X = 215$ $\sum X^2 = 9{,}267$	$\sum X = 133$ $\sum X^2 = 3{,}555$	$\sum X_{r_2} = 348$ $\sum X_{r_2}^2 = 12{,}822$
Col Total	$\sum X_{c_1} = 547$ $\sum X_{c_1}^2 = 31{,}349$	$\sum X_{c_2} = 315$ $\sum X_{c_2}^2 = 10{,}265$	$\sum\sum X = 862$ $\sum\sum X^2 = 41{,}614$

Source Table – Maze Learning Data					
Source	**SS**	***df***	**MS**	**F**	***p***
Columns	2,691.2	1	2,691.2	266.455	< .05
Rows	1,377.8	1	1,377.8	136.416	< .05
Interaction	231.2	1	231.2	22.891	< .05
Within	161.6	16	10.1		
Total	4,461.8	19			

1. $SS_{Total} = 41614.00 - \dfrac{862^2}{20} = 41614.00 - 37152.2 = 4461.8$

2. $SS_{wg} = 41614.00 - (\dfrac{332^2}{5} + \dfrac{182^2}{5} + \dfrac{215^2}{5} + \dfrac{133^2}{5}) = 41614.00 - 41452.4 = 161.6$

3. $SS_r = (\dfrac{514^2}{10} + \dfrac{348^2}{10}) - \dfrac{862^2}{20} = 38530 - 37152.2 = 1377.8$

4. $SS_c = (\dfrac{547^2}{10} + \dfrac{315^2}{10}) - \dfrac{862^2}{20} = 39843.4 - 37152.2 = 2691.2$

5. $SS_{rxc} = 44618 - (161.6 + 1377.8 + 2691.2) = 231.2$

6. a) $df_{Total} = 20 - 1 = 19$, b) $df_{wg} = (5\text{-}1) + (5\text{-}1) + (5\text{-}1) + (5\text{-}1) = 16$, C) $df_r = 2 - 1 = 1$,
d) $df_c = 2 - 1 = 1$, e) $df_{rxc} = 1 \cdot 1 = 1$.

7. $MS_{wg} = \dfrac{161.6}{16} = 10.1$

8. $MS_r = \dfrac{1377.8}{1} = 1377.8$

9. $MS_c = \dfrac{2691.2}{1} = 2691.2$

10. $MS_{rxc} = \dfrac{231.2}{1} = 231.2$

11. $F_r = \dfrac{1377.8}{10.1} = 136.416$

12. $F_c = \dfrac{2691.2}{10.1} = 266.455$

13. $F_{rxc} = \dfrac{231.2}{10.1} = 22.891$

14. Critical value for F with 1,16 degrees of freedom = 4.49. a. The F for rows is significant. Reject the null hypothesis.

15. Critical value for F with 1,16 degrees of freedom = 4.49. a. The F for columns is significant. Reject the null hypothesis.

16. Critical value for F with 1,16 degrees of freedom = 4.49. a. The F for rows x columns is significant. Reject the null hypothesis.

17.

Interaction of Diet and Environment on Learning Maze
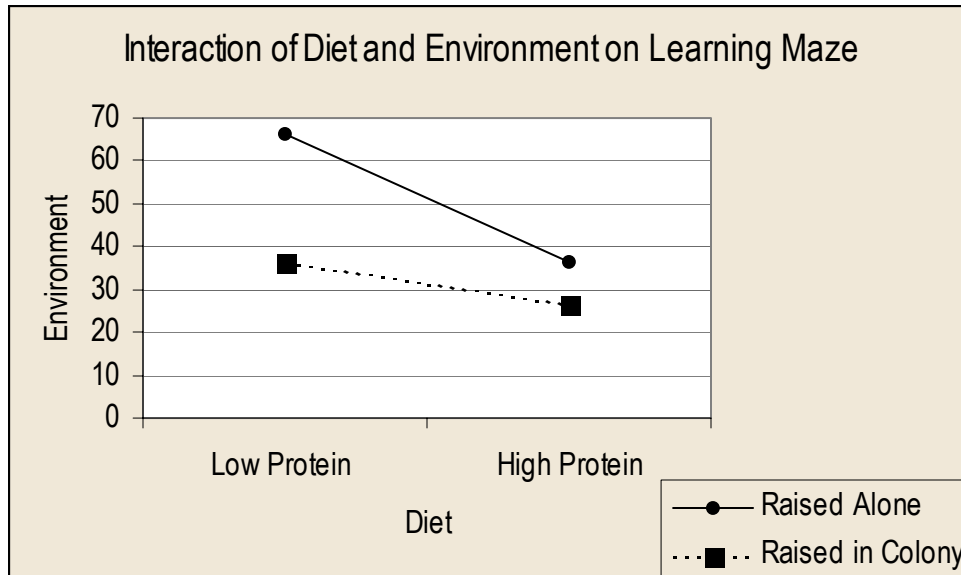
18. The results indicate that both the diet and the environment in which the rats are raised have significant effects on the ability of the rats to run the maze. Rats on a high protein diet take fewer trials to run the maze than those on a low protein diet. Moreover, the rats raised in the colony also take fewer trials to learn the maze.   When rats are raised alone and on a low protein diet, they take the most trials to learn the maze. When rats are raised in the colony and on a high protein diet, they take the least trials to learn the maze. As shown on the graph, both those rats raised alone and those raised in a colony take fewer trials on the high protein diet; however the biggest effect is on those rats that are raised alone.